ISSN 0378-5254 Journal of Consumer Sciences, Special Edition
Food and nutrition challenges in Southern Africa, Vol 2, 2017

THE ASSOCIATION BETWEEN DIETARY FAT KNOWLEDGE AND CONSUMPTION OF FOODS RICH IN FAT AMONG BLACK FIRST-YEAR STUDENTS IN A SOUTH AFRICAN UNIVERSITY SELF-CATERING RESIDENCES

Leocardia Ranga & Irma Venter*

ABSTRACT

High fat consumption among university students is a matter of major concern. The objective of this study was to determine the association between dietary fat knowledge and consumption of foods rich in fat among first-year students in self-catering residences at a university of technology in Cape Town, South Africa. The dietary fat knowledge, represented by fat food knowledge and fat nutrition knowledge, and consumption of foods rich in fat were assessed separately. Two norm-referenced, valid and reliable knowledge tests and an intake screening questionnaire were used for the assessments, before the associations between the phenomena were determined (using the Pearson's chi-square test). The stratified sample included 225 black students who provided written consent for participation. While no significant ($p > 0,05$) association was found between the students' fat food knowledge and consumption of foods rich in fat, significant associations were found between the students' fat nutrition knowledge and consumption of foods rich in fat ($p < 0,05$), and between their fat food knowledge and fat nutrition knowledge ($p < 0,001$). Therefore, in order to reduce students' consumption of foods high in fat, food and nutrition education should place emphasis on fat nutrition knowledge and consider fat food knowledge.

— ***Ms L Ranga***
Department of Biotechnology and Consumer Science
Cape Peninsula University of Technology
Tel: +27 (0)76 805 9012
Email: rangaleocardia@yahoo.com

— ***Associate Prof I Venter***
Department of Biotechnology and Consumer Science
Cape Peninsula University of Technology
Tel: +27 (0)21 460 3428
Fax: +27 (0)86 660 4153
Email: venteri@cput.ac.za
*Corresponding author

ARTICLE INFO

Article history
Received 18 January 2017
Final review submitted 23 June 2017
Accepted 24 November 2017

Keywords
fat food knowledge; fat nutrition knowledge; consumption of foods rich in fat; fat knowledge and consumption associations; first-year students; self-catering residence

INTRODUCTION

The transition to independent living during university study is a demanding period (Deshpande et al, 2009; El Ansari et al, 2012) in which students need to adjust to a new milieu in terms of added responsibilities (Dyson & Renk, 2006). It is also a time of increased responsibility for their own food choices and eating habits. Students' failure to adjust appropriately to this dietary change involving the self-selection of food may lead to undesirable consequences for their eating habits and subsequent health (Deliens et al, 2014). This transitional period is consequently an opportune time to establish healthy lifestyle behaviours (Von Ah et al, 2004). But the results of several studies indicate that university students frequently consume foods rich in fat such as cakes (Okeyo, 2009:62; El Ansari et al, 2012; Van den Berg et al, 2013), biscuits, potato crisps (Okeyo, 2009:62; Van den Berg et al, 2013), margarine (Ntuli, 2005:151; Okeyo, 2009:62; Takomana & Kalimbira, 2012; Van den Berg et al, 2012) and fast/fried foods (El Ansari et al, 2012; Ter Goon et al, 2013; Al-Faris et al, 2015). Since high dietary fat consumption is one of the

major risk factors for non-communicable diseases (NCDs) (Vorster et al, 2000), students represent an at-risk group for health distress. South Africa (SA) is moreover experiencing ongoing urbanisation of black Africans, including students who leave their rural homes to attend university in urban areas (Richter et al, 2014). Urbanisation and its associated unhealthy lifestyles, such as the consumption of high-fat diets, is a leading cause of the growing burden of NCDs in SA (World Health Organization, 2014:173) with black Africans in the centre of a cardiovascular disease epidemic (Nojilana et al, 2016).

It has been suggested that university students' knowledge of healthy dietary habits and nutritional requirements may be negligible (Matvienko et al, 2001). Although universities provide health services to students as part of their student services provision, Pei Lin and Wan (2012) pointed out that nutrition information and guidance on healthy diets is rarely provided to university students. In order to enjoy a healthy lifestyle free of NCDs, it is essential for students to acquire and implement basic food and nutrition knowledge. However, in the scientific literature published towards the end of the previous century, an insignificant association was reported between nutrition knowledge and dietary intake, leading researchers to query the importance of nutrition education and the application of nutrition knowledge in food choice and consumption (Shepherd & Towler, 1992; Stafleu et al, 1996; Wardle et al, 2000). Nonetheless, the majority of studies conducted subsequent to these, as reviewed in a study by Spronk et al (2014), reported a positive association between nutrition knowledge and healthier dietary intake, although the association was described as weak.

An essential consideration for health programmes aimed at university students is that the food choice behaviour adopted by students during this transition phase is likely to influence lifelong eating behaviour (Savage et al, 2007). Therefore to support the inclusion of nutrition education in these health programmes, it is imperative to know if knowledge, whether it be food and/or nutrition knowledge, is an important determinant of food choices among the target population. A particular consideration would be the consumption of foods rich in fat by this population and their knowledge about this dietary constituent because of its likely detrimental effects on their future health. Dietary fat is also central to the current low-carbohydrate, high-protein, high-fat dietary regimens that gripped the South African public of which the Banting diet, a high-fat ketogenic regimen, are widely held. It is said that enticing dietary regimens confuses the public (Catsicas et al, 2014) which should influence their food and nutrition knowledge acquired and them making informed food choices. This may be particularly relevant to consumer knowledge of dietary fat and their consumption of foods rich in fat.

The main objectives of this study were to investigate the following in relation to black first-year students living in a self-catering residence at a university of technology, Cape Town, SA: (i) the association between their fat food knowledge and their consumption of foods rich in fat; (ii) the association between their fat nutrition knowledge and their consumption of foods rich in fat; and (iii) the association between their fat food and nutrition knowledge. Consequently, the subsidiary objectives of this study were to assess these students': (i) level of fat food knowledge; (ii) level of fat nutrition knowledge; and (iii) consumption of foods rich in fat.

METHODOLOGY

Permission to conduct the study

Permission to conduct the study was obtained from the Cape Peninsula University of Technology (CPUT) Faculty of Applied Sciences Research Committee, while ethics approval was granted by the Faculty of Applied Sciences Research Ethics Committee (Ref. 3/2015). Permission was also obtained from the Head of the CPUT residences department to approach the sample group where they resided. All the students selected for participation in the study were individually informed of the purpose of the survey, and participated voluntarily and anonymously after signing a participant information and consent form.

Sample selection and sampling method

First-year university students in self-catering residences on the CPUT Cape Town campus were selected as the study population. As only

black African students stayed in these residences they formed the sample group. It had been recommended that first-year university students should be targeted for nutrition education intervention programmes, as they are in the process of adjusting to the university environment and experiencing independence in life for the first time (Pei Lin & Wan, 2012). Emrich and Mazier (2009) conclude that nutrition education is more likely to result in a favourable change in consumption among first-year students than among students at other levels of study, improving their overall diet quality and reducing their risk of NCDs relating to fat consumption in later life. The CPUT Cape Town campus was selected as the study location as its self-catering residences are located within an urban setting offering easy access to food procurement.

Stratified sampling was used to select the respondents from a population of 451 black first-year students residing (in 2015) in the five self-catering residences. The stratified sample size of 225 students (error of confidence interval = 0,250%; normal probability = 0,975; Z^2pq = 0,9604; width of interval = 0,50%) was directed by the sample size provisions of Sekaran and Bougie (2000:295) and divided among the self-catering residences according to the number of first-year students residing in each, in order to obtain the same representation in the sample as in the population. To obtain the sample of 225 students, every second student in these residences – in terms of the student bed allocation – was invited to participate.

Questionnaire construction

The questionnaire consisted of four sections. The first section (Section A) assessed the students' fat food knowledge. The norm-referenced, valid and reliable test used here was developed by Hanekom et al (2014) to determine the food knowledge of first-year students at a university of technology in the Western Cape, SA, which makes the test suitable for use in this study. The test with its 25 multiple choice questions having three response options each focuses on the choice, purchase, preparation and cooking methods of fats (and oils).

The second section (Section B) sought to determine the respondents' fat nutrition knowledge. The norm-referenced valid and reliable test that was utilised consisted of 18 multiple choice questions having four response options each. It was originally developed for use in a South African study of the sensory acceptability of baked products with a reduced fat content. The sample group consisted of higher education students (Venter, 2008), which makes the test appropriate for use in this study. The test also includes a number of knowledge items that cover practical dietary application in relation to fat quality, with questions included on cholesterol (n = 4), saturated fat (n = 1), trans-fat (n = 1), omega-3 fatty acids (n = 1), monounsaturated fat (n = 1) and a combination of these types of dietary fat (n = 3). A shift has recently taken place toward a focus on the quality of dietary fat rather than just the quantity (Smuts & Wolmarans, 2013). The test accommodates this shift, with 11 (61%) of the questions covering the quality of dietary fat.

The third section (Section C) incorporated a screening questionnaire (adapted from Block), in the format of an unquantified food frequency questionnaire (FFQ), supplied by the South African Medical Association Dyslipidaemia Nutrition Working Group (2000). This screening questionnaire provided material for the dietary management of dyslipidaemia through evaluating the dietary intake of South Africans in terms of the consumption of 15 foods rich in fat covering five consumption frequency options. These consumption frequencies delineated comprise 'never/once or less than once per month', 'two to three times per month', 'one to two times per week', 'three to four times per week', and 'five or more times per week'. As the reliability and validity of this section of the questionnaire was seemingly not determined after being adapted (Venter & Winterbach, 2010), a comparison was conducted between the foods listed on the screening questionnaire and those usually consumed by adults in SA as a whole, in order to establish that the questionnaire was appropriate to the study population. Virtually all of the dietary sources of fat that are universally consumed in the Western Cape, SA, were included in the screening questionnaire – i.e., nine of the ten, nine of the nine and seven of the nine consumed fat food sources, as determined through a food procurement and household inventory questionnaire (Maunder & Labadarios, 2000:586), 24-hour-recall (Maunder &

Labadarios, 2000:294), and quantitative FFQ (Maunder & Labadarios, 2000:476), respectively, were itemised in the screening questionnaire. In comparison to the ten most frequently consumed foods by South Africans as provided by Mchiza et al (2015), six of the seven fat food sources listed across the considered studies were itemised in the screening questionnaire. Although the score obtained from this third section of the questionnaire (see data analysis account below) is connected to the amount of fat consumed instead of the quality, the food listed in the screening questionnaire corresponds with the current emphases on fat quality, particularly those relating to the maintenance of heart health (Klug et al, 2015).

The last section (Section D) of the questionnaire comprised multiple choice questions on demographic (e.g. gender) and other (e.g. lifestyle and biographic characteristics) information pertaining to the students obtained from previous questionnaires constructed for survey use through the academic programme.

Pre-testing of the questionnaire

The questionnaire was pre-tested on a small set of 23 respondents (approximately 10% of the proposed stratified sample of 225) prior to the actual data collection. The fat nutrition knowledge section of the questionnaire included terms such as saturated, cholesterol, trans-fatty acids, unsaturated and hydrogenated fatty acids. These terms were confusing or unfamiliar to a number of the students. Although this was a knowledge test, and being unfamiliar with terms relating to fat quality may represent a lack of knowledge in that regard, a 'don't know' option (as applied in the study by Venter and Winterbach, 2010) was added to the answers of all 18 questions in Section B of the questionnaire, so as not to discourage students puzzled by the terms from completing the whole questionnaire.

The face validity of question six ('What will be the healthiest way to cook beef steak?') in Section A was improved since some students did not understand the meaning of the word 'sear', which was one of the alternative answers to that question. The definition of searing, i.e. "to quickly cook all sides", was extracted from the Oxford Dictionary of Food and Nutrition (2009:485) and included in the answer as "quickly cook all sides (seared)", in order to improve its clarity. To avoid the possibility of giving away the answer to respondents indirectly, the pattern of the other two answers to that same question was also slightly adjusted so that all the alternatives in question six had a similar pattern.

Data collection

After the questionnaire was pre-tested and adjustments were made, data collection proceeded, from April to May of 2015. As the university was in session during this period, students were attending classes. Because of this, the questionnaire was administered between 17:30 and 21:00 from Monday to Friday, and from 14:00 till late on Saturday and Sunday, since most of the students did not attend class over the weekend. The data were collected in one self-catering residence at a time. When the required stratified sample from a particular residence was obtained, the principal investigator moved on to another self-catering residence. Every student was approached individually for participation. After signing the consent form, the respondents were presented with the self-administered questionnaire. In order to prevent them from searching for the answers on the internet or asking their roommates (established in the questionnaire pre -testing), the principal investigator remained close by, but not too close to intimidate them.

Data analysis

The two knowledge tests (first two sections of the questionnaire) were first scored dichotomously for correct and incorrect answers, after which standard score categories were considered for each based on the total score obtained. For the fat food knowledge category assessment, a score of 11 or below represented poor or below-average knowledge, a score of 12 to 17 average knowledge and a score of 18 and above, above-average or good knowledge (Hanekom et al, 2014). For the fat nutrition knowledge test, a score of seven or below indicated a poor score, a score of eight to 12 an average score, and a score of 13 or higher, a good score (Venter, 2008).

The questions included in these two knowledge tests were also used for assessing imperative and declarative knowledge. To achieve accuracy in categorising the knowledge assessment in each question as imperative or

declarative, triangulation involving more than one investigator was employed to achieve an authoritative viewpoint (Kelly, 2006:380). The triangulation was carried out by a review panel consisting of the principal investigator and the two knowledge test developers. The procedure was based on the definition of declarative knowledge as knowledge of concepts and facts (Jones & Idol, 2013:515), and imperative knowledge as knowledge of how to complete certain tasks or actions (Jones & Idol, 2013:516). It was undertaken to ascertain the imperative knowledge of the respondents, as imperative knowledge is understood to be more likely to cause a change in behaviour than declarative knowledge (Dickson-Spillman & Siegrist, 2011).

For the assessment of the consumption of foods rich in fat (third section of the questionnaire), points were allocated to each food item according to the consumption frequency, as: zero, one, two, three and four for the consumption frequency of never/once or less than once per month, two to three times per month, one to two times per week, three to four times per week, and five or more times per week, respectively. The total points for each food item were summed to form an overall score which was then used to assess the level at which an individual student consumed foods high in fat. Overall scores of more than 27 represents a diet high in fat, scores of 25 to 27 a diet quite high in fat, scores of 22 to 24 the typical Western diet, scores of 18 to 21 a diet with low-fat food choices, and scores of 17 or less a desirable (almost ideal) fat intake (South African Medical Association Dyslipidaemia Nutrition Working Group, 2000).

The Pearson's chi-square test at a significance level of five percent was applied to these categorical findings to determine associations between the students' fat food knowledge and consumption of foods rich in fat, fat nutrition knowledge and consumption of foods rich in fat, and fat food and nutrition knowledge. Due to the investigative emphasis on fat knowledge, the categorical findings of the students' fat food and fat nutrition knowledge were respectively also used to establish associations with their gender and their own perceived knowledge of dietary fat compared to that of other students (as 'much less', 'somewhat less', 'about similar', 'somewhat more' and 'much more') and their major source of food and nutritional information (both the latter as biographic characteristic question inclusions in the last section of the questionnaire) via the Pearson's chi-square test at a significance level of five percent. The associations with gender were carried out to determine potential confounder influence as gender is a demographic factor known to influence nutrition knowledge scores (Parmenter et al, 2000; Hendrie et al, 2008) and the associations with the biographic factors carried out to support validity-related evidence for the students' fat food and fat nutrition knowledge level outcomes.

RESULTS

Respondent sample size, demographic and lifestyle characteristics

Two hundred and twenty-five first-year students from the black population group participated in this study. All students invited partook in the study. The final stratified student sample representation for the self-catering residences (n = 5) was the same as that of the population. It included a near equal representation of females (51,1%) and males (48,9%), and of those who considered themselves to be physically active (50,2%) and those not (49,8%). The majority (81,3%) of the respondents declared themselves to be non-smokers, while those who were currently smokers comprised just above a tenth (14,2%). Almost three-quarters (74,2%) of the respondents perceived their own body weight status to be optimal ('normal') and a near equal percentage considered themselves to be either underweight (10,2%) or slightly overweight/ overweight (14,7%).

Respondent fat food knowledge

The fat food knowledge of the respondents includes their test item scores, norm score categories achieved and descriptive statistics pertaining to their achieved scores. These are presented below.

Test item scores Among the top ten questions answered correctly (those answered correctly by 52% and more of the respondents), the majority (70%) were considered by the review panel to assess imperative fat food knowledge, while 30% were considered to assess declarative fat food knowledge.

However, with regard to the 13 questions that were answered correctly by less than half of the respondents, ranging from 28,4% (for question 14) to 49,8% (for question 16), approximately two-thirds (69,2%) were also considered by the review panel to assess imperative fat food knowledge. The number and percentage of respondents who correctly answered each test item is indicated in Table 1.

Test scores and norm score categories Nearly half (48,4%) of the respondents obtained an average fat food knowledge score, followed by just above a third (38,7%) who achieved a poor/below-average knowledge score. The mean score of 12 and the median score of 13 of the respondent group reflected an average knowledge score, as they were equal to and just above the minimum range of the norm score for an average achievement, being 12 to 17 (Hanekom et al, 2014) (See Table 2).

Respondent fat nutrition knowledge

As with the fat food knowledge, the fat nutrition knowledge of the respondents incorporates their test item scores, norm score categories achieved and descriptive statistics of the achieved scores, as presented below.

Test item scores All of the first five questions, and those best answered by the respondents, were considered by the review panel to assess imperative fat nutrition knowledge. Nonetheless, among the nine poorest answered questions (answered correctly by 13,8% to 24,4% of the respondents), just above half (55,6%) were considered by the review panel to assess imperative fat nutrition knowledge, while less than half (44,4%) were considered to assess declarative fat nutrition knowledge. The number and percentage of respondents who correctly answered each test item is presented in Table 1.

Test scores and norm score categories The respondents were found to have poor fat nutrition knowledge, as evidenced by the poor/ below-average score obtained by the majority (80,9%), with the mean score (5,25 ± 2,80) achieved being below seven (Venter, 2008) (See Table 2).

Respondent consumption of foods rich in fat

The respondents' intake of foods rich in fat, incorporating the consumption frequencies and the norm score categories for their consumption of these foods, is presented below.

Intake of foods rich in fat About a quarter to a third of the respondents indicated that they consumed fried chicken (with skin) (31,1%), potato crisps, corn chips, popcorn, etc. (29,8%), potato chips ('slap chips') (28,4%), eggs (26,2%), margarine or butter (25,3%) and salad dressings, mayonnaise, etc. (23,6%), once or twice a week. Just above a third (34,7%) of the respondents indicated that they consumed full-cream milk five or more times per week, followed by approximately a quarter who consumed eggs (25,3%) and margarine or butter (23,1%) five or more times per week. These and the rest of the consumption frequencies are detailed in Table 3.

Consumption category classification Less than half (47,5%) of the respondents' diet was either desirable in terms of fat consumption (29,3%) or contained food items low in fat (18,2%), compared with more than half (52,5%) that either followed a typical Western diet (14,7%), a diet quite high in fat (10,7%) or a diet high in fat (27,1%).

Association between the respondent fat knowledge and their consumption of foods rich in fat

For the purposes of this study, the respondents' dietary fat knowledge was separated into two constituents, fat food knowledge and fat nutrition knowledge. The association between the respondents' dietary fat knowledge in respect of these constituents and their consumption of foods high in fat is presented below.

Respondent fat food knowledge and their consumption of foods rich in fat No significance ($p > 0,05$) was found in the association between the respondents' fat food knowledge score categories and their consumption of foods rich in fat score categories. Among the respondents who obtained poor or average and above-average fat food knowledge scores, a near equal percentage (50,6% and 45,7% respectively) followed a diet with low-fat food choices and a desirable fat intake, followed by those who

ISSN 0378-5254 Journal of Consumer Sciences, Special Edition
Food and nutrition challenges in Southern Africa, Vol 2, 2017

TABLE 1: NUMBER AND PERCENTAGE OF THE RESPONDENTS (N = 225) WHO CORRECTLY ANSWERED THE TEST ITEMS IN THE FAT FOOD AND FAT NUTRITION KNOWLEDGE TESTS

Fat food knowledge test*					Fat nutrition knowledge test**				
Question	Question description	Type of knowledge assessed***	Correct answers		Question	Question description	Type of Knowledge assessed***	Correct answers	
			n	%				n	%
1	What to do with unpleasant smelling oil	Imperative	181	80,4	1	Lowest to highest fat listed foods	Imperative	112	49,8
2	Name of cooking method used when food is submerged in hot oil	Declarative	171	76,0	2	Food with the highest fat content per 100g	Imperative	89	39,6
3	Type of fat best to use for deep frying	Imperative	145	64,4	3	Food item not containing cholesterol	Imperative	82	36,4
4	Preferred oil choice to use when making Greek salad	Imperative	158	70,2	4	Food item which is high in omega-3 fatty acids	Imperative	86	38,2
5	Kilojoule representation on a food label	Declarative	159	70,7	5	Trans-fatty acid containing food item	Imperative	104	46,2
6	Healthiest way of cooking beef steak	Imperative	117	52,0	6	Cholesterol containing food item	Imperative	55	24,4
7	Best descriptor of a fat replacer	Declarative	162	72,0	7	Food item with the lowest fat content per 100g	Imperative	55	24,4
8	Ingredients needed when making French toast	Imperative	132	58,7	8	True fact of cholesterol	Declarative	60	26,7
9	What smoking oil indicates when shallow-frying	Imperative	124	55,1	9	'Good' fats in the diet	Declarative	68	30,2
10	Oil that promotes heart health	Imperative	104	46,2	10	Products usually containing cholesterol	Declarative	31	13,8
11	Reason for fried potatoes being greasy	Imperative	116	51,6	11	Dietary factor most associated with high blood cholesterol levels	Declarative	46	20,4
12	Best fat choice when making shortbread biscuits	Imperative	91	40,4	12	Energy content of fat compared to that of starch	Declarative	46	20,4
13	Fresh cream replacer for a lower energy provision	Imperative	109	48,4	13	Most appropriate margarine to protect against heart disease	Declarative	55	24,4
14	Best fat to use when making pastry	Imperative	64	28,4	14	Monounsaturated fat containing oil	Imperative	70	31,1
15	Type of canned tuna that has the lowest energy value	Imperative	113	50,2	15	Oils that should not be allowed in a diet used for the treatment of coronary heart disease	Imperative	44	19,6
16	Statement best describing margarine labelled 'Halaal'	Declarative	112	49,8	16	Food item with the lowest fat content per serving slice	Imperative	53	23,6
17	Why butter rather than margarine is chosen when cooking	Imperative	68	30,2	17	Food item high in saturated fat	Imperative	80	35,6
18	How to reduce the energy content when preparing spaghetti bolognaise	Imperative	101	44,9	18	Food item with the highest energy content per 100g	Imperative	46	20,4
19	Meaning of 'breading'	Declarative	87	38,7					
20	Meat (per 100g) with the lowest fat content	Imperative	92	40,9					
21	Cooking method when oil just covers base of pan without completely covering the food	Declarative	95	42,2					
22	Why deep fried food are first breaded or battered	Imperative	134	59,6					
23	Cold dessert with the lowest energy value	Imperative	67	29,8					
24	Fat that may contribute to heart disease	Declarative	90	40,0					
25	Cut of pork that will hold moisture during cooking	Imperative	88	39,1					

* Source: Hanekom et al (2014); ** Source: Venter (2008); *** Declarative knowledge as being knowledge of concepts and facts (Source: Jones & Idol, 2013:515) and imperative knowledge as being knowledge of how to complete certain tasks or actions (Source: Jones & Idol, 2013:516) based on the review panel categorisation

TABLE 2: FAT FOOD AND FAT NUTRITION KNOWLEDGE SCORES OF THE RESPONDENTS (N = 225)

Fat food knowledge scores					Fat nutrition knowledge scores				
Descriptive statistics	Respondent score	Norm score categories*	Respondent score category achievement		Descriptive statistics	Respondent score	Norm score categories**	Respondent score category achievement	
Mean ± SD***	12,80 ± 3,85		n	%	Mean ± SD***	5,25 ± 2,80		n	%
Median	13	Good/Above-average (≥ 18)	29	12,9	Median	5	Good/Above-average (≥ 13)	4	1,8
Minimum	4	Average (12 - 17)	109	48,4	Minimum	1	Average (8 - 12)	39	17,3
Maximum	23	Poor/Below-average (≤ 11)	87	38,7	Maximum	16	Poor/Below-average (≤ 7)	182	80,9

*Obtained from the fat food knowledge test developed by Hanekom et al (2014); ** Obtained from the fat nutrition knowledge test developed by Venter (2008); *** Standard deviation

TABLE 3: CONSUMPTION FREQUENCY OF FOODS RICH IN FAT BY THE RESPONDENTS (N = 225) BASED ON A SCREENING QUESTIONNAIRE*

Foods rich in fat	Consumption frequency									
	Never/≤ 1 time per month		2 - 3 times per month		1 - 2 times per week		3 - 4 times per week		5+ times per week	
	n	%	n	%	n	%	n	%	n	%
Hamburger or cheeseburger	123	54,7	75	33,3	23	10,2	4	1,8	0	0
Red meat e.g. beef and mutton	57	25,3	88	39,1	48	21,3	23	10,2	9	4,0
Fried chicken (with skin)	45	20,0	58	25,8	70	31,1	40	17,8	12	5,3
Hot dogs, frankfurters, salami, Russians, sausages	79	35,1	67	29,8	48	21,3	20	8,9	11	4,9
Cold cuts, lunch meats, ham (with fat), etc.	117	52,0	58	25,8	32	14,2	12	5,3	6	2,7
Salad dressings, mayonnaise, etc.	58	25,8	45	20,0	53	23,6	42	18,7	27	12,0
Margarine or butter	32	14,2	34	15,1	57	25,3	50	22,2	52	23,1
Eggs	15	6,7	30	13,3	59	26,2	64	28,4	57	25,3
Bacon or pork sausages	97	43,1	68	30,2	39	17,3	15	6,7	6	2,7
Cheese or cheese spread	76	33,8	46	20,4	49	21,8	37	16,4	17	7,6
Full-cream milk	28	12,4	27	12,0	37	16,4	55	24,4	78	34,7
Potato chips ('slap chips')	36	16,0	65	28,9	64	28,4	36	16,0	24	10,7
Potato crisps, corn chips, popcorn, etc.	44	19,6	60	26,7	67	29,8	31	13,8	23	10,2
Ice cream	94	41,8	79	35,1	30	13,3	11	4,9	11	4,9
Doughnuts, cake, cookies, puddings, etc.	61	27,1	78	34,7	44	19,6	29	12,9	13	5,8

*Screening questionnaire (adapted from Block) acquired from the South African Medical Association Dyslipidaemia Nutrition Working Group (2000)

consumed a diet quite high/high in fat (35,6% and 39,1%, respectively) and those following a typical Western diet (13,8% and 15,2%, respectively) (See Table 4).

Respondent fat nutrition knowledge and their consumption of foods rich in fat A significant difference ($p < 0,05$) was found between the respondents' fat nutrition knowledge score categories and their consumption of foods rich in fat score categories. Among respondents who obtained a poor fat nutrition knowledge score, fewer (43,4%) followed a diet with low-fat food choices and a desirable fat intake, compared with respondents who achieved an average and

TABLE 4: ASSOCIATION BETWEEN THE RESPONDENTS' FAT FOOD AND FAT NUTRITION KNOWLEDGE, AND THEIR INTAKE OF FOODS RICH IN FAT (N = 225)

Fat food knowledge and intake of foods rich in fat						Fat nutrition knowledge and intake of foods rich in fat					
Consumption of foods rich in fat score categories	Fat food knowledge score categories				P-value*	Consumption of foods rich in fat score categories	Fat nutrition knowledge score categories				P-value*
	Poor (n = 87)		Average and above-average** (n = 138)				Poor (n = 182)		Average and above-average*** (n = 43)		
	n	%	n	%			n	%	n	%	
Diet quite high/high in fat**** (n = 85)	31	35,6	54	39,1	0,772	Diet quite high/high in fat**** (n = 85)	75	41,2	10	23,3	0,034
Typical Western diet (n = 33)	12	13,8	21	15,2		Typical Western diet (n = 33)	28	15,4	5	11,6	
Diet low in fat***** (n = 107)	44	50,6	63	45,7		Diet low in fat***** (n = 107)	79	43,4	28	65,1	

* Pearson's chi-square test; The following score categories were combined due to low cell counts: ** 'Average' and 'above-average' fat food knowledge; *** 'Average' and 'above-average' fat nutrition knowledge; **** 'A diet quite high in fat' and 'a diet high in fat' fat intake score categories and ***** 'A diet with low-fat food choices' and 'a desirable fat intake' fat intake score categories

above-average fat nutrition knowledge category score (65,1%). Correspondingly, among the respondents who achieved an average and above-average fat nutrition knowledge score, fewer followed a diet quite high/high in fat or a typical Western diet (23,3% and 11,6%, respectively), compared with those who obtained a poor fat nutrition knowledge score following these same dietary fat intakes (41,2% and 15,4%, respectively) (See Table 4).

Respondent fat food knowledge and their fat nutrition knowledge A significant association ($p < 0,001$) was found between the fat food knowledge scores obtained by the respondents and their fat nutrition knowledge scores. Among those respondents who obtained poor fat food knowledge category scores, only a few (3,4%) achieved average and above-average fat nutrition knowledge category scores, while among those respondents who obtained average and above-average fat food knowledge category scores, far more (29%) attained average and above-average fat nutrition knowledge category scores (see Table 5).

No significance ($p > 0,05$) was respectively found between the gender of the respondents and their fat food and their fat nutrition knowledge scores obtained, as well as the respondents' major source of food and nutritional information and their fat nutrition knowledge scores obtained. Nonetheless, a significant difference ($p < 0,05$) was found between the respondents' perception of their own dietary fat knowledge compared to that of other students and their actual fat food and fat nutrition knowledge scores obtained and between the respondents' major source of food and nutritional information and their fat food knowledge scores obtained (see Table 6). Of those respondents who obtained a poor fat food knowledge score, only about a tenth (10,3%) perceived their own dietary fat knowledge to be more than that of other students compared to about a quarter (23,9%) of those respondents who achieved an average and above-average fat food knowledge score who did so. Among the respondents who obtained a poor fat nutrition knowledge score, almost half (46,7%) perceived their own dietary fat knowledge to be less than that of other students compared to only about a quarter (27,9%) of those respondents who achieved an average and above-average fat nutrition knowledge score who perceived their own dietary fat knowledge to be less than that of other students. Likewise, among the respondents who achieved an average and above-average fat nutrition knowledge score, about a third (34,9%) of these respondents perceived their own dietary fat knowledge to be more than that of other students compared to only roughly a tenth (14,8%) of those respondents who obtained a poor fat nutrition knowledge score who perceived their own dietary fat knowledge to be more than that of other students. Among those respondents who obtained a poor fat food

TABLE 5: ASSOCIATION BETWEEN THE RESPONDENTS' FAT FOOD KNOWLEDGE AND THEIR FAT NUTRITION KNOWLEDGE (N = 225)

Fat nutrition knowledge score categories	Fat food knowledge score categories				P-value***
	Poor (n = 87)		Average and above-average* (n = 138)		
	n	%	n	%	
Poor (n = 182)	84	96,6	98	71,0	0,000
Average and above-average** (n = 43)	3	3,4	40	29,0	

The following score categories were combined due to low cell counts: * 'Average' and 'above-average' fat food knowledge score categories; ** 'Average' and 'above-average' fat nutrition knowledge score categories *** Fisher's exact test

TABLE 6: ASSOCIATIONS BETWEEN THE RESPONDENTS' FAT FOOD AND FAT NUTRITION KNOWLEDGE, AND THEIR GENDER AND BIOGRAPHIC FACTORS (N = 225)

Respondent gender and biographic factors	Total	Fat food knowledge score categories				P-value*	Fat nutrition knowledge score categories				P-value*
		Poor (n = 87)		Average and above-average** (n = 138)			Poor (n = 182)		Average and above-average*** (n = 43)		
		n	%	n	%		n	%	n	%	
Gender											
Female	115	38	43,7	77	55,8	0,077	90	49,5	25	58,1	0,305
Male	110	49	56,3	61	44,2		92	50,5	18	41,9	
Perception of own dietary fat knowledge compared to other students											
Much less and somewhat less	97	43	49,4	54	39,1	0,035	85	46,7	12	27,9	0,006
About similar	86	35	40,2	51	37,0		70	38,5	16	37,2	
Somewhat more and much more	42	9	10,3	33	23,9		27	14,8	15	34,9	
Major source of food and nutritional information											
Family (at home)	111	43	49,4	68	49,3	0,019	94	51,6	17	39,5	0,054
Media (articles in magazines, books, internet, television and radio)	52	23	26,4	29	21,0		44	24,2	8	18,6	
Friends	25	14	16,1	11	8,0		20	11,0	5	11,6	
School subjects (such as Consumer Studies and Life Orientation)	37	7	8,1	30	21,7		24	13,2	13	30,2	

* Pearson's chi-square test; The following score categories were combined due to low cell counts: ** 'Average' and 'above-average' fat food knowledge; *** 'Average' and 'above-average' fat nutrition knowledge

knowledge score, only a few (8,1%) respondents acquired food and nutritional information from school subjects such as Consumer Studies and Life Orientation, while among those who achieved an average and above-average fat food knowledge, more (21.7%) respondents had acquired their food and nutritional information from school subjects (see Table 6).

DISCUSSION

Respondent fat food knowledge

The literature search revealed a scarcity of reported studies on the fat food knowledge of students or indeed of any other populations. The results of an earlier study (Bednar et al, 1998) that assessed the knowledge of fast food restaurant managers on fats and the fat content of foods showed that they lacked knowledge and that their lack of knowledge may contribute to them selecting food items and preparation methods that increase the fat content of the menu items they serve. Nevertheless, the

respondents in this study seemed to be reasonably knowledgeable about this aspect of dietary fat as their mean fat food knowledge score fell into the 'average' category. However, most of the respondents performed poorly on test items that assessed imperative fat food knowledge, the type of knowledge more likely to lead to a change in dietary behaviour (Dickson-Spillman & Siegrist, 2011). The respondents aptly perceived their own dietary fat knowledge as gathered through their fat food knowledge scores, providing validity-related evidence for the students' fat food knowledge outcome. More of those students who perceived themselves to have more dietary fat knowledge than other students, indeed achieved an average and above-average fat food knowledge score compared to those who perceived themselves to have less dietary fat knowledge than other students. In addition, more of those students who acquired their food and nutritional information from school subjects achieved an average and above-average fat food knowledge score compared to those who scored poorly. Food and nutrition is a central topic in the school subject Consumer Studies of which about a third of the subject teaching, learning and assessment has to be allocated to teaching practical skills (Booyse et al, 2013). This may be closely linked to the sub-domains of the fat food knowledge test of knowledge of food preparation and cooking methods and which may have strengthened the association. Student gender, as a possible confounding factor, provided no association with the level of fat food knowledge that they had.

Respondent fat nutrition knowledge

In contrast to the fat food knowledge assessment, the respondents generally struggled to complete the fat nutrition knowledge assessment. This had emerged during the pre-testing of the questionnaire, and had led to the addition of the response option 'don't know' to all of the test questions. The students' difficulty with this range of questions was confirmed when the majority of them scored poorly in the assessment. The respondents also did not answer the imperative knowledge questions in the assessment well. When the respondents' perception of their own dietary fat knowledge was associated with their fat nutrition knowledge scores, it was found that their perceptions were again apt and consequently also offers support for validity-related evidence for the students' fat nutrition knowledge outcome. Those students who perceived their own dietary fat knowledge to be less than that of other students, generally also scored poorly in the fat nutrition knowledge test. It should however be noted that it had been reported that generally individuals have a tendency of over-estimating their own knowledge (Alba & Hutchinson, 2000; Atir et al, 2015). The students' gender also provided no association with the level of fat nutrition knowledge that they had. However, a significant difference was found between respondents' gender and their nutrition knowledge scores in studies among other conducted by Parmenter et al (2000), Hendrie et al (2008) and Venter and Winterbach (2010:77). In these studies, the females scored significantly higher than the males. Where the students acquired their food and nutritional information was additionally not found to be significantly associated with the level of fat nutrition knowledge that they had. The general lack of fat nutrition knowledge among the students, and which led them to score poorly in this knowledge test, can probably be ascribed to the perceived lack of concern of students to learn about nutrition (Pham et al, 2017) and, in their youth, not being anxious about illness/disease (Nasser et al, 2011).

Venter and Winterbach (2010) assessed the fat nutrition knowledge of mid-adolescents (n = 168) from SA using the fat nutrition knowledge test employed in this study. These mid-adolescents achieved a mean score of 6,45 (± 2,65) out of 18 points, which represented a generally poor/below-average level of fat nutrition knowledge similar to that found in this study (5,25 ± 2,80). First-year female black students from the University of the North, SA, also scored poorly (mean percentage = 40,7%) in an overall nutrition knowledge test (Steyn et al, 2000). A study by Al-Isa and Alfaddagh (2014) conducted on male students (n = 378) from Kuwaiti University reported a mean percentage dietary fat knowledge of 52,7%. Congruently, in a study conducted by Elhassan et al (2013) on female students (n = 350) from the Ahfad University, Sudan, the mean percentage dietary fat knowledge score recorded was 54%. However these latter studies (Elhassan et al, 2013; Al-Isa & Alfaddagh, 2014) included only a few test items on dietary fat as they were aimed at assessing the overall

nutrition knowledge of the students. This may be one reason for the dissonance between the mean fat knowledge scores they obtained and the fat nutrition knowledge score of the students reported in this study.

Respondent consumption of foods rich in fat

Past studies (Liedman et al, 2001; Ibrahim et al, 2014) have indicated that the diet of students is typically high in foods rich in fat. This may be attributed to their quest for convenience foods (Candel, 2001) and their high consumption of fried/fast foods (Sakamaki et al, 2005; Al-Faris et al, 2015). This study provides corroboration that students' diets are generally high in fat, as evidenced by the finding that more than half of the respondents followed a typical Western diet, a diet quite high in fat, or a diet high in fat.

The screening questionnaire itemised fast foods, fried foods and high fat snacks such as potato chips (potato crisps and chips / 'slap chips'). Comparable findings with regard to the consumption frequencies of potato crisps were reported in this study and the studies conducted by Van den Berg et al (2013) and Okeyo (2009:62). In this study, approximately a third of the respondents indicated that they consumed potato crisps, corn chips, popcorn, etc. two to three times per month, with another third indicating that they consumed the same items once or twice a week. Okeyo (2009:62) assessed the eating practices of black students (n = 162) registered at the University of Fort Hare, SA, and reported that most of them (83,3%) indicated that they consumed chips (crisps) monthly. Van den Berg et al (2013) assessed the nutritional status of students (n = 161) registered at the University of the Free State, SA, and reported that 88,2% of these students consumed chips (crisps) on a weekly basis. However, only three consumption frequency options were provided to the students in these two studies, i.e. "do not eat", "eat monthly" and "eat daily" in the study by Okeyo (2009:62), and "do not eat", "eat weekly" and "eat daily" in the study by Van den Berg et al (2013). This contrasts with the five consumption frequency options provided to the respondents in this study.

Most of the students in this study consumed full-cream milk and margarine/butter more frequently than other foods rich in fat. Just over a third of them consumed full-cream milk five or more times per week, while about a quarter consumed margarine/butter five or more times per week. A comparable result was reported among black students in other studies conducted in SA by Ntuli (2005:151), Okeyo (2009:62) and Van den Berg et al (2012), and in Malawi by Takomana and Kalimbira (2012). Ntuli (2005:151) assessed the dietary intake of students (n = 192) enrolled at the Durban Institute of Technology, SA, and reported that most (72%) of these students reported an 'almost daily' consumption of margarine. Likewise, 67,9% of the students assessed by Okeyo (2009:62) reported a daily consumption of margarine, as well as 68,3% of the students assessed by Van den Berg et al (2012); 77% of these students also reported daily consumption of full-cream milk. The screening questionnaire did not differentiate between butter or margarine and the available types of margarine but instead itemised butter and margarine together. It should be noted that this itemisation in the present-day availability of such food products in different ranges is a limitation of the screening questionnaire in the assessment of the consumption of foods rich in fat.

Association between the respondent fat food knowledge and consumption of foods rich in fat

The results from this study indicated that the respondents' fat food knowledge was not associated with their consumption of foods rich in fat. This might seem to imply that a respondent's level of fat food knowledge (whether poor or average or above-average) does not affect dietary behaviour in terms of the consumption of foods high in fat. However, it has to be assumed that other factors not explored in this study might have contributed to this lack of association. Apart from an individual's food knowledge, various other factors have been identified as possible influences on an individual's dietary consumption pattern (Ganasegaran et al, 2012), preventing an association with the former from being established. An individual's preference for specific types of foods has been found to influence dietary behaviour (Gracia & Albisu, 2001), and this might eclipse that individual's fat food knowledge when it comes to food selection.

Since young adults in general report that they devote most of their time to personal and professional undertakings (Koszewski & Kuo, 1996), a lack of time (Marquis, 2005) resulting in a quest for convenience foods has become a commonplace response from this age group (Candel, 2001). This has been reported in a number of studies (King et al, 2007; Van Zyl et al, 2010; Avram & Oravitan, 2013). Other factors that have been reported as influencing the eating habits of young adults or students include "taste" (Al-Faris et al, 2015), "price" (Avram & Oravitan, 2013; Al-Faris et al, 2015), "attractive advertisements" (Al-Faris et al, 2015), "availability" and "peer influence" (King et al, 2007). All these factors might have influenced the consumption of foods rich in fat by the student sample in this study, and contributed to the absence of association between their fat food knowledge and their consumption of foods rich in fat. It could also conversely imply that not having fat food knowledge may negatively influence the fat nutrition knowledge and as a result support the consumption of foods rich in fat as the fat food knowledge and the fat nutrition knowledge were associated and the fat nutrition knowledge inversely with the consumption of foods rich in fat.

Association between the respondent fat nutrition knowledge and consumption of foods rich in fat

Unlike the case of respondents' fat food knowledge, this study found a significant association between their fat nutrition knowledge and their consumption of foods rich in fat. More of the respondents who achieved average and above-average fat nutrition knowledge scores followed a diet with low-fat food choices that represented a desirable fat intake, as compared with those who obtained poor fat nutrition knowledge scores. Reciprocally, more of the respondents who obtained poor fat nutrition knowledge scores followed either a diet quite high in fat, a diet high in fat, or a typical Western diet, compared with those who achieved average and above-average fat nutrition knowledge scores. This implies that fat nutrition knowledge positively influences behaviour in terms of the consumption of foods rich in fat.

A study that assessed the fat nutrition knowledge and fat intake of mid-adolescents in Cape Town, SA, also found a significant association between the respondents' fat nutrition knowledge and their fat intake (Venter & Winterbach, 2010). In that study, those mid-adolescents who obtained poor fat nutrition knowledge scores mostly followed a diet high in fat, while those who achieved average fat nutrition knowledge scores mostly followed a diet including a desirable fat intake (Venter & Winterbach, 2010). Venter and Winterbach's (2010) study is the only one to our knowledge that has specifically assessed the fat nutrition knowledge and fat intake of respondents.

At this point the question remains as to why the fat nutrition knowledge and not the fat food knowledge of the respondents seemed to affect their dietary behaviour in terms of their fat intake. Although this questions the relevance of the fat food knowledge questionnaire, various factors that may have hindered the students' fat food knowledge from influencing their dietary behaviour have been discussed above, and should incidentally be considered as well as the value of the fat food knowledge questionnaire explored in additional studies. The content sub-domains of the fat food knowledge test comprise the choice and purchasing of food items, raw food preparation and cooking methods, while the content sub-domains of the dietary fat nutrition knowledge test are disease associations, food sources and food choices. This difference in the sub-domain contents of the two fat knowledge tests might be a contributing factor. It might be inferred that the knowledge of how certain foods affect health (disease associations) might be more likely to lead to healthier dietary behaviour out of fear of illness and disease, compared with the knowledge of raw food preparation or cooking methods. Although young adults/students themselves may not be concerned about illness/ disease (Nasser et al, 2011), they may come from households where illness/disease is a concern, since there is increasing incidence of NCDs in SA. According to the World Health Organization 2014 country profiles (World Health Organization, 2014:173), out of a total 608 000 deaths that occurred in SA, about 43% were due to NCDs. This in itself is a cause for alarm; but it has been reported that it is often the onset of an illness/disease that causes a change in eating behaviour (Thomson & Foster, 2014:144). This may consequently have had an

impact on the fat nutrition knowledge students from households affected by illness/disease.

Association between the respondent fat food knowledge and fat nutrition knowledge

A significant association between respondents' fat food knowledge and fat nutrition knowledge was found in this study. Of the respondents who obtained poor fat food knowledge scores, the majority also obtained poor fat nutrition knowledge scores. It could be assumed that when fat nutrition information is acquired by an individual, it often contains aspects of both fat food and fat nutrition information. This suggests a link between information relating to fat food knowledge and fat nutrition knowledge of a kind embodied in the concept of "food literacy". "Food literacy" embraces food planning, management, selection, preparation and eating, all factors that shape an individual's food intake and dietary pattern (Vaitkeviciute et al, 2014).

CONCLUSIONS AND RECOMMENDATIONS

As discussed above, it turned out to be fat nutrition knowledge and not fat food knowledge that significantly influenced the students' consumption of foods rich in fat. Since to our knowledge, this is the first study to provide information of this kind, it is recommended that food and nutrition education which objective it is to reduce students' consumption of foods high in fats, and certain fats in particular, place greater emphasis on fat nutrition knowledge than fat food knowledge if they are to achieve their objective.

The study findings also revealed that the students generally had average fat food knowledge and poor or below-average fat nutrition knowledge. This result further reinforces the recommendation for nutrition education aimed at students to provide emphasis on fat nutrition knowledge, which seemed largely lacking among the majority of students assessed in this study. South Africans should ideally learn about good nutrition at an earlier life stage, as schoolchildren, through attending school and residing at home as was supported in this study by the acquired fat food knowledge. This recommendation is supported by evidence that curriculum-based nutrition programmes provided at school impart nutrition knowledge to schoolchildren and improve their eating behaviour (Steyn, 2010). Although nutrition education is used on a global level as a medium for conveying nutrition information and guidance on healthy diets to various population ranges, it is rarely provided to university students (Pei Lin & Wan, 2012). It is important to include nutrition education in health programmes provided by university health services, especially to first-year students responsible for their own food provision. Educational efforts should also be targeted at those students who perceive themselves to not be as knowledgeable as others, as this study found that, given the fact that the food and nutrition knowledge scores they achieved, these students had an accurate perception of their dietary fat knowledge. University students are at a vital phase of transition from parental control to assuming full responsibility for their lifestyle choices, which include food selection and dietary intake (Cousineau et al, 2006). Food choice behaviour adopted during this transition phase is also likely to influence life-long eating behaviour (Savage et al, 2007). Van den Berg et al (2013) maintain that after individuals have acquired nutrition education, their knowledge alone may not be enough to motivate them to eat more healthily, and their environment may have an important role to play. Accordingly, it is recommended that university institutions support nutrition education efforts by providing an environment at campus level that supports students' attempts to apply their nutrition knowledge in their day-to-day lives. Adapting the kind of foods provided in university cafeterias, providing a regular food market with a "health" theme and constant nutritional health messages on campus television, etc., may help to create such an environment. In an effort to encourage and support the health and wellbeing of its young people, the South African Government has implemented a number of legislative and policy initiatives including recommending a reduction in fat intake (Reddy et al, 2003:11).

Since this study was limited in its range, fat food knowledge and fat nutrition knowledge and their associations with fat intake should be further investigated in other populaces and even across different groups to uncover confounding factors, for instance demographic variation in these associations of which gender as demographic confounder did not impact the fat food or fat nutrition knowledge of first-year university students in this study. Perhaps even adding

food and nutrition knowledge of other pertinent dietary constituents in relation to dietary intake can be explored. Probing the different fat food knowledge content sub-domains and how they are each associated with fat intake may be a consideration for future research as all the knowledge questions forming a content sub-domain in the test did meet the criteria of item analysis. In such an analysis, the obtained scores would be directly utilised and not categorised. This might provide insight into the integrative framework of fat food knowledge and support the appeal by Vaitkeviciute et al (2014) for research to be undertaken to address the connectedness between food literacy, which includes food knowledge, and dietary intake.

The kind of study envisaged, aimed at expanding the information relating to food and nutrition knowledge and its relation to dietary intake, would optimally have to take a multidisciplinary approach, involving natural and social science food and nutrition experts, in order to take into account the various factors (intrapersonal, interpersonal and environmental) that influence dietary behaviour (Wardle et al, 2000; Ganasegaran et al, 2012). Such a comprehensive study could have real significance in addressing the broad range of the South African food-based dietary guidelines: a low-fat intake in terms of the food sources of fat is but one factor among many in the deterrence of NCDs (Steyn, 2010).

ACKNOWLEDGEMENTS

A word of appreciation goes to the Cape Peninsula University of Technology for provision of a post-graduate bursary as well as Prof. Dirk Van Schalkwyk, for the statistical analysis of the data and Ms Raché Hanekom for assistance with the imperative and declarative knowledge categorising of the items in the two knowledge tests.

REFERENCES

Alba, J.W. & Hutchinson, J.W., 2000, Knowledge calibration: what consumers know and what they think they know, *Journal of Consumer Research,* 27(2), 123-156.

Al-Faris, N.A., Al-Tamimi, J.Z., Al-Jobair, M.O. & Al-Shwaiyat, N.M., 2015, Trends of fast food consumption among adolescent and young adult Saudi girls living in Riyadh, *Food and Nutrition Research,* 59, 1-10.

Al-Isa, A. & Alfaddagh, A., 2014, Nutritional knowledge among Kuwaiti college students, *Health*, 6(5), 448-453.

Atir, S., Rosenweig, E. & Dunning, D., 2015, When knowledge knows no bounds: self-perceived expertise predicts claims of impossible knowledge, *Psychological Science*, 26(8), 1295-1303.

Avram, C. & Oravitan, M., 2013, Fruit, vegetables and fast food consumption among university students, *Timisoara Physical Education and Rehabilitation Journal,* 5(10), 54-60.

Booyse, C., Du Rand, E. & Koekemoer, A., 2013, The standing of the curriculum for Consumer Studies as school subject in the South African context, *Journal of Family Ecology and Consumer Sciences,* 41, 85-94.

Candel, M.J., 2001, Consumer's convenience orientation toward meal preparation: conceptualization and measurements, *Appetite,* 36(1), 15-28.

Bednar, C., Czajka-Narins, D. & Elahi, F., 1998, Knowledge of fats/oils and fat content of foods by fast food restaurant managers, *Journal of the American Dietetic Association,* 98(9 Suppl), A-106.

Catsicas, R., Julsing-Strydom, C., Seelinger, J., Bhawan, M., Watson, M., Grant, N., Otto, Z., Meyer, C., Rautenbach, P. & Drummond, L., 2014, Food faddism – A review, *South African Journal of Diabetes,* 7(2), 11-13.

Cousineau, T.M., Franko, D.L., Ciccazzo, M., Goldstein, M. & Rosenthal, E., 2006, Web-based nutrition education for college students: Is it feasible?, *Evaluation and Program Planning,* 29(1), 23-33.

Deliens, T., Clarys, P., De Bourdeaudhuij, I, & Deforche, B., 2014, Determinants of eating behaviour in university students: a qualitative study using focus group discussions, *Public Health,* 14(1), 53-65.

Deshpande, S., Michael, D.B. & Basil, D.Z., 2009, Factors influencing healthy eating among college students: an application of the health belief model, *Health Marketing Quarterly,* 26(2), 145-164.

Dickson-Spillman, M. & Siegrist, M., 2011, Consumer's knowledge of healthy diets and its correlation with dietary behaviour, *Journal of Human Nutrition and Dietetics,* 24(1), 54-60.

Dyson, R. & Renk, K., 2006, Freshman adaption to university life: depressive symptoms, stress and coping, *Journal of Clinical Psychology,* 62 (10), 1231-1244.

El Ansari, W., Stock, C. & Mikolajczyk, R.T., 2012, Relationships between food consumption and living arrangements among university students in four European countries: a cross-sectional study, *Nutrition Journal*, 11(1), 28-34.

Elhassan, M.R., Eman, G.H. & Somiya, M.G.S., 2013, Nutrition knowledge attitude and practices among students of Ahfad university for women, *Indian Journal of Scientific Research,* 4(1), 25-34.

Emrich, T.E. & Mazier, M.J., 2009, Impact of nutrition education on university students' fat consumption, *Canadian Journal of Dietetic Practice and Research,* 70(4), 187-192.

Ganasegaran, K., Al-Dubai, S.A.R., Qureshi, A.M., Alabed, A.A., Rizal, A.M. & Aljuni, S.M., 2012, Social and psychological factors affecting eating habits among university students in a Malaysian medical school: cross-sectional study, *Nutrition Journal*, 11(1), 48-54.

Gracia, A. & Albisu, L.M., 2001, Food consumption in the European Union: main determinants and country differences, *Agribusiness,* 17(4), 469-488.

Hanekom, R., Venter, I. & Du Toit, L.D., 2014, Development of a food knowledge test for first year students at a university of technology in the Western Cape, South Africa, *Journal of Family Ecology and Consumer Sciences,* 42, 1-16.

Hendrie, G.A., Coveney, J. & Cox, D., 2008, Exploring nutrition knowledge and the demographic variation in knowledge levels in an Australian community sample, *Public Health Nutrition,* 11(12), 1365-1371.

Ibrahim, N.K., Mahnashi, M., Al-Dhaheri, A., Al-Zahrani, B., Al-Wadie, E., Alhsbri, M., Al-Shanketi, R., Al-Shehri, R., Al-Sayes, F.M. & Bashawri, J., 2014, Risk factors of coronary heart disease among medical students in King Abdulaziz University, Jeddah, Saudi Arabia, *Public Health,* 14(1), 411.

Jones, B.F. & Idol, L., 2013, *Dimensions of thinking and cognitive instruction*, Routledge, Hillsdale.

Kelly, K., 2006, Calling it a day: reaching conclusions in qualitative research, in M.T. Blanche, K. Durrheim, & D. Painter, 2006, *Research in practice: applied methods for the social sciences*, UCT Press, Cape Town.

King, K.A., Mohl, K., Bernard, A.L. & Vidourek, R.A., 2007, Does involvement in healthy eating among university students differ based on exercise status and reasons for exercise?, *Californian Journal of Health Promotion,* 5(3), 106-119.

Klug, E.Q., Raal, F.J., Marais, A.D., Taskinen, M.R., Dalby, A.J., Schamroth, C., Rapeport, N., Jankelow, D., Blom, D.J., Casticas, R. & Webb, D.A., 2015, South African dyslipidaemia guideline consensus statement: A joint statement from the South African Heart Association (SA Heart) and the Lipid and Atherosclerosis Society of Southern Africa (LASSA) - Guidelines, *South African Family Practice,* 57(2), 22-31.

Koszewski, W. & Kuo, M., 1996, Factors that influence the food consumption behaviour and nutritional adequacy of college women, *Journal of the American Dietetic Association,* 96(12), 1286-1288.

Liedman, M., Cameron, B.A., Carson, D.K., Brown, D.M. & Meyer, S.S., 2001, Dietary fat reduction behaviours in college students: relationship to dietary status, gender and key psychosocial variables, *Appetite,* 36(1), 51-56.

Marquis, M., 2005, Exploring convenience orientation as a food motivation for college students living in residence halls, *International Journal of Consumer Studies,* 29(1), 55-63.

Matvienko, O., Lewis, D.S. & Schafer, E., 2001, A college nutrition science course as an intervention to prevent weight gain in female college freshman. *Journal of Nutrition Education,* 33(2), 95-101.

Maunderer, E. & Labadarios, D., 2000, *The national food consumption survey (NFCS): children aged 1-9 years, South Africa, 1999*, Department of Health, Pretoria.

Mchiza, Z.J., Steyn, N.P., Hill, J., Kruger, A., Schönfeldt, H., Nel, J. & Wentzel-Viljoen, E., 2015, A review of dietary surveys in the adult South African population from 2000 to 2015, *Nutrients,* 7(9), 8227-8250.

Nasser, R., Cook, S., Bashutski, M., Hill, K., Norton, D., Coleman, J., Walker, S. & Charlebois, S., 2011, Consumer perceptions of trans fats in 2009 show awareness of negative effects but limited concern regarding use in snack foods, *Applied Physiology, Nutrition and Metabolism,* 36(4), 526-532.

Nojilana, B., Bradshaw, D., Pillay-Van Wyk, V., Msemburi, W., Somdyala, N., Joubert, J.D., Groenewald, P., Laubscher, R. & Dorrington, R.E., 2016, Persistent burden from non-communicable diseases in South Africa needs

strong action, *South African Medical Journal,* 106(5), 436-437.

Ntuli, Z., 2005, *An investigation of sociodemographics, nutrition knowledge and dietary intake of black students attending the Steve Biko campus of Durban Institute of Technology*, Masters dissertation, Durban Institute of Technology, Durban.

Okeyo, A.P., 2009, *Eating practices, nutritional knowledge and body weight in nursing science students at the University of Fort Hare*, Masters dissertation, University of the Free State, Bloemfontein.

Oxford Dictionary of Food and Nutrition, 3rd ed, 2009, Oxford University Press, Oxford.

Parmenter, K., Waller, J. & Wardle, J., 2000, Demographic variation in nutrition knowledge in England, *Health Education Research,* 15(2), 163 -174.

Pei Lin, L. & Wan, P.E., 2012, The impact of nutrition education interventions on the dietary habits of college students in developed nations: a brief review, *Malaysian Journal of Medical Sciences,* 19(1), 4-14.

Pham, Q.T.H., Worsley, A., Lawrence, M. & Marshall, B., 2017, Opportunities and barriers to public health nutrition education in Vietnamese universities, *Asia Pacific Journal of Clinical Nutrition,* 26(3), 494-503.

Reddy, S.P., Panday, S. & Swart, D., 2003, *Umthenthe Uhlaba Usamila: The South African youth risk behavior survey 2002,* South African Medical Research Council, Cape Town.

Richter, M., Baumgartner, J., Wentzel-Viljoen, E. & Smuts, C.M., 2014, Different dietary fatty acids are associated with blood lipids in healthy South African men and women: the PURE study, *International Journal of Cardiology,* 172 (2), 368-374.

Sakamaki, R., Amamoto, R., Mochida, Y., Shinfuku, N. & Toyama, K., 2005, A comparative study of food habits and body shape perception of university students in Japan and Korea, *Nutrition Journal,* 4(1), 31-36.

Savage, J.S., Orlet, F.J. & Birch, L.L, 2007, Parental influence on eating behavior: conception to adolescence, *Journal of Law Medicine and Ethics,* 35(1), 22-34.

Sekaran, U. & Bougie, R., 2000, *Research methods for business: a skill building approach*, John Wiley & Sons Ltd, Chichester.

Shepherd, R. & Towler, G., 1992, Nutrition knowledge, attitudes and fat intake: application of the theory of reasoned action, *Journal of Human Nutrition and Dietetics,* 5(6), 387-397.

Smuts, C.M. & Wolmarans, P., 2013, The importance of the quality or type of fat in the diet: a food-based dietary guideline for South Africa, *South African Journal of Clinical Nutrition,* 26(3), 87-99.

South African Medical Association Dyslipidaemia Nutrition Working Group, 2000, Dietary management of dyslipidaemia clinical guideline, *South African Medical Journal,* 90(2), 179-185.

Spronk, I., Kullen, C., Burdon, C. & O'Connor, H., 2014, Relationship between nutrition knowledge and dietary intake, *British Journal of Nutrition,* 111(10), 1713-1726.

Stafleu, A., Van Staveren, W.A., De Graaf, C. & Burema, J., 1996, Nutrition knowledge and attitudes towards high–fat foods and low–fat alternatives in three generations of women, *European Journal of Clinical Nutrition,* 50(1), 33-41.

Steyn, N., 2010, Does dietary knowledge influence the eating behaviour of adolescence?, *South African Journal of Clinical Nutrition,* 23(2), 62-63.

Steyn, N.P., Senekal, M., Brits, S. & Nel., J., 2000, Urban and rural differences in dietary intake, weight status and nutrition knowledge of black female students, *Asia Pacific Journal of Clinical Nutrition,* 9(1), 53-59.

Takomana, G. & Kalimbira, A.A., 2012, Weight gain, physical activity and dietary changes during the seven months of first-year university life in Malawi, *South African Journal of Clinical Nutrition,* 25(3), 132-139.

Ter Goon, D., Libalela, M., Amusa, L.O. & Muluvhu, T.C., 2013, Screening for total and abdominal obesity among university of Venda students, *African Journal for Physical, Health Education, Recreation and Dance,* 19(4:2), 1014 -1024.

Thomson, C.A. & Foster, G.D., 2014, Dietary behaviours: promoting healthy eating, in K.A, Riekert, J.K. Oekene, & L. Pbert., 2014, *The handbook of health behaviour change*, 4th ed., Springer, New York.

Vaitkeviciute, R., Ball, L. & Harris, N., 2014, The relationship between food literacy and dietary intake in adolescents: a systematic review, *Public Health Nutrition,* 18(4), 649-658.

Van den Berg, V.L, Abera, B.M.M., Nel, M. & Walsh, C.M., 2013, Nutritional status of undergraduate healthcare students at the University of the Free State: original research, *South African Family Practice,* 55(5), 445-452.

Van Den Berg, V.L., Okeyo, A.P., Dannhausser, A. & Nel, M., 2012, Body weight, eating practices and nutritional knowledge amongst university nursing students, Eastern Cape, South Africa: original research, *African Primary Health Care and Family Medicine,* 4(1), 1-9.

Van Zyl, M.K., Steyn, N.P. & Marais, M.L., 2010, Characteristics and factors influencing fast food intake of young adult consumers in Johannesburg, South Africa: original research, *South African Journal of Clinical Nutrition,* 23(3), 124-130.

Venter, I., 2008, Construction of a valid and reliable test to determine knowledge on dietary fat of higher-educated young adults, *South African Journal of Clinical Nutrition,* 21(3), 133-139.

Venter, I. & Winterbach, A., 2010, Dietary fat knowledge and intake of mid-adolescents attending public school in the Bellville/ Durbanville area of the city of Cape Town, *South African Journal of Clinical Nutrition,* 23(2), 75-83.

Von Ah, D., Ebert, S., Ngamvitroj, A., Park, N. & Kang, D.H., 2004, Predictors of health behaviors in college students, *Journal of Advanced Nursing,* 48(5), 463-474.

Vorster, H.H., Wissing, M.P., Venter, C.S., Kruger, H.S., Malan, N.T. & De Ridder, J.H., 2000, The impact of urbanization on physical, physiological and mental health of Africans in the North West Province of South Africa: the THUSA study, *South African Journal of Science,* 96, 505-514.

Wardle, J., Parmenter, K. & Waller, J., 2000, Nutrition knowledge and food intake, *Appetite,* 34(3), 269-275.

World Health Organization, 2014, *Noncommunicable diseases: country profiles 2014*, WHO Document Production Services, Geneva.