

NUTRITION KNOWLEDGE AND FOOD CHOICES OF PRIMARY SCHOOL LEARNERS IN LIMPOPO PROVINCE, SOUTH AFRICA

Cate M Molotja*, Lucy L Maliwichi & Afam IO Jideani

ABSTRACT

Poor nutrition knowledge coupled with poor dietary practices are factors in the development of malnutrition. This study aimed to assess the nutrition knowledge underpinning the food choices and factors influencing food choices of primary school learners in selected rural schools of Limpopo Province, South Africa. The study followed a mixed-method approach and involved 474 primary school learners (grades three to seven) aged 10 to 15 years. Learners who participated in this study received meals from the National School Nutrition Programme (NSNP) and were taught about nutrition at their schools. Learners completed a pre-tested dietary knowledge questionnaire and participated in focus group discussions. The results revealed that children in this study had poor nutrition knowledge, especially of food groups and their roles in the body. Few learners were able to identify and allocate food items to the correct food groups (27.4% for grains/starchy foods, 11.6% for fruits and vegetables, and 37.5% for milk and milk products). The learners had some knowledge of healthy types of foods and were aware of the relationship between diet and disease, but they failed to apply the knowledge when buying food. Most learners reported buying unhealthy snacks, such as sweets, biscuits and chips. Factors such as taste, preference, satiety, peer pressure and availability influenced the learners' food choices. These findings indicate a need for nutrition education interventions that will equip learners with the necessary knowledge and encourage them to apply that knowledge to make healthy food choices. These interventions should target schools, homes and communities to ensure that the environment is supportive, and knowledge is shared and applied by all. The provision of food through the NSNP presents an opportunity to teach nutrition education in terms

of healthy eating but should be coupled with supportive food environments, such as the family and communities, to encourage and reinforce healthy eating.

— *Dr CM Molotja*

Institute for Rural Development
University of Venda
Thohoyandou
South Africa
Tel: +27 (0)83 877 4224
Email: makwenamolotja@gmail.com
*Corresponding author

— *Prof LL Maliwichi*

Department of Consumer Sciences
University of Venda
Thohoyandou
South Africa
Tel: +27 (0)82 254 2764
Email: Lucy.Maliwichi@gmail.com

— *Prof AIO Jideani*

Department of Food Science and Technology
University of Venda
Thohoyandou
South Africa
Tel: +27 (0)15 962 8078
Email: Afam.Jideani@univen.ac.za
Orcid id: 0000-0002-9122-8697

ARTICLE INFO

Received October 2018
Revised May 2019
Accepted November 2020

KEYWORDS

nutrition knowledge, food choices, dietary knowledge, learners

INTRODUCTION

The double burden of malnutrition is a serious global health problem. Unhealthy diets are an important cause of malnutrition (FAO et al. 2017). The Food and Agriculture Organization of the United Nations (FAO) observed that multiple forms of malnutrition coexist, with countries experiencing high rates of child undernutrition and adult obesity simultaneously (FAO et al. 2017). Although child undernutrition continues to decline, the numbers of overweight children are increasing, both in low- and middle-income countries (FAO et al. 2017). The World Health Organization (WHO) reported that overweight and obese children are likely to stay obese in adulthood and are more likely to develop non-communicable diseases (NCDs), such as diabetes and cardiovascular diseases, at a young age (WHO 2008). The 2012 South African National Health and Nutrition Examination Survey (SANHANES-1) reported a high prevalence of overweight and obesity among South African children aged 2–14 years (Shisana et al. 2014). Monyeki et al. (2015) noted that the burden of underweight and overweight is still a problem for South African children, with the former being more prevalent in children residing in rural areas and the latter in children from urban areas. Various studies indicate that poor dietary practices are a major contributor to the development of chronic non-communicable diseases (NCDs) and other health problems (FAO et al. 2017; Hawkes 2013; IFPRI 2016; Ransley et al. 2010; Zaborskis et al. 2012). Many of these diseases and health problems originate from dietary practices that were mainly formed during childhood (Hwenda 2013; Mikkila et al. 2005). The International Food Policy Research Institute (IFPRI) reported that diet is now the number one risk factor for the global burden of disease (IFPRI 2016). An unhealthy diet can be modified

through nutrition knowledge and a positive attitude toward healthy eating. Therefore, acquiring proper nutrition knowledge during childhood will assist children in making healthy food choices, establish healthy eating habits throughout their lives and prevent the early onset of chronic diseases associated with the consumption of an unhealthy diet.

Poor nutrition knowledge is one of the main factors in the development of malnutrition and needs to be addressed (Briggs et al. 2010). Lack of nutrition knowledge, together with inaccurate nutrition education, misconceptions, harmful diet traditions and poor nutritional practices passed from parents to children, have been reported as contributors to unhealthy eating habits (Vorster et al. 2001). Zaborskis et al. (2012) reported growing evidence suggesting that young children from developing countries are increasingly making unhealthy food choices due to a lack of knowledge and wrong perceptions of healthy foods. Primary school learners are therefore at risk of developing poor dietary habits because of the food choices they make at school, particularly when they buy food and/or snacks. Children's eating behaviours are influenced by factors such as family meals, parents' nutritional knowledge and parenting styles (Zaborskis et al. 2012). McKeown and Nelson (2018) reported that the food choices of most adolescents were influenced by parents (meals cooked at home) and peers. Independent food choices for most adolescents (60%) were based on individual food preferences, which always included unhealthy food choices.

Good nutrition is important for the health and educational performance of school-age children. In South Africa, learners attending public schools in quintiles 1 to 3 (i.e. schools ranked as the poorest or lowest in terms of socio-economic status) receive school meals through the National School Nutrition Programme (NSNP). The NSNP is intended to address barriers to learning associated with hunger and malnutrition by providing nutritious meals (consisting of a starch, protein, vegetable and/or fruit) to learners on all school days (Department of Basic

Education 2015). The objectives of the NSNP are to: (1) provide daily nutritious meals to enhance learning capacity; (2) promote healthy lifestyles through nutrition education; and (3) support the development of food gardens in schools (Department of Basic Education 2015). According to the Department of Basic Education (2015), nutrition education is a key pillar of the NSNP as it promotes healthy lifestyles and eating habits among learners and school communities. Furthermore, educators receive nutrition education materials to support the nutrition education curriculum taught in schools. However, the 2012 SANHNES-1 revealed that the majority (71.7%) of South African children had a low score on general nutritional knowledge (Shisana et al. 2014). Given the objectives of the NSNP, learners benefiting from the NSNP would be expected to have the necessary nutrition knowledge to make healthy food choices. This paper reports on a study that assessed the nutrition knowledge, food choices and factors influencing food choices of primary school learners in schools participating in the NSNP. This specific study is part of a larger project that reviewed the degree to which school feeding programmes can alleviate hunger, promote nutrition education and enhance the development of rural communities.

METHODS

Research design

A descriptive, cross-sectional design, using a mixed method approach that included both qualitative and quantitative techniques of investigation, was used. The philosophical foundation of mixed methods research is pragmatism as the emphasis is on the research problem and it uses all approaches available to understand the problem (Creswell & Creswell 2018). Pragmatism is not committed to one particular method of inquiry, such as qualitative or quantitative methods, but believes in drawing from both qualitative and quantitative methods to derive knowledge about a research problem. Pragmatism allows for the use of multiple

methods, different worldviews and different assumptions as well as different forms of data collection and analysis (Creswell & Creswell 2018). The study used a convergent design that involves the separate collection and analysis of qualitative and quantitative data in a single study and the results were merged or mixed during the overall data interpretation process (Creswell 2003; Creswell & Creswell 2018; Edmonds & Kennedy 2013; Hearn 2010).

Study population and sampling procedures

The study population consisted of learners from the 11 randomly selected primary schools in Blouberg Local Municipality (BLM). Systematic random sampling (Dawson & Trapp 2004) was used for selecting eligible learners within BLM. The sample size was determined by using the statistical package nQuery Advisor based on the estimates obtained from previous studies as well as the standard sampling techniques that are recommended for descriptive, cross-sectional surveys. Due to the non-availability of credible estimates for the total number of learners at BLM during the time of the study, the population size was used to determine the sample size. The population size is larger than the total number of school children and, by using the population size, increased both the sample size of the study and the power of study slightly in magnitude, which is desirable in terms of obtaining theoretically more reliable estimates of parameters. The population size of BLM was estimated at 162,629 in 2011 (Blouberg Local Municipality 2011). A total sample of 474 eligible learners (10 to 15 years old) provided data for this study. For a descriptive, cross-sectional study of this type, a sample of size $n = 474$ and a power of 95% are suitable for the study (Levy & Lemeshow 2013).

The study area

The study was conducted in selected rural schools of Blouberg Local Municipality (BLM) situated in Limpopo Province, South Africa. The municipality is predominantly rural and is characterised by high poverty levels, illiteracy

and unemployment (Blouberg Municipality 2017).

Data collection

Quantitative data were collected using a structured and pre-tested questionnaire that was modified for this study. The design of the questionnaire was based on various literature sources, such as previous nutrition knowledge studies (Kigaru et al. 2015; Oldewage-Theron & Egal 2010) and a validated questionnaire that was used by the HSRC to conduct a nation-wide study called the SANHANES in 2012. Some dietary knowledge questions from the SANHANES were used and, in some cases, various food items and pictures were replaced with those familiar to learners in the study area. The South African food-based dietary guidelines (FBDG) were used to guide the design of some questions. The questionnaire included (i) demographic information; (ii) knowledge of different food groups (yes/no); (iii) questions about functions of various food groups (e.g. which food group is the body's main source of energy); (iv) questions regarding which food groups should be eaten more, less or sparingly in accordance with the FBDG; (v) questions about functions of food in the human body in two formats (multiple-choice and yes/no); (vi) a question to allocate food items to the correct food group and consequently classify the food as healthy or unhealthy from the 20 pictures of food items provided. These 20 food items comprised eight items from meat and alternatives; four from fruits and vegetables; two for fats and oils; three for carbohydrates/starch; three for milk and milk products; and (vii) five questions to test knowledge about diet-disease relationship (e.g. "Are you aware of any diseases or health problems caused by the consumption of too much salt in a diet?"). The last part of the questionnaire asked general questions such as: "Are you taught about healthy eating at school? What is taught? Do you take a lunch box to school? What food do you take? Do you take money to school? What do you buy?" To ensure content validity, experts in the field of nutrition provided input to the

questionnaire. As a means of ensuring reliability, the Cronbach Alpha test (Ritchie et al. 2013) was used. The alpha coefficient for the questionnaire was 0.81 ($\alpha = 0.81$) indicating that the tools used for measurement were reliable and consistent. To ensure face validity, a pilot study using the questionnaire was conducted with 10 primary school learners of the same age group but at a different school. To facilitate data collection, the questionnaire was translated into Sepedi language, the first language for residents of BLM. This was done to ensure the full participation of all learners and to ensure that they all understood the questions. The questionnaire was self-administered by learners and the researcher and the research assistant were present during data collection to clarify any misunderstandings. This was done in such a way that the researchers did not lead the learners to any answers thereby avoiding researcher bias.

Qualitative data about the learners' food choices and the reasons thereof were collected by focus group discussions with some learners (recorded using a tape recorder), direct observations of food bought and consumed at school and by taking notes and photographs. The focus groups lasted for 30 to 40 minutes and took place within the school premises (after school to avoid interfering with the school activities). The focus groups consisted of 10–15 learners. Qualitative research is not concerned with large sample sizes, but the researcher must probe until data saturation is reached, when no new information is revealed (Yin, 2011).

To ensure credibility and trustworthiness, the study involved a researcher and a research assistant who were trained before data collection. Using more than one person minimised bias. Notes were taken and discussions were recorded for further listening and transcribing at a later stage. The researcher or research assistant probed for further clarity and understanding, where necessary. A checklist was used to guide the discussions. The researcher or research assistant introduced the topic to be discussed and requested permission

to record the discussions. One learner assisted (i.e. by noting learners who wanted to contribute and ensuring that there was one speaker at a time) the researchers who facilitated the discussion and another learner wrote what was discussed on a flip chart and presented it to the group to ensure that everything was captured.

Ethical considerations

Ethical considerations regarding the rights of participants were applied throughout the study. The University of Venda granted ethical clearance (SARDF/16/IRD/11/2009) and approval to conduct the study prior to its commencement. Permission was also obtained from the Department of Education, Capricorn District Office in Polokwane, South Africa. All participants were informed about the purpose of the study and participated willingly and anonymously. Learners gave assent and their parents and/or guardians signed consent forms permitting them to participate in the study.

Data management and analysis

The dietary knowledge questionnaire was coded and the participants' responses were captured on a Microsoft Excel spreadsheet. The statistical package STATA version 14 (for performing quantitative data analysis, checking and validation) was used to analyse the data (STATA Corporation 2015). Descriptive statistics were computed and the data were presented in frequency tables, pie charts and bar charts for each discrete variable of study. The level of nutrition knowledge was calculated from all correct responses under each knowledge sub-section and then converted to a percentage. An average score of $\leq 40\%$ was categorised as having low nutrition knowledge, 40–69% moderate and $\geq 70\%$ high nutrition knowledge. Similar categories were used in a study by Kigaru et al. (2015) to assess the nutrition knowledge, attitudes and practices of primary school children in Kenya.

Thematic content analysis was used to analyse qualitative data (Anderson 2007; Yin 2011). This

involved repeated reading of field notes and the listening, transcribing and translating (from Sepedi to English) recorded data from focus group discussions. Data obtained were organised, sorted and coded into meaningful units. An inductive approach was followed, and codes or labels assigned to the data were generated by working from the text during the data analysis process. The codes were clustered into meaningful groups, called themes. The data organised under themes were then interpreted.

RESULTS

All learners were Black Africans and 99% of the learners were South African nationals. The mean age of the sample was 12.5 years and females represented 57% of the total sample. The children were in grades three to seven, with the majority in grades six, seven and five respectively. Table 1 provides a summary of the demographic information of the study population. All learners ($n = 474$) who participated in this study indicated that they were taught about nutrition (i.e. healthy eating, food groups and their importance) at school, as part of the Life Skills, Life Orientation and Natural Science and Technology curriculum. Although the learners were taught about nutrition, the curriculum covers a small section of nutrition that is not enough to encourage behaviour change as also reported by Oldewage-Theron and Abdulkadir (2012).

All the learners mentioned that they knew the different food groups. The quantitative results presented in Table 2 show the percentages of learners who gave correct responses for each sub-section of the questionnaire. Most learners had a low level of nutrition knowledge (an average score of 29%) regarding the functions of food groups. However, the majority (61%) knew that food from the fats and oils group should be restricted in meals. Moderate levels of nutrition knowledge (average scores of 67% and 66% respectively) were noted in the multiple-choice questions and for the yes/no statements

TABLE 1: DEMOGRAPHIC DETAILS OF THE STUDY POPULATION

Characteristic	Number of participants (n = 474)	Percentage (%)
Age (years)		
10	89	18.8
11	113	23.8
12	132	27.9
13	88	18.6
14	50	10.5
15	2	0.4
Sex		
Male	206	43.5
Female	268	56.5
Grade in school		
3	11	2.3
4	64	13.5
5	104	22
6	157	33.1
7	138	29.1

regarding functions of food in the human body. The first set of multiple-choice questions showed that most of the participants (94%) knew the importance of water in the human body and chose it as the best beverage to quench thirst. This was confirmed by 97% who chose water as healthier than Coke in another set of questions. There was consistency in terms of participants (86%) who knew that carrots (and other yellow and orange-fleshed fruits and vegetables) are important for good eyesight from the multiple-choice questions and the 'yes' and 'no' statements. While few participants (16%) knew that starchy foods are the body's main source of dietary energy, most knew that maize meal porridge is the best source of energy (60%) when they had to choose between milk, apple and maize meal. Also, the 'yes' or 'no' statements showed that 90% of the learners agreed that maize meal porridge is the best source of energy. This could imply that they do not know that maize meal is a starchy food.

The learners had a moderate level of nutrition knowledge (average score of 47%) in the subsection of food groups that should be eaten more, less or sparingly. When asked about the amounts of food to be eaten in a healthy diet, most learners knew that more fruits (72%), vegetables (83%) and milk and dairy products (63%) should be eaten in a healthy diet. Only a few, 35%, 33% and 28% of the learners knew

that sugary, fatty and salty foods respectively should be consumed sparingly in a healthy diet.

Inconsistencies were also observed regarding milk and its role in strengthening bones and teeth. In the multiple-choice questions, 48% of learners knew that the consumption of milk helps to strengthen bones and teeth but, in the 'yes' or 'no' statements, 86% of the learners agreed that milk strengthen bones. Additionally, 66% of learners indicated that eating apples will strengthen their teeth. This clearly shows that most learners' knowledge of nutrition in terms of food groups and their functions is poor.

The results show a high level of nutrition knowledge (average score of > 90%) regarding choosing a healthy food when the choice was limited to two food items. However, when there were more items to choose from (i.e. 20 food items), a low level of nutrition knowledge was shown. Thus, most learners demonstrated a low level of nutrition knowledge as they could not allocate foods to different food groups (an average of 16% of the learners allocated food into the correct food group). Additionally, very few learners (average of 18% and 19%) were able to differentiate between healthy and unhealthy food items respectively (Figure 1). Some food items were allocated to more than one food group. A similar pattern was noticed as most learners could not allocate food correctly in

TABLE 2: KNOWLEDGE OF FOOD GROUPS AND THEIR FUNCTIONS (N = 474)

Question	Learners with correct Answer (%)
FOOD GROUPS & THEIR FUNCTIONS:	
Starchy foods should be included in most meals	18
Protein-rich foods are the best to build the body's muscles and keep organs strong	28
Starchy foods are the body's main source of dietary energy	16
Food from the fats and oils group should be restricted in meals	61
Fruits and vegetables protect the body against illnesses	22
AMOUNT OF FOOD FOR A HEALTHY DIET:	
Eat more vegetables	83
Eat more starchy foods	15
Fatty foods should be eaten sparingly	33
More milk/cheese/yoghurt should be consumed in a healthy diet	63
Eat more fruits	72
Eat sugary foods (cakes, sweets, chocolate) sparingly	35
Meat (chicken, beef, lamb, pork) should be consumed the least	47
Eat salty food (e.g. (processed foods such as French polony) sparingly	28
MULTIPLE CHOICE QUESTIONS:	
Maize meal porridge is the best source of energy	60
Eggs are the best source of protein	36
Carrots are important to have good eyesight	86
Milk strengthens your bones and teeth	48
A peanut butter sandwich is the chosen snack to eat in the morning	78
Water is the best beverage to drink when thirsty	94
HEALTHY FOOD CHOICES:	
Orange is healthier than chips ("disimba")	97
Water is healthier than Coca Cola	97
Peanuts are healthier than sweets	97
Banana is healthier than biscuits	97
Brown bread and peanut butter is healthier than fat cakes and atchar	93
Mashed potato is healthier than fried chips	92
Fresh milk is healthier than Cremora	96
YES OR NO STATEMENTS:	
Eat different kinds of foods (variety) to be able to grow and develop properly	57
Eating fruits and vegetables will help your body to fight against illnesses like colds and flu	74
Consume milk so that you can have strong bones	86
Dry beans can replace meat in a healthy diet	55
Eating fruits and vegetables such as mangoes, yellow peaches, carrots, pumpkin, butternut and cabbage will help to improve your eyesight	86
Maize meal porridge is a good source of energy	90
Eating apples will help to strengthen my teeth	34
Cremora can replace milk (fresh or <i>maas/inkomazi</i>) in your diet because they supply the same amounts of nutrients as milk	78
Foods from the fats and oils group play an important role in my body	28
It is important to eat breakfast every morning because it helps me to concentrate or learn better at school	93
It is important to eat enough fibre (examples of food containing fibre: brown bread, rice) because it helps us to go to the toilet regularly	77
Eating a lot of sugar, sweets and sweet food can make people fat	35

terms of the most and least healthy types of food.

Despite having most food items (eight out of 20)

belonging to the meat and alternatives food group, very few learners (1.68%) identified and allocated these food items correctly as presented in Figure 1. This means that most

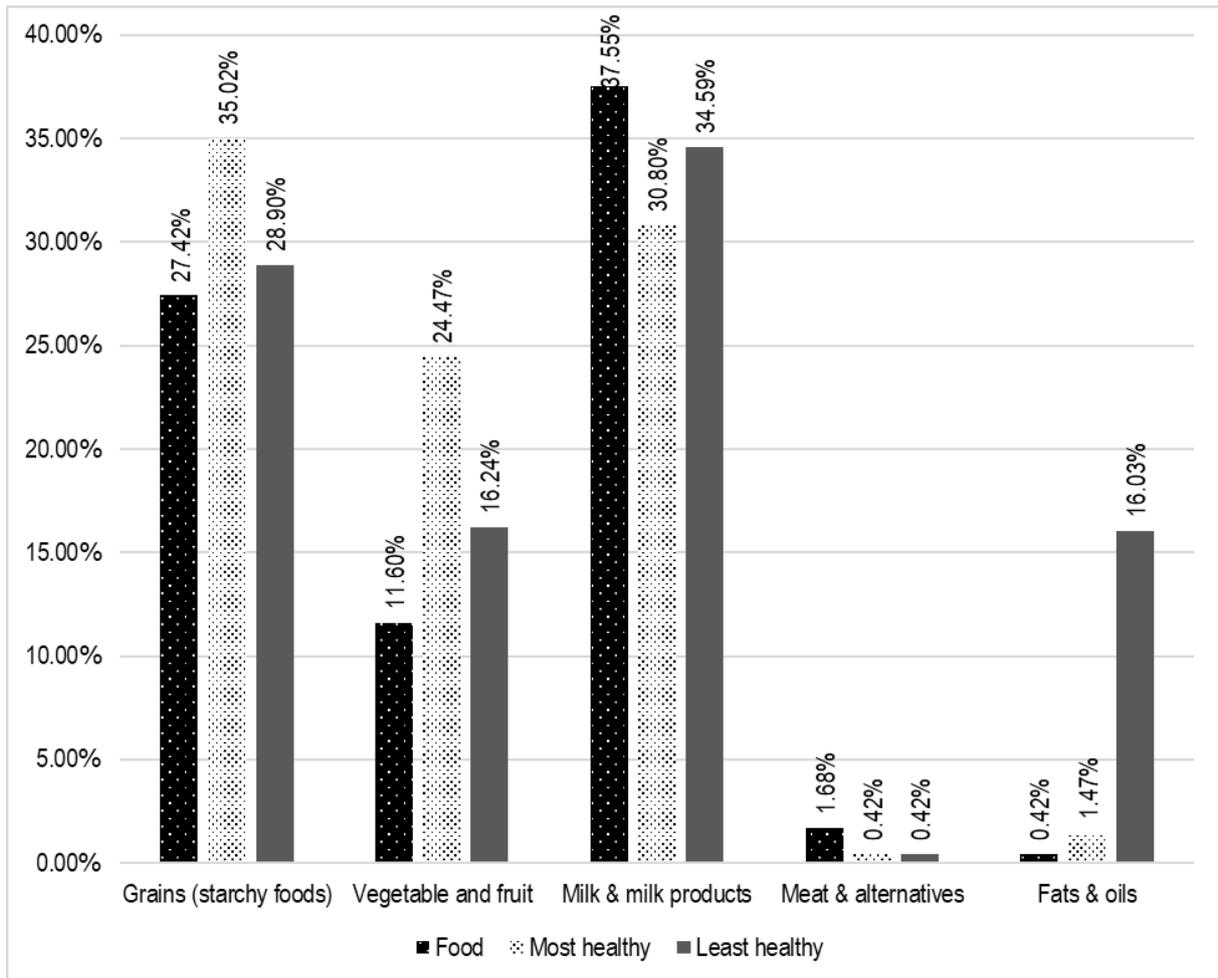


FIGURE 1: FOOD GROUPS, HEALTHY AND UNHEALTHY FOOD

learners allocated the food items incorrectly to other food groups indicating that most learners' knowledge of food groups was poor.

Most of the learners were aware of diet-related diseases as indicated in Figure 2. Eighty-six percent (86%) of the learners were aware that the consumption of a diet with too little fibre and with too much salt could cause diet-related diseases. Most learners (74%) were aware that the consumption of too much sugar could cause diet-related diseases but many of them (65%) did not know that eating too many sugary foods could result in weight gain (Table 2 – 'yes' or 'no' statements). More than half of the learners (55%) were aware that an unhealthy diet, coupled with no exercise, could cause health problems and 52% were aware that too much fat in the diet could cause diseases.

Some learners (36%) occasionally brought food from home, of whom the majority (77%) had brown bread. The lunch box items included a peanut butter sandwich or brown bread with margarine and French polony, atchar and concentrated juice. These foods were also mentioned during the focus group discussions with the learners. The quantitative results, as shown in Figure 3, revealed that most learners (91%) took money to school to buy food. Table 3 indicates the food choices that learners make when they buy food at school.

Only a few learners mentioned that they bought and consumed fruits such as bananas (12.26%), oranges (11.57%) and apples (11.11%). The results of the focus group discussions with the learners confirmed that the foods presented in Table 3 are the learners' food choices when they buy food at school. Most of the frequently

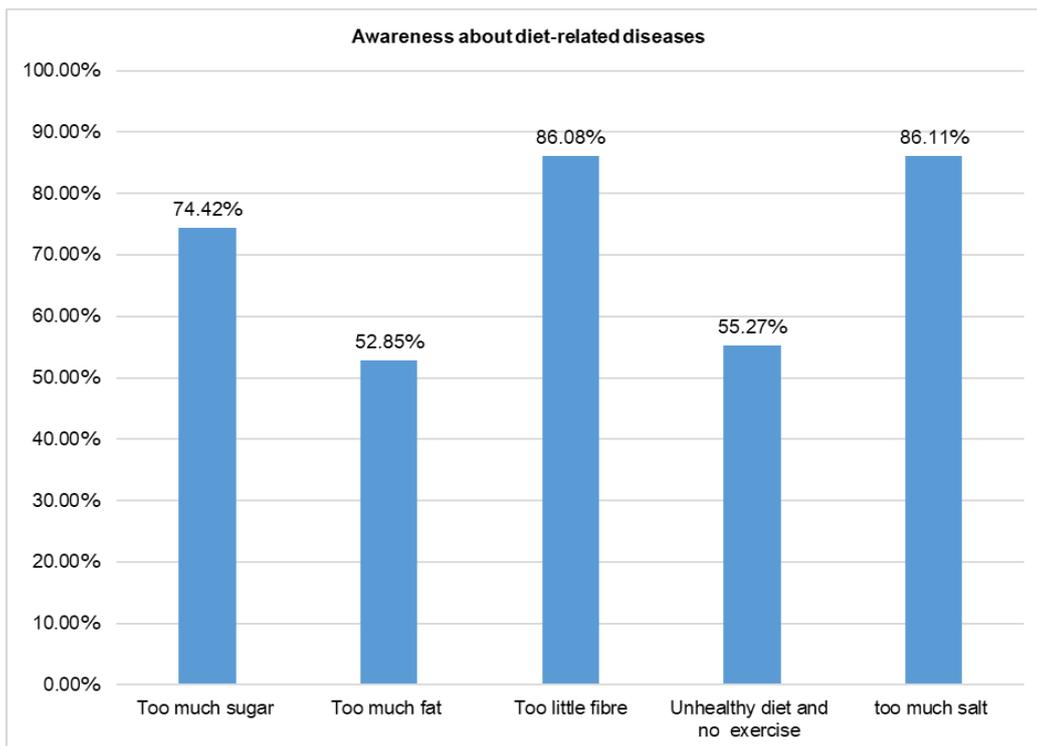


FIGURE 2: AWARENESS OF DIET-RELATED DISEASES

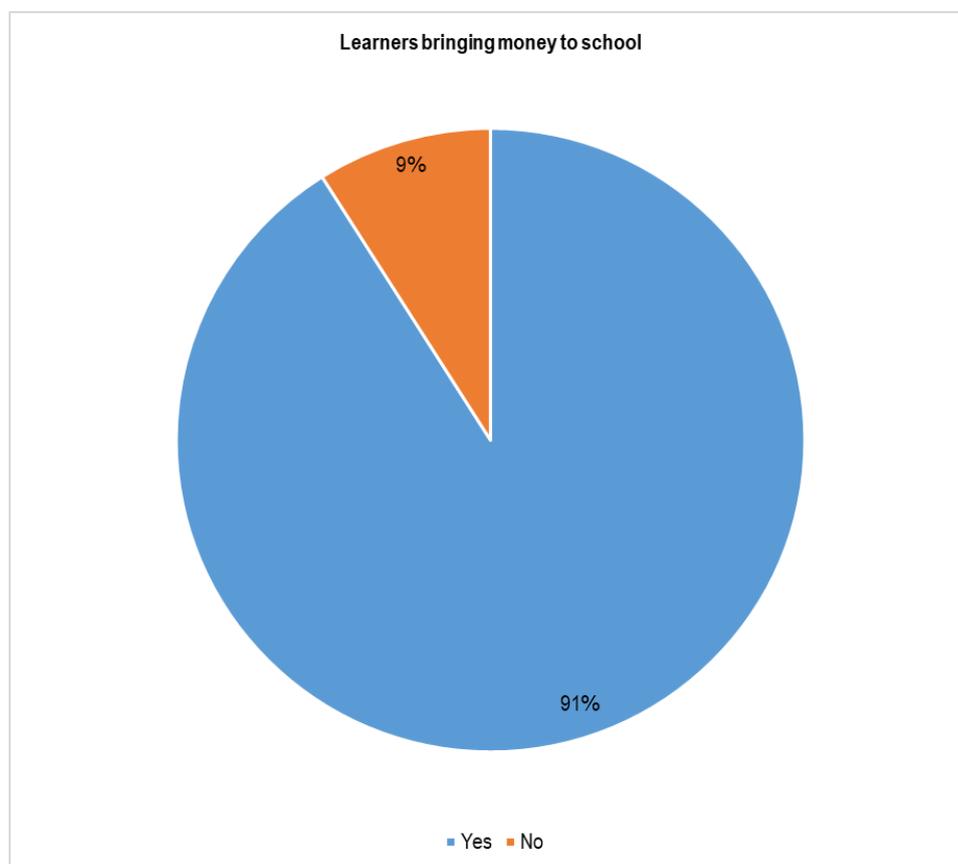


FIGURE 3: LEARNERS WHO BRING MONEY TO SCHOOL

TABLE 3: LEARNERS' FOOD CHOICES AT SCHOOL

Food item	Number of participants who bought and consumed the food item (%)
<i>Disimba (mashwamshwam & Niknaks)</i>	76.38
Sweets	72.68
Biscuits	41.43
Sweetened ice	31.48
Fried chips	13.19
Banana	12.26
Orange	11.57
Apple	11.11
<i>Bunny chow/Kota (bread, fried chips, atchar, French polony)</i>	9.25
Fat cakes (<i>magwinya</i>)	6.94

bought and consumed foods (except fruits) are high in sugar, salt and fat therefore they are not suitable for a healthy lifestyle. During the focus group discussions, the following themes emerged when learners were asked about the reasons for their food choices: (i) individual factors such as taste, preference and satiety; (ii) peer pressure; and (iii) food sold at school. The extracts from the focus group discussions are given for each theme.

The learners considered the taste of food when choosing what to buy as substantiated by the following extracts:

“The food items we buy taste good.”

“The food we buy are delicious.”

“We like to buy sweets, biscuits and sweetened ice because they are sweet.”

The learners mentioned that they know about healthy eating, as they are taught in class and they get nutritious meals from the NSNP, but they prefer certain food items. Some mentioned that they are satisfied if they consume food items listed in Table 3. The extracts below support this statement.

“We like these food items and we buy what we like.”

“These are our favourite snacks that we prefer and enjoy.”

“I know that we should eat fruits more often, but I prefer to buy sweets, biscuits, Simba Chips rather than banana or apple.”

“We feel satisfied after eating these food items.”

“When I feel like eating sweet things, I buy sweets and biscuits, then I get satisfied.”

Influence from friends (peer pressure) played a crucial role in the food choices of learners in this study. Learners' comments are given below.

“We see other learners buying these food items and we also follow because everyone is eating these foods.”

“Our friends like to buy these food items therefore we also buy the same food items like our friends do.”

The food sold in and around the school premises also influenced the choices of the learners in this study as indicated by the extracts below.

“We like these food items and they are always available at the vendors selling in or around the school premises. The vendors sell what we like.”

“These are the food we get from the informal vendors in and around our schools, therefore we buy them because we like them. If we don't get what we want, we will go to the shops and buy there. Luckily, the vendors know what sells and what we like.”

The few learners who bought fruits, such as bananas, apples and oranges, mentioned that they also buy sweets, fat cakes, Simba chips, biscuits and other food items which are not healthy.

DISCUSSION

The aim of this study was to assess the nutrition knowledge, food choices and factors influencing the food choices of primary school learners in Blouberg Local Municipality. In line with the results of the SANHANES-1, the children in this study reflected poor nutrition knowledge, particularly regarding food groups, their roles and the different types of foods belonging to a particular food group. Contrary to this study, Oldewage-Theron and Egal (2010) reported an average nutrition knowledge for primary school learners in QwaQwa.

Most learners in this study could not categorise food items into appropriate food groups and did not know the types of starchy foods and their functions in the body. Only 16% of the learners knew that starchy foods are the body's main source of dietary energy. Contrary to this, 71% of Japanese school children were able to choose starchy foods as a source of energy in the human body (Asakura et al. 2017). There were also inconsistencies in the results regarding the role of milk in strengthening bones and teeth (i.e. 48% of learners knew that the consumption of milk helps to strengthen bones and teeth and in the 'yes' or 'no' statements, 86% of the learners agreed that milk strengthen bones) and that apples are linked with the strengthening of teeth (66% of the learners indicated that eating apples will strengthen their teeth). This clearly shows that the learners in this study were uncertain about their answers.

Most learners in this study could not differentiate between the most and least healthy types of food in each group. Although most learners knew that certain foods constitute a healthy diet, it is a serious concern that few learners knew that fatty (33%), sugary (33%) and salty (28%)

foods should be consumed sparingly in a healthy diet. When learners had to choose healthy food alternatives from a list of two food items, more than 90% of the learners were able to choose healthy food items. These results align with those of the SANHANES-1 where most children had a high score when choosing healthy food alternatives (Shisana et al. 2014). Although most learners could choose healthy food types from a list of two food items, they seemed unable to apply their knowledge when making food choices sold within and around the school premises. The learners preferred unhealthy foods that were processed, high in sugar, salt, and fats. This was also the case in studies by Hoque et al. (2016), Kigaru et al. (2015), Ransley et al. (2010) and Zaborskis et al. (2012) that indicated that unhealthy foods, such as sweets, chocolates, chips, biscuits, soft drinks, pastries, fast foods and savoury snacks, were prominent in the diets of school children. Verjans-Janssen et al. (2018) also reported that Dutch primary school learners were found to consume large quantities of unhealthy foods. Similarly, South African adolescents were reported to consume snacks that were high in sugar, sodium and fats but relatively low in vitamins and minerals (Ndlovu, 2015). In this study, most learners (> 50%) were aware of diet-disease relationships that involve the consumption of a diet high in sugar, salt and fats, but this did not prevent them from eating unhealthy snacks high in sugar, salt and fats.

Even though learners in this study ate food from the NSNP that promotes healthy eating, most preferred to buy and consume unhealthy types of food as snacks at school. While they mentioned that they would buy fruit, they still bought unhealthy snacks. Similar to the findings of a study by Ndlovu (2015), learners in this study mentioned taste and preference as factors that influenced their food choices. Peer pressure played a crucial role in the food choices of the learners in this study as was the case in some other studies (McKeown & Nelson, 2018; Ndlovu, 2015).

The food environment influences food choices

more than individual factors such as knowledge, attitudes and behaviours (Thow et al. 2015). The school and family environment are important settings that influence children's nutrition behaviour as they can promote or discourage healthy eating (McKeown & Nelson, 2018; Verjans-Janssen et al. 2018). Ndlovu (2015) reported that the quality of food sold at the school tuckshop was cited as a barrier to healthy nutrition behaviours by adolescents as they would buy what is available or sold in and around the school premises. Most learners identified the increased availability of unhealthy food as a factor influencing their eating habits (Ndlovu 2015). Similarly, learners in this study bought unhealthy snacks from informal vendors within or just outside the school and they bought what was available and what they liked. Therefore, unhealthy food environments promote unhealthy diets. On the contrary, Ransley et al. (2010) reported that children from schools with gardens ate more vegetables compared to those who were from schools without gardens. Therefore, the environment that supplies and makes food available and accessible to learners plays a crucial role in shaping food choices. The following aspects in this study are of serious concern and need more attention: (i) the food environment (the types of food sold in and around the school premises); (ii) the learners' food choices; and (iii) their poor knowledge in terms of food groups and the types of food in each food group.

The learners' poor nutrition knowledge needs to be addressed because this could lead to poor dietary habits, the onset of chronic non-communicable diseases and other health problems (FAO 2006; FAO et al. 2017; Hawkes 2013; IFPRI 2016; Zaborskis et al. 2012). Various studies have demonstrated that people with basic nutrition knowledge were more likely to make healthy food choices (Kolodinsky et al. 2007; Nani 2016; Parmenter et al. 2000; Read & Schlenker 1993). Children's dietary intake was associated with their nutrition knowledge as well as that of their guardians (Asakura et al. 2017). Therefore, nutrition knowledge plays a very important role in influencing eating habits. Some

studies reported that nutrition interventions improved children's nutrition knowledge significantly, but not their nutrition behaviour (De Villiers et al. 2016). Other studies found that individuals failed to make nutrition a priority when selecting food because they were poorly informed about dietary guidelines (Lissner & Heitmann 1995; Mitchell 1990). Despite these contradictions, nutrition knowledge is a prerequisite for positive behaviour changes and, if applied by learners in this study, would positively influence their dietary behaviour and food choices.

Improving children's dietary habits is important to decrease the future burden of noncommunicable diseases (Asakura et al. 2017). When learners acquire the necessary nutrition knowledge, they may use it to influence their food choices and contribute to their health and well-being. The importance of nutrition to the Sustainable Development Goals (SDGs) has been emphasised by the International Food Policy Research Institute (IFPRI) because improved nutrition is the platform for progress in health, education, employment, female empowerment, poverty and inequality reduction (IFPRI 2016). While poverty and inequality, water, sanitation and hygiene, education, food systems, climate change, social protection and agriculture all have an important impact on nutrition outcomes (IFPRI 2016), adopting healthy food choices and eating habits, and eating well promotes good health.

Nutrition education programmes or interventions have been reported to improve nutrition knowledge (Lakshman et al. 2010; Oldewage-Theron & Abdulkadir 2012), but it is important to note that nutrition knowledge alone is not enough to change dietary habits even though it is one of the important factors for improving dietary habits. This is because, in addition to nutrition knowledge, food choices and dietary habits are influenced by many other factors such as socioeconomic status, cost, taste and preference (Smit et al. 2017). However, Steyn (2010) and Ndlovu (2015) reported that there is sufficient convincing evidence that curriculum-

based nutrition programmes offered in schools significantly increase children's nutrition knowledge and improve their dietary behaviours. Therefore, there is a need to build and encourage positive attitudes toward healthy eating early in childhood as this will continue throughout adulthood. The NSNP plays a crucial role in this as it serves as an additional support to nutrition education in South African schools. The provision of school meals should be integrated with other efforts, such as the involvement of parents in food production in the school food gardens, food preparation and nutrition education in the school curriculum, rather than being a separate entity. The integration would send a strong message that will equip learners, educators and parents with the necessary knowledge to make healthy food choices and adopt healthy eating habits and could influence the community as well as the local food environment to sell healthy food items.

Bundy et al. (2018) emphasised the fact that more education equates to better health outcomes and that the two are therefore intertwined. Children who are in good health and appropriately nourished are more likely to participate when in school (Bundy et al. 2018). Therefore, nutrition education taught in schools is for the benefit of learners and the population connected to the schools. Poor nutrition knowledge leads to unhealthy eating habits and ultimately to the development of chronic diseases (Briggs et al. 2010; Nani 2016; Verjans-Janssen et al. 2018; Vorster et al. 2001; Zaborskis et al. 2012), therefore the results of this study indicate the gaps in knowledge. This should inform nutrition education programmes that will allow the target population to fill the gaps.

CONCLUSIONS AND RECOMMENDATIONS

Learners in this study demonstrated poor nutrition knowledge, more especially in terms of food groups and their roles. Although they were taught about nutrition at school and were able to choose healthy food alternatives when the

choices were limited to two food items, most learners could not do the same from a list of 20 food items. Learners were aware of the relationship between diets and diseases, but they seemed unable to apply their knowledge when buying food at school. In addition to the nutritious meals served at schools, these children preferred and bought unhealthy snacks that were sold in and around the schools. Their food choices were influenced by taste, preference, satiety, peer pressure and availability. The exposure to unhealthy food poses a great risk to the health of these learners. Participants in this study need to improve their nutrition knowledge, particularly in terms of food groups and their roles in the body as well as knowledge of healthy types of foods. If the learners have this knowledge and are able to apply it when making food choices, this could prevent the development of chronic diseases caused by unhealthy diets.

Learners in this study are at an age where they can make independent food choices at school. From this study, therefore, there is a recommendation for extensive health and nutrition education at an early age to improve the health and nutrition knowledge of learners. Nutrition education interventions would encourage and reinforce positive behaviour changes and should target schools, homes and communities so that positive results could be realised. As suggested by other studies, urgent intervention is needed for the vendors who sell food at schools to support the teaching of healthy eating habits by selling healthy food. Future research should focus on the association between nutrition knowledge and practices to determine whether learners with good nutrition knowledge can apply the knowledge in making healthy food choices both at school and beyond the school environment. The parents' nutrition knowledge and food choices should also be assessed because they determine what learners acquire and eat at home.

ACKNOWLEDGEMENTS

The Limpopo Department of Basic Education,

District Office South Africa, the communities, schools and learners that participated in this study. The University of Venda, South Africa for funding the study.

REFERENCES

- Al-Domi, H.A., Faqih, A., Jaradat, Z., Al-Dalaeen, A., Jaradat, S. & Amareh, B., 2019, 'Physical activity, sedentary behaviours and dietary patterns as risk factors of obesity among Jordanian schoolchildren', *Diabetes & Metabolic Syndrome: Clinical Research & Reviews* 13(1), 189–194, viewed 10 October 2018, from <https://www.sciencedirect.com/science/article/pii/S1871402118303667>
- Abraham, S., Noriega, B.R. & Shin, J.Y., 2018, 'College students eating habits and knowledge of nutritional requirements', *Journal of Nutrition and Human Health* 2(1), 13–17, viewed 22 October 2018, from <https://www.alliedacademies.org/.../college-students-eating-habits-and-knowledge-of-nutritional-requirements.pdf>
- Anderson, R., 2007, 'Thematic content analysis (TCA): Descriptive presentation of qualitative data', viewed 14 September 2014, from <http://rosemarieanderson.com/wp-content/uploads/2014/08/ThematicContentAnalysis.pdf>
- Asakura, K., Todoriki, H. & Sasaki, S., 2017, 'Relationship between nutrition knowledge and dietary intake among primary school children in Japan: Combined effect of children's and their guardians' knowledge', *Journal of Epidemiology* 27(10), 483–491 viewed 01 March 2018, from <https://www.ncbi.nlm.nih.gov/pubmed/28576447>
- Bless, C., Higson-Smith, C. & Sithole, S.L., 2013, *Fundamentals of social research methods: An African perspective*, Juta, Cape Town, South Africa.
- Blouberg Local Municipality, 2011, 'Municipal information', viewed 05 September 2014, from <http://www.localgovernment.co.za/locals/view/118/blouberg-local-municipality>.
- Blouberg Municipality, 2017, 'Final integrated development plan budget 2017/2018', viewed 29 August 2018, from <http://www.blouberg.gov.za/sstaff/pages/sites/blouberg/documents/idp/Final%20IDP-Budget%202017-18.pdf>
- Briggs, M., Fleschhacker, S. & Mueller, C.G., 2010, 'Position of the American Dietetic Association, School Nutrition Association, and Society for Nutrition Education: Comprehensive School Nutrition Services', *Journal of Nutrition Education and Behaviour*, 42(6), 360–371, viewed 15 August 2017, from <https://www.ncbi.nlm.nih.gov/pubmed/21070977>
- Bundy, D.A.P, de Silva, N., Horton, S., Jamison, D.T. & Patton, G.C. (eds.), 2018, 'Optimizing education outcomes: High-return investment in school health for increased participation and learning', The World Bank, Washington DC, Disease Control Priorities, Volume 8, viewed 12 October 2018, from <http://documents.worldbank.org/curated/en/781571521530863121/Optimizing-education-outcomes-high-return-investments-in-school-health-for-increased-participation-and-learning>
- Creswell, J.W., 2003, *Research design: Qualitative, quantitative, and mixed methods approaches*, 2nd Edition, Sage Publications, Thousand Oaks, CA.
- Creswell, J.W. & Creswell, J.D., 2018, *Research design: Qualitative, quantitative and mixed methods approaches*, 5th Edition, Sage Publications, Thousand Oaks, CA.
- Dawson, B. & Trapp, R.G., 2004, *Basic & clinical biostatistics*, 4th edition, McGraw-Hill, Boston, United States of America.
- Department of Basic Education, 2015, *National School Nutrition Programme (NSNP) 2013/2014 Annual Report*, Government Printer, Pretoria, South Africa, viewed 02 February 2016, from <https://www.education.gov.za/Portals/0/Documents/Reports/NSNP%20ANNUAL%20REPORT%202014%20website%20upload.pdf?ver=2015-07-06-153339-633>
- Department of Basic Education, 2016, *Vote No. 14 Annual Report 2015–2016*, Government Printer, Pretoria, South Africa, viewed 28 August 2017, from <http://www.education.gpg.gov.za/Document5/Documents/Annual%20%20report%202015%20and%202016.pdf>
- De Villiers, A., Steyn, N.P., Draper, C.E., Hill, J., Gwebushe, N., Lambert, E.V. & Lombard, C.,

- 2016, 'Primary school children's nutrition knowledge, self-efficacy, and behavior, after a three-year healthy lifestyle intervention', *Ethnicity & disease* 26(2), 171–180.
- Edmonds, W.A. & Kennedy, T.D., 2013, *An applied reference guide to research designs: Quantitative, qualitative, and mixed methods*, Sage Publications, Thousand Oaks, CA.
- FAO, IFAD, UNICEF, WFP & WHO, 2017, 'The state of food security and nutrition in the world 2017: Building resilience for peace and food security', Rome, FAO, viewed 02 March 2018, from <http://www.fao.org/3/a-l7695e.pdf>
- Hawkes, C., 2013, 'Promoting healthy diets through nutrition education and changes in the food environment: An international review of actions and their effectiveness', Nutrition Education and Consumer Awareness Group, Food and Agriculture Organization of the United Nations, Rome, viewed 10 November 2017 from www.fao.org/ag/humannutrition/nutritioneducation/69725/en/
- Hearn, J., 2010, 'Mixed method designs', in J.H. McMillan & S. Schumacher (eds.), *Research in education: Evidence-based inquiry*, 7th Edition, Pearson Education, Harlow, England.
- Hoque, K.E., Kamaluddin, M.A., Razak, A.Z.A. & Wahid, A.A.A., 2016, 'Building healthy eating habits in childhood: A study of the attitudes, knowledge and dietary habits of schoolchildren in Malaysia', *PeerJ* 4(1), e2651, DOI: 10.7717/peerj.2651, viewed 29 March 2019, from <https://peerj.com/articles/2651.pdf>
- Hwenda, L., 2013, 'Addressing diet-related risk factors for non-communicable diseases', Global Health Governance, viewed 14 February 2018, from <https://blogs.shu.edu/ghg/2013/06/03/addressing-diet-related-risk-factors-for-non-communicable-diseases/>
- International Food Policy Research Institute [IFPRI], 2016, 'Global nutrition report 2016: From promise to impact: Ending malnutrition by 2030', Washington, DC, viewed 01 March 2018, from <http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/130354/filename/130565.pdf>
- Kigaru, D.M.D., Loechl, C., Moleah, T., Macharia-Mutie, C.W. & Ndungu, Z.W., 2015, 'Nutrition knowledge, attitude and practices among urban primary school children in Nairobi City, Kenya: A KAP study', *BMC Nutrition* 1(44), 1–8, viewed 01 March 2018, from <https://bmcnutr.biomedcentral.com/track/pdf/10.1186/s40795-015-0040-8>
- Kolodinsky, J., Harvey-Berino, J.R., Berlin, L., Johnson, R.K. & Reynolds, T.W., 2007, 'Knowledge of current dietary guidelines and food choice by college students: Better eaters have higher knowledge of dietary guidance', *Journal of the American Dietetic Association* 107(8), 1409–1413, viewed 12 September 2017, from <https://www.sciencedirect.com/science/article/pii/S0002822307007444>
- Lakshman, R.R., Sharp, S.J., Ong, K.K. & Forouhi, N.G., 2010, 'A novel school-based intervention to improve nutrition knowledge in children: Cluster randomised controlled trial', *Public Health*, 10(123), 1–9, viewed 19 August 2017, from <https://www.ncbi.nlm.nih.gov/pubmed/20219104>
- Levy, P.S. & Lemeshow, S., 2013, *Sampling of populations: Methods and applications*, John Wiley & Sons, New York.
- Lissner, L. & Heitmann, B.L., 1995, 'Dietary fat and obesity: Evidence from epidemiology', *European Journal of Clinical Nutrition* 49(2), 79–90.
- Lovelace, S. & Rabiee-Khan, F., 2015, 'Food choices made by low-income households when feeding their pre-school children: A qualitative study', *Maternal & Child Nutrition* 11(4), 870–881, viewed 14 September 2018, from <https://www.ncbi.nlm.nih.gov/pubmed/23320519>
- McKeown, A. & Nelson, R., 2018, 'Independent decision making of adolescents regarding food choices', *International Journal of Consumer Studies* 42(5), 469–477, viewed 20 September 2018, from <https://onlinelibrary.wiley.com/doi/full/10.1111/ijcs.12446>
- Mikkila, V., Räsänen, L., Raitakari, O.T., Pietinen, P. & Viikari, J., 2005, 'Consistent dietary patterns identified from childhood to adulthood: The cardiovascular risk in young Finns study', *British Journal of Nutrition* 93(6), 923–931, viewed 02 March 2018, from <https://www.ncbi.nlm.nih.gov/pubmed/16022763>
- Mitchell, S.J., 1990, 'Changes after taking a college basic nutrition course', *Journal of the American Dietetic Association* 90(7), 955–961,

- viewed 08 August 2017, from <https://www.ncbi.nlm.nih.gov/pubmed/2365937>
- Monyeki, M.A., Awotidebe, A., Strydom, G.L., De Ridder, J.H., Mamabolo, R.M. & Kemper, H.C.G., 2015, 'The challenges of underweight and overweight in South African children: Are we winning or losing the battle? A systematic review', *International Journal of Environmental Research and Public Health* 12(2), 1156–1173, viewed 01 March 2018, from <https://www.ncbi.nlm.nih.gov/pubmed/25648175>
- Nani, M.O., 2016, 'Relationship between nutrition knowledge and food intake of college students', Master's thesis, College of Education, Health, and Human Services, Kent State University, viewed 20 September 2017, from https://etd.ohiolink.edu/!etd.send_file?accession=kent1469155764&disposition
- Ndlovu, P., 2015, Exploring food habits and nutritional behaviours in adolescents at a secondary school in South Africa', Masters Dissertation, Department of Health Studies, University of South Africa, viewed 28 March 2019, from http://uir.unisa.ac.za/bitstream/handle/10500/20145/dissertation_ndlovu_p.pdf?sequence=1&isAllowed=y
- Oldewage-Theron, W.H. & Abdulkadir, E., 2012, 'Impact of nutrition education on nutrition knowledge of public-school educators in South Africa: A pilot study', *Health SA Gesondheid* 17 (1), 1–8, viewed 08 September 2017, from <http://www.hsag.co.za/index.php/HSAG/article/view/602>
- Oldewage-Theron, W.H. & Egal, A.A., 2010, 'Nutrition knowledge and nutritional status of primary school children in QwaQwa', *South African Journal of Clinical Nutrition* 23(3), 149–154, viewed 12 August 2017, from <http://www.sajcn.co.za/index.php/SAJCN/article/view/393>
- Parmenter, K., Waller, J. & Wardle, J., 2000, 'Demographic variation in nutrition knowledge in England', *Health Education Research* 15(2), 163–174 viewed 08 August 2017, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4344545/>
- Ransley, J.K., Taylor, E.F., Radwan, Y., Kitchen, M.S., Greenwood, D.C. & Cade, J.E., 2010, 'Does nutrition education in primary schools make a difference to children's fruit and vegetable consumption?', *Public Health Nutrition* 13(11), 1898–1904, viewed 02 March 2018, from <https://www.ncbi.nlm.nih.gov/pubmed/20338089>
- Read, M. & Schlenker, E.D., 1993, 'Food selection patterns among the aged', *Nutrition in Aging*, 10(4), 45–53.
- Ritchie, J., Lewis, J., Nichols, M.C. & Ormston, R., 2013, *Qualitative research practice: A guide for social science students and researchers*, Sage Publications, Thousand Oaks, CA.
- Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., Reddy, P., Parker, W., Hoosain, E., Naidoo, P., Hongoro, C., Mchiza, Z., Steyn, N.P., Dwane, N., Makoae, M., Maluleke, T., Ramlagan, S., Zungu, N., Evans, M.G., Jacobs, L., Faber, M. & the SANHANES-1 Team, 2014, *South African National Health and Nutrition Examination Survey (SANHANES-1): 2014 Edition*, HSRC Press, Cape Town.
- Smit, Y., Kassier, S., Nel, D. & Koen, N., 2017, 'The barriers that women face when choosing food for their primary school children: A case study in the Western Cape Province, South Africa', *South African Journal of Child Health* 11 (3), 129–134, viewed 15 March 2018, from <https://www.ajol.info/index.php/sajchh/article/view/164484/153998>
- STATA Corporation, 2015, *User's guide for STATA Version 14*, STATA Corporation, Texas, USA.
- Steyn, N., 2010, 'Does dietary knowledge influence the eating behaviour of adolescents?', *South African Journal of Clinical Nutrition* 23(2), 62–63, viewed 12 September 2017, from <http://www.sajcn.co.za/index.php/SAJCN/article/view/444>
- Thow, A., Sanders, D., Drury, E., Puoane, T., Chowdhury, S.N., Tsolekile, L. & Negin, J., 2015, 'Regional trade and the nutrition transition: Opportunities to strengthen NCD prevention policy in the Southern African Development Community', *Global Health Action*, 8(1), DOI: 10.3402/gha.v8.28338
- United Nations, 2012, *Status of food security in Africa*, Economic and Social Council, Economic Commission for Africa, United Nations, Addis Ababa, Ethiopia, viewed 01 August 2017, from

https://www.uneca.org/sites/default/files/uploaded-documents/CFSSD/CFSSD8/3._cfssd-8-0032-ore-status_of_food_security_in_africa_2012.pdf
Verjans-Janssen, S.R.B., Van Kann, D.H.H., Gerards, S.M.P.L., Vos, S.B., Jansen, M.W.J. & Kremers, S.P.J., 2018, 'Study protocol of the quasi-experimental evaluation of "KEIGAAF": A context-based physical activity and nutrition intervention for primary school children', *BMC Public Health* 18, 1–12, viewed 10 October 2018, from <https://bmcpublikealth.biomedcentral.com/track/pdf/10.1186/s12889-018-5764-3>
Vorster, H.H., Love, P. & Browne, C., 2001, 'Development of food-based dietary guidelines for South Africa – The process', *South African Journal of Clinical Nutrition*, 14(3), S3–S6, viewed 12 October 2017, from https://www.researchgate.net/publication/267819503_Development_of_Food-Based_Dietary_Guidelines_for_South_Africa_-

[_the_process](#)
World Health Organization [WHO], 2008, 'School policy framework: Implementation of the WHO global strategy on diet, physical activity and health', Geneva, Switzerland, WHO, viewed 31 July 2018, from http://apps.who.int/iris/bitstream/handle/10665/43923/9789241596862_eng.pdf?sequence=1&isAllowed=y
Yin, R.K., 2011, *Qualitative research from start to finish*, Guilford Press, London, viewed 11 September 2014, from <http://0-lib.mylibrary.com.oasis.unisa.ac.za/PrintPages.aspx>
Zaborskis, A., Lagunaite, R., Busha, R. & Lubiene, J., 2012, Trend in eating habits among Lithuanian school-aged children in context of social inequality: Three cross-sectional surveys 2002, 2006 and 2010, *BMC Public Health* 12, 1–12, viewed 12 October 2017, from <https://www.ncbi.nlm.nih.gov/pubmed/22260778>
