



Cape Peninsula
University of Technology

The association between dietary fat knowledge and consumption of foods rich in fat among first-year students in self-catering residence at a university of technology, Cape Town, South Africa

by

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ABSTRACT

Objective: To determine the association between the dietary fat knowledge and consumption of foods rich in fat among first-year students in self-catering residence at a university of technology, Cape Town, South Africa.

Design: The two concepts – the dietary fat knowledge (represented by dietary fat food knowledge and dietary fat nutrition knowledge) and the 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 (as subsidiary objectives), before the associations between the concepts were determined (main objective). The dietary fat food and nutrition knowledge as assessed was categorised in the range poor or below average, average and good or above average, and the consumption of foods rich in fat as high, quite high, the typical Western diet, approaching low or desirable. The Pearson's chi-square test was applied to these categorical findings to determine if associations (five percent significance) existed between the concepts.

Results: The stratified sample included 225 first-year students. Nearly half (48.4%) of them achieved an average fat food knowledge score, while the majority (80.9%) achieved a poor fat nutrition knowledge score. More than half (52.5%) either followed a typical Western diet, a diet quite high in fat or high in fat. While no significant ($p > 0.05$) association was found between the students' dietary fat food knowledge and consumption of foods rich in fat, significant results were found in the association between the students' dietary fat nutrition knowledge and consumption of foods rich in fat ($p < 0.05$) and between their fat food knowledge and fat nutrition knowledge ($p < 0.001$).

Conclusions: An inverse association was found between the students' dietary fat nutrition knowledge and fat consumption, a positive association between their dietary fat food knowledge and dietary fat nutrition knowledge, and no association between their dietary fat food knowledge and fat consumption.

Key words: Dietary fat knowledge; Fat food knowledge; Fat nutrition knowledge; Consumption of foods rich in fat; Fat consumption; Concept associations; First-year students; Self-catering residence

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LIST OF ABBREVIATIONS

CHD	Coronary heart disease
CPUT	Cape Peninsula University of Technology
CVD	Cardiovascular diseases
DINE	Dietary Instrument for Nutrition Education
FFQ	Food frequency questionnaire
HDL	High-density lipoprotein
LDL	Low-density lipoprotein
MEDFICTS	Meats, eggs, dairy, fried foods, fats in baked goods, convenience foods, table fats, and snacks
NCDs	Non-communicable diseases
SA	South Africa
UoT	University of Technology
USA	United States of America
WHO	World Health Organization

CLARIFICATION OF BASIC TERMS AND CONCEPTS

Balanced diet:	A diet that contains all the essential nutrients required by the body in their recommended quantities (Esnouf et al., 2013:60).
Dietary fat:	An essential macronutrient required by the body in small amounts that consists of glycerol and fatty acids primarily expressed as triglycerides (Nielsen, 2010:241).
Eating habits:	Acquired food consumption behaviour patterns that are habitually followed by either cultural, social, religious or other groups (Samelson, 2011:80).
Fatty acids:	Carboxylic acids with an aliphatic tail that can be branched (Gargaud et al., 2011:581).
Food knowledge:	For the purpose of this study, as adapted from Hanekom et al. (2014:5), food knowledge entails both the facts and practical aspects of food such as choice, purchasing, storage, preparation and cooking methods.
Knowledge:	Facts and skills obtained through experience and/or education (Maier, 2007:60).
Nutrient:	A food component that is needed for the growth, repair and maintenance of the body (Brown, 2008:630).
Nutrition knowledge:	Facts known about food sources, food choices and food intake in relation to dietary recommendations, health benefits and disease associations considering the functions of the individual nutrients in the body (Mew et al., 2003:795).
Saturated fat:	A fatty acid without double bonds in its structure as it has the total possible number of hydrogen atoms. It is generally solid at room temperature and comes primarily from animal food sources (Nielsen, 2010:241).
Students:	Persons studying at a university, college or at similar higher educational establishments (Concise Oxford English Dictionary, 2004:1431).
Trans fatty acids:	A polyunsaturated fatty acid that has gone through the process of saturation to increase the hydrogen atoms in its structure (Winter, 2009:532).
Triglycerides:	A high energy dense ester that is formed from three fatty acids and a glycerol molecule. It is the main form of natural dietary fat (Nielsen, 2010:242).
Western diet:	A term originally given to a diet that is high in refined carbohydrates, fat, sodium, added sugars, with processed meat as a principle element in meals, and low in dietary fibre (typical of Western foods). The term 'Western diet' has recently become out-dated as a meal devoid of Western foods may no longer be common in most African diets (Reedy

et al., 2013:266). Nonetheless, the term is used in the standard score system of the dietary fat intake screening questionnaire utilised in this study.

Young adults: Generally a person between the ages of 18 and 35 (Petry, 2002:92).

CHAPTER ONE

INTRODUCTION

1.1 Statement of the research problem

University students are customarily exposed to convenience foods (generally high in fat, refined carbohydrate and sodium content) and fast foods (containing saturated fat) and are also primarily responsible for their own food choices (Bu, 2013:126). The results of several studies (Al-Rethaiaa et al., 2010:41; Chourdakis et al., 2011:379; El Ansari et al., 2012:30; Al-Faris et al., 2015:3) indicate a generally high consumption of foods rich in fat among university students. Since high dietary fat consumption is one of the major risk factors for non-communicable diseases (NCDs) (Vorster et al., 2000:510), students represent an at-risk group for health distress. Another study (Matvienko et al., 2001:95) has suggested that university students' knowledge of healthy dietary habits and nutritional requirements may be negligible. As a result of their increased exposure to convenience and fast foods (Nicklas et al., 2001:602), and their lack of experience in (Bull, 1988:24; Papadaki et al., 2007:170) and knowledge of (Betts et al., 1997:76) food preparation, university students constitute a population group of nutritional-health concern. The food obtained from fast food outlets, restaurants or other outlets that sell pre-prepared food has been reported to generally contain more saturated fat and trans-fat compared to home-prepared meals (Hertzler & Fray, 1992:867; Lin et al., 1998:2; Gillman et al., 2000:238).

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, 1992:387; Stafleu et al., 1996:33; Wardle et al., 2000:269). However, the majority of studies conducted subsequent to these, as reviewed in a study by Spronk et al. (2014:1721), reported a significant positive association between nutrition knowledge and healthier dietary intake, although the association was described as weak. The review concluded that a true association can only be identified when a study uses validated assessment methods, as some of the studies reviewed did not use well-validated assessment tools (Spronk et al., 2014:1723).

An essential consideration for health programmes aimed at university students is that the students are in a vital phase of transition from parental control to assuming full responsibility for their lifestyle behaviours, which include their food choices and resulting dietary intake (Cousineau et al., 2006:23). Food choice behaviour adopted during this transition phase is

likely to influence lifelong eating behaviour (Savage et al., 2007:25). Therefore to support nutrition education as part of health programmes aimed at university students, it is imperative to know if knowledge, whether it be food and/or nutrition knowledge, is an important determinant of food choices among this population. A particular consideration would be the consumption of foods rich in fat by this population group and the detrimental effects on their health as a result.

1.2 Background to the research problem

Like other developing countries, South Africa (SA) has been experiencing a shift in the consumption habits of its people from traditional low-fat and high-fibre diets to diets that are high in fat, added sugars and low in unrefined carbohydrates, dairy foods, fruits and vegetables. There has also been a shift from conventionally more active to more sedentary lifestyles (Bourne et al., 2002:157; Crush et al., 2011:17; Tathiah et al., 2013:718). This is mainly due to the fact that SA is experiencing the ongoing urbanisation of black Africans, including students who leave their rural homes to attend university in urban areas (Richter et al., 2014:368). The transition to independent living during university study is a demanding period (Deshpande et al., 2009:145; Ansari & Stock, 2012:28) in which students need to adjust to a new milieu in terms of added responsibilities (Dyson & Renk, 2006:1232). It is also a time of increased responsibility for their own food choices and eating habits. When students fail to adjust passably to this dietary change involving the self-selection of food, it may lead to undesirable consequences for their eating habits and their subsequent health (Deliens et al., 2014:54). This transitional period is consequently an opportune time to establish healthy lifestyle behaviours (Von Ah et al., 2004:464). Nonetheless, abundant literature (Betts et al., 1995:59; Bu, 2013:125) reports that university students have inappropriate eating habits that include meal skipping, snacking and the consumption of fast food that is generally high in dietary fat. Environmental aspects likewise contribute to university students' adopting unhealthy eating habits (Ganasegaran et al., 2012:48). The expansion of shopping malls, convenience stores, vending machines and fast food outlets has created further opportunities encouraging young adults to consume food high in total fat and saturated fatty acids (King et al., 2007:106).

In a study by Mia and Vorster (2000:68) that investigated coronary heart disease (CHD) risk factors among the South African Indian youth, a link was found between adolescents who consumed a diet high in fat and CHD. This study concluded that compliance with a low-fat diet at a young age could perhaps lower CHD risk. Atherosclerosis, the fundamental cause of CHD, begins in childhood (Strong et al., 1999:727) and progresses into adulthood (Demory-Luce et al., 2004:1684). The degree of atherosclerotic variation in children and young adults

can be associated with the presence of similar risk factors found in adults (Williams et al., 2002:143). Overweight in childhood and adolescence has similarly been associated with augmented risks of adverse lipid profiles, hypertension and type 2 diabetes, as well as an elevated risk of adult obesity (Williams et al., 2002:145). Dairy fat and an increased dietary intake of high energy snacks is usually believed to be among the aetiologies of obesity, owing to the high energy density of these foods (Smalley et al., 2004:374; Kratz et al., 2013:3). Studies done in SA (Vorster et al., 2000:505; Kruger et al., 2002:422; MacIntyre et al., 2002:239) indicate that an increase in obesity among South Africans is associated with a high fat intake, reported especially by urban subjects. Though type 2 diabetes is generally considered to be a multifaceted disease with numerous causes (Hu et al., 2001:805), an experimental study by Marshall and Bessesen (2002:620) strongly reinforced the idea that high fat diets (especially saturated fat) are linked to impaired insulin action, leading to type 2 diabetes. Data from some epidemiological studies additionally suggests that high intake of total fat, saturated fat and cholesterol may heighten the risk of dementia in the later adult years (Feskens et al., 1997:34; Morris & Tangney, 2014:61).

Dietary consumption manipulation is critical in the prevention of several diseases, as well as in the treatment of these diseases (Mammas et al., 2004:17). It is during childhood that lifestyle and eating habits are inaugurated and knowledge of food evolves (Sherratt, 1997:2). According to Gan et al. (2011:213), a lack of knowledge may affect dietary consumption and nutritional status adversely. Results from a study by Sherratt (1996:2) indicated that although students were mindful of the connection between fat consumption and CHD, their lack of knowledge about the fat content of food impaired their ability to embrace the healthy lifestyle practice of minimising fat consumption. Habits established in childhood years generally track into adulthood, even if detrimental to health, and may not be that easy to alter (Savage et al., 2007:25). Nonetheless, as mentioned above, the transitional phase that transpires at university is an auspicious moment to change towards healthy lifestyle behaviours (Von Ah et al., 2004:464). The adoption of healthy eating habits through healthful lifestyle training at a young age may aid in the prevention of chronic disease development in subsequent adult life (Strong et al., 1999:727; Williams et al., 2002:143; Demory-Luce et al., 2004:1684).

The South African Government has implemented a number of legislative and policy initiatives in order to encourage and support the health and wellbeing of its young people, including recommending a reduction in fat intake (Reddy et al., 2003:11). According to the newly revised food-based dietary guidelines for SA, fats should be consumed sparingly, with plant oils recommended for use and consumption instead of hard fats (Smuts & Wolmarans, 2013:87). The guidelines are targeted at prime nutrition for every South African above the age of four years (Vorster et al., 2001:S3), indicating that optimal nutrition should begin at an

early age. The transition that students and young people in general are undergoing poses perilous challenges to these initiatives (Reddy et al., 2003:11; Mayosi et al., 2012:2029). The findings of this study should contribute important information to support policies and programmes pertaining to the health and well-being of young people in SA. More specifically, it should assist in the planning and implementation of programmes aimed at entrance-level university students becoming knowledgeably responsible for their own food provision, particularly with regard to their consumption of dietary fat

1.3 Research questions

The following are the research questions, the first three being the main research questions. With regard to first-year students living in a self-catering residence at a university of technology (UoT), in Cape Town, SA:

- a) Is there an association between their dietary fat food knowledge and their consumption of foods rich in fat (see Figure 1.1)?
- b) Is there an association between their dietary fat nutrition knowledge and their consumption of foods rich in fat (see Figure 1.1)?
- c) Is there an association between their dietary fat food and their dietary fat nutrition knowledge (see Figure 1.1)?
- d) Is their dietary fat food knowledge poor (below average), average or good (above average)?
- e) Is their dietary fat nutrition knowledge poor (below average), average or good (above average)?
- f) Is their consumption of foods rich in fat high, quite high, representative of the typical Western diet, approaching low or desirable?

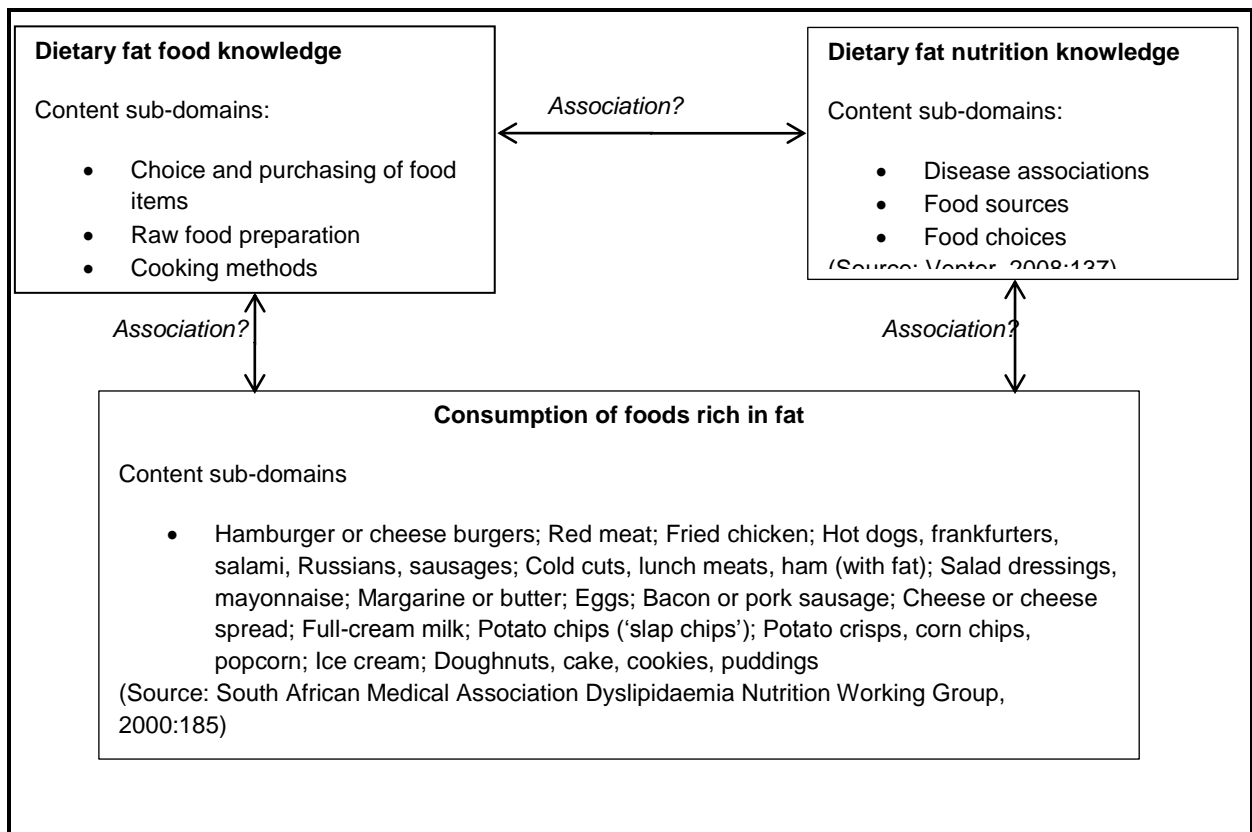


Figure 1.1: Conceptual framework of the main research questions addressed by this study

1.4 Objectives of the research

In response to the research problem and the research questions, this study investigated the following in relation to first-year students living in a self-catering residence at a UoT, Cape Town, SA:

1.4.1 Main objectives

- a) The association between their dietary fat food knowledge and their consumption of foods rich in fat.
- b) The association between their dietary fat nutrition knowledge and their consumption of foods rich in fat.
- c) The association between their dietary fat food and nutrition knowledge.

1.4.2 Subsidiary objectives

- a) To categorise their dietary fat food knowledge as poor or below average, average and good or above average using a norm-referenced, valid and reliable direct knowledge assessment tool representing a test comprising selected response questioning.

- b) To categorise their dietary fat nutrition knowledge as poor or below average, average and good or above average using a norm-referenced, valid and reliable direct knowledge assessment tool representing a test comprising selected response questioning.
- c) To categorise their consumption of foods rich in fat as high, quite high, the typical Western diet, approaching low or desirable using an intake screening tool representing an unquantified food frequency questionnaire (FFQ).

CHAPTER TWO

LITERATURE REVIEW

This chapter reviews the literature stemming from past research in the fields relevant to this study. First, there is discussion of the general food knowledge, nutrition knowledge and dietary consumption among university students, with a focus on the availability of information on dietary fat. This is followed by consideration of the literature on the relationship between these several concepts. There is a particular focus on the assessment of knowledge and dietary intake, because this will be the basis of data collection in this study. Wardle et al. (2000:270), for example, offers several explanations for why knowledge as one of the determinants of food choice may have been underestimated, and the value of nutrition education as a result prematurely rejected – one of the foremost explanations being the use of knowledge assessment tools that are not well-validated (Spronk et al., 2014:1723). The health concerns pertaining to dietary fat intake are reviewed as further support for selecting dietary fat as the content domain of the research.

2.1 Food and nutrition knowledge of students with dietary fat as the focal point

The dietary consumption patterns of university students are of the utmost importance as they may have consequences for the students' health in their later adult life (Soriano et al., 2000:1249). The adoption of healthy dietary consumption patterns at this life stage prevents the manifestation of various chronic diseases in late adulthood (Strong et al., 1999:727; Soriano et al., 2000:1249; Williams et al., 2002:143; Demory-Luce et al., 2004:1684). Among other factors, food knowledge may have an influence on an individual's dietary consumption pattern (Ganasegaran et al., 2012:48). It is believed that food and nutrition education leads to an increased awareness of aspects of food and nutrition that in the long run positively impacts the health of a population (Stampfer et al., 2000:16; Barzegari et al., 2011:1012). In order to enjoy a healthy lifestyle, it is imperative to acquire and implement food and nutrition knowledge (Elhassan et al., 2013:25).

Surprisingly, there has been inconsistency in the published literature on the association between nutrition knowledge and dietary consumption patterns, with some studies (Saegert & Young, 1983:103; Read et al., 1988:571; McLean-Meyinsse et al., 2012:138) indicating a positive link between the two concepts, and others (Story & Resnick, 1986:188; Shah et al., 2011:304) reporting an insignificant correlation between the two. In recent years, studies have been conducted in different parts of the world (Dallongeville et al., 2000:32; Pirouznia, 2000:89; Wardle et al., 2000:274; Sharma et al., 2008:361; Emrich & Mazier, 2009:187; Kostanjevec et al., 2013:568), including SA (Steyn, 2010:62; Venter & Winterbach, 2010:81). These studies have focused on adults in general (including young adults), scholars and

students, in order to determine the association between various aspects of nutrition knowledge and food intake. Two reports discussing the topics of “sports nutrition for young athletes” (Cotugna et al., 2005:323) and “school-based health education strategies for the improvement of body image and prevention of eating problems” (O’Dea, 2004:11) concluded that the majority of scholars are not sufficiently knowledgeable about food to support health maintenance in various conditions.

For the purposes of this literature review, the food knowledge and nutrition knowledge of university students are discussed separately, as they were investigated separately in this study.

2.1.1 Food knowledge

According to Hanekom et al. (2014:5), food knowledge involves both facts and the practical aspects of food acquisition and consumption. In the general absence of research on dietary fat food knowledge *per se*, this section addresses food knowledge in general. The food knowledge of students in relation to four food knowledge sub-domains are presented below: food choice and purchasing, food storage, food preparation and cooking methods (see Figure 1.1). All these domains are relevant to food knowledge assessment in this study.

2.1.1.1 Food choice and purchasing knowledge and behaviour

According to Stanton (2011:11), healthy eating revolves around food selection since not all foods are beneficial to the body (Balch, 2003:213; Lanigan, 2011:372). A prolonged selection of unwholesome food for consumption is said to be one of the chief causes of morbidity and mortality (Belasco, 2008:2). In order to make a healthy food choice, an individual should have the ability to discriminate between wholesome and unwholesome foods (Sigman-Grant et al., 2014:121). Dietary concerns relating to food choice have risen in recent years (Navia et al., 2003:590), particularly in the case of the poor food choices being made by university students (Georgiou et al., 1997:754; Bu, 2013:125). These include foods high in saturated fats and other unwholesome foods (Hsieh, 2004:85; Satia et al., 2004:1093; King et al., 2007:106).

The transition from parental supervision and control to living self-reliantly (which university students undergo) has been considered a time of emotional strain, and there is evidence indicating that it affects food choice (Sharma et al., 2010:353). The availability of convenience foods (Marquis, 2005:55), price and financial resources (Pan et al., 1999:54; Papadaki & Scott, 2002:455), living arrangements (Brevard & Ricketts, 1996:36), health and taste (Steptoe et al., 1995:276) were among the factors reported to influence food choice and food purchasing behaviour among young adults. As food choice seems inseparable from

purchasing behaviour (Van der Merwe et al., 2010:12), it is essential to comprehend the purchasing behaviour of university student consumers.

When a consumer purchases a product such as food, the purchasing episode generally follows a five-step process named the “buying decision process” (Kotler & Kelle, 2006:191), which begins prior to the actual purchase (Comegys et al., 2006:337). One of the steps that may influence a purchasing decision is the consumer’s search for information (Comegys et al., 2006:338) about a food product through sources such as food labels (Van der Merwe et al., 2010:12). Nonetheless, a lack of knowledge about how to acquire information (from food labels, for example) that is part of a purchasing decision may hinder a student from purchasing healthy food (Van der Merwe et al., 2010:12).

Worldwide, nutrition labelling has become compulsory for packaged food products to assist consumers in making informed dietary choices (Cheftel, 2005:531; Cowburn & Stockley, 2005:21; Misra, 2007:2130; Van Herpen et al., 2014:138). SA is no exception (South Africa. Department of Health, 2010:18). Shortly after nutrition fact labels were introduced, Downes et al. (1995:A69) evaluated the comprehension of students (n = 184) registered for a rudimentary nutrition course at the Pennsylvania State University in the United States of America (USA), in respect of food labelling information – before they had attended their first lesson. The fat and energy content information were most read by the majority of these students (out of those who read nutrition labels), due to concern about their body weight. But they did not have the knowledge to use that information to quantify the percentage of energy derived from fat or adjust the daily percentage value to suit their individual needs. Nonetheless, an improvement was shown in the students’ ability to determine the percentage of energy from fat using the information provided on food labels after they had acquired basic food knowledge (Downes et al., 1995:A69).

Twelve years later, Misra (2007:2131) assessed nutrition knowledge through a label reading survey of 537 university students from the Ohio and Truman state universities in the USA. Approximately half (55%) of these students lacked knowledge in the actual use of nutrition labels, a finding somewhat similar to that reported in the study by Downes et al. (1995:A69). A study by Tanaka et al. (2009:A90) on the association between label use and selected portion sizes among students enrolled at the University of Wisconsin-Stout, USA, revealed that the majority (83.9%) of these students often read serving size information on food labels. However, slightly less than two thirds of these students actually applied the serving size information in their daily diet (Tanaka et al., 2009:A90).

Studies conducted in various regions and countries such as the West Indies (Peters-Teixeira & Badrie, 2005:508), New Zealand (Gorton et al., 2009:1359), Greece (Drichoutis et al., 2008:293), the United Kingdom (Grunert et al., 2010:177), Ireland (Shine et al., 1997:290)

and the USA (Jay et al., 2009:25), all indicated that female respondents used food labels more frequently than male respondents. Correspondingly, students (285 males and 259 females) from the University of Saskatchewan, Canada, were appraised on their use of food labels in a study carried out by Smith et al. (2000:176). When purchasing a particular food for the first time, a comparatively small difference was found between the males who exploited food labelling information for guidance (n = 139) and those who did not (n = 146) (Smith et al., 2000:178). Conversely, from the same study, a considerable difference was reported between the number of female students who used food labels (n = 204) in the food purchasing process and those who did not (n = 55) (Smith et al., 2000:178). Jasti and Kovacs (2010:309) also found that the probability of male students reading labelling information, specifically on trans-fats, is less than that of female students. McLean-Meynsse et al. (2012:138) reported a direct link between not using labelling information on trans-fats and increased consumption of fried foods.

In SA, the Foodstuffs, Cosmetics and Disinfectants Act, No. 54 of 1972, include regulations relating to food labelling information. The core purpose is to guide food manufacturers on the country's labelling regulations while protecting consumers from misleading information (South Africa. Department of Health, 2010:18). In a qualitative study conducted by Van der Merwe et al. (2010:11) on undergraduate students at the North-West University in SA on food label use, most respondents (81%) read nutrition labels in order to acquire information about the fat and energy (kilojoule) content of the product before a purchasing decision was made. Some students, however, were reported to be insensitive to nutrition labels and based their food purchasing decisions on the appearance of the product packaging instead (Van der Merwe et al., 2010:14). In Pietermaritzburg, SA, Wiles et al. (2009:69) explored the reasons for food label use among women (n = 150) aged 25 years and above, in the context of purchasing fat spreads. Approximately half of the respondents read nutritional information in order to be assisted in the purchasing of fat spreads and slightly over two-thirds deemed nutritional information as essential when purchasing a food product for the first time (Wiles et al., 2009:72). This study also determined that, of those respondents who read nutrition labels (n = 82), more women who had some form of post-secondary education (n = 51) did so than those with matric (secondary education) or lower (n = 31, a difference of 24%) (Wiles et al., 2009:71).

Food selection usually starts at a young age (Vuille & Schenkel, 2001:287; Maes & Lievens, 2003:517; Johansen et al., 2006:32), with university entrance often representing a phase of increased responsibility in terms of making own food choices (Colic Baric et al., 2003:473). Poor dietary habits and lifestyle practices have been reported for university students in various countries, practices that tend to worsen during their university careers (Anding et al., 2001:167; Steptoe et al., 2002:97; Huang et al., 2003:83; Mammas et al., 2004:17; Racette

et al., 2005:245). As previously mentioned, the food choices of young adults may be determined by several factors (Steptoe et al., 1995:276; Brevard & Ricketts, 1996:36; Pan et al., 1999:54; Nicklas et al., 2001:602; Papadaki & Scott, 2002:455; Marquis, 2005:55). Food choices made by students (n = 258) from the University of Nebraska, USA, were evaluated by Driskell et al. (2005:798) through a self-administered questionnaire. The study findings indicated that convenience, taste and the cost of the food were considered the foremost factors affecting students' food purchasing/selection, and that health considerations had a lesser influence on their food choices (Driskell et al., 2005:799). In a cross-sectional study conducted by Kolodinsky (2007:1409) through an internet-based survey on first-year students enrolled at the University of Vermont, USA, regarding their food choice knowledge and behaviour, it was determined that in general those students with more nutrition knowledge were inclined to choose more healthy foods.

2.1.1.2 Food storage knowledge and behaviour

Proper food storage is an essential aspect of both food safety and healthy dietary consumption (Mulvany, 2008:45). When unsaturated fatty acids are exposed to oxygen, they are generally susceptible to oxidation (initiating rancidity) due to their structure (O'Brien, 2009:276; DeBruyne & Pinna, 2014:95). Depending on the degree of oxidation, foods that have undergone the process of rancidity produce compounds (De Vries, 1997:78), such as peroxides, which at a later stage decompose into aldehydes and ketones (Vaclavik & Christian, 2014:246). If consumed, these aldehydes and ketones can affect the metabolism (Gogus, 2011:270) and become detrimental to the future health of an individual (De Vries, 1997:78). The process of lipid oxidation has also been reported to reduce the nutritive value of food products, and this is of great concern as the healthier fatty acids (such as the omega-3 fatty acids) are the ones more prone to oxidation (Chaiyasit, 2008:1). Although storing fats and oils under optimal conditions does not halt the process of lipid deterioration, mixing new oil with used oil when storing has been reported to accelerate the process of oxidation (O'Brien, 2009:166). It is therefore essential to have appropriate knowledge about storing and handling fats and oils as different types of fats may require different methods of storage in order to minimise deterioration (McWilliams, 2006:157). However, the food industry has developed a custom of hydrogenating unsaturated oils in order to make their storage and handling easier (Getz & Reardon, 2007:2501).

A study by Du Toit and Venter (2005:76) conducted on 60 female university students residing in the self-catering residences of a UoT, SA, evaluated their practices in relation to food safety, including their food storage behaviour. All the respondents (n = 60) in this study stored perishable foods in the fridge (Du Toit & Venter, 2005:79), demonstrating their knowledge that perishable foods should be stored in the refrigerator soon after purchase (Edelstein, 2014:339). Conversely, only a small fraction (slightly less than one tenth) of the

respondents was reported to use the expiry date on food packaging as a guideline to food storage (Du Toit & Venter, 2005:80). Correspondingly, out of a total of 815 youths aged 14 to 19 years and 646 adults aged 20 years and above from Turkey that were assessed on their knowledge and practice of food safety, the majority (n = 718) of the youths and many (n = 111) of the adults stated that they preferred tasting milk to checking its expiry date to guide them when storing it for further use (Sanlier, 2009:539). Gordon-Davis (2011:70) insists that expiry dates on food labels be used as a guideline when storing food and that food must be thrown away when it reaches its expiry date.

Most foods rich in fat, such as butter, full-cream milk and ice cream, are normally stored in the refrigerator or freezer to minimise spoilage, and the temperature of the refrigerator/freezer should be at the correct level to make that possible (Edelstein, 2014:223). Yet in a study carried out by Osaili et al. (2011:272) on female students (n = 867) from the Jordan University of Science and Technology, Jordan, approximately two-thirds of the students gave a wrong answer when asked the correct temperature range at which refrigerators should be set to ensure the safety of food. Also, in a study conducted in Slovenia by Jevšnik et al. (2008:742) on consumer awareness of food safety, slightly more than two-fifths of the respondents (the majority being young adults) were not sure of the temperature at which their refrigerators were set.

2.1.1.3 Food preparation knowledge and skills

Apart from equipping an individual to be self-reliant (Caraher et al., 1999:590; Ternier, 2010:70), food preparation proficiency expands one's food selection and dietary quality (Larson et al., 2006:2005) as it enables one to integrate wholesome ingredients in prepared wholesome foods/meals in order to achieve a balanced diet (Levy & Auld, 2004:198). Meals prepared at home relative to those obtained from fast-food outlets, restaurants or supermarkets (pre-prepared food) have been found to contain lower levels of saturated fat and trans-fatty acids (Hertzler & Frary, 1992:867; Lin et al., 1998:2; Gillman et al., 2000:238). On the other hand, home-prepared meals are higher in fibre, calcium, iron and folate, among other wholesome nutrients (Gillman et al., 2000:238). Recipes have been a fundamental method to elucidate principles of food preparation and nutrition over centuries (Hertzler, 1983:466). However, it is reported that contemporary consumers seldom prepare meals using recipes, and that the number of ingredients, kitchen utensils and steps employed in meal preparation has diminished over time (Sloan, 1998:37; Soliah et al., 2006a:729). Given these facts, the food preparation knowledge and skills of university students who have just been weaned from eating at home is of particular concern (Arnett, 2000:469).

The literature suggests that young adults generally devote their time to personal and professional undertakings (Koszewski & Kuo, 1996:1286) and develop strategies to reduce the time and energy spent on cooking (Marquis, 2005:55). Likewise, it has been reported that there is a quest for convenience when it comes to meal preparation among young adults (Armstrong et al., 1991:224; Candel, 2001:15), to the extent of neglecting the value of nutrition (Betts et al., 1997:76). Apart from the question of convenience, a study by Betts et al. (1997:76) indicated that food preparation skills and available facilities were additional barriers to home-prepared meals among 1 475 young adults from different states in the USA. From the University of Minnesota, USA, male (n = 764) and female (n = 946) young adults were assessed regarding their food preparation behaviour and skills, and the relation of these to diet quality (Larson et al., 2006:2002). The majority of these students (76.8% of the males and 81.7% of the females) perceived that they had adequate cooking competence, although a considerable number of both males (n = 267) and females (n = 350) reported that they had insufficient time for actual food preparation (Larson et al., 2006:2004). When the food preparation frequency of these young adults (both male and female students combined) was measured according to their living situation, the university students residing at the campus's self-catering residences reported the lowest food preparation frequency rate compared to students residing elsewhere (Larson et al., 2006:2005).

In 2004, Franciscy et al. (2004:28) conducted a survey in the USA on attitudes and behaviours of male university students regarding meal preparation. Microwaving, toasting and grilling were the preparation methods that were most commonly used by the students, with some of them reporting a lack of culinary skills. The majority of them expressed a desire to learn more about food preparation (Franciscy et al., 2004:30). In a study that explored the food preparation ability of first-year female university students from the south-western region of the USA, most were found knowledgeable in baking, and predominantly in baking sweet food products such as cakes and muffins, which they had been taught to prepare in their earlier years at home (Soliah et al., 2006b:9). A general observation from the same study involving these female students was that the more students knew about food preparation, the more likely they were to prepare food at their place of residence. On the other hand, lack of food knowledge, time and kitchen resources were cited by some of the students as contributing factors to their inability to cook (Soliah et al., 2006b:9). Hertzler and Bruce (2002:340) investigated the perception of college students (both male and female) from an eastern university in the USA on their food preparation. A small percentage (15%) of these students reported little or no food preparation experience, while the majority perceived themselves as having just sufficient culinary skills to prepare a simple dish (Hertzler & Bruce, 2002:341).

The transition to independent living during the university phase represents a time of increased responsibility for own food choices and eating habits (Dyson & Renk, 2006:1232; Deshpande et al., 2009:145; El Ansari et al., 2012:28). But Bull (1988:24) and Papadaki et al. (2007:170) report that young adults often lack experience in food/ingredient shopping, meal planning and food preparation. Increased exposure to fast foods and convenient foods was among the reasons provided for this lack of experience (Nicklas et al., 2001:602). In SA, consumers (including students) are widely exposed to fast foods as these are available from both formal and informal food outlets (Feely et al., 2012:e1).

2.1.1.4 Knowledge and application of cooking methods

According to the Culinary Institute of America (2008:86), the use of wholesome ingredients in food preparation does not guarantee quality in the sensory aspects of the final cooked food, as every ingredient yields best results when used with a particular cooking method. Knowledge of different cooking methods (Walsh & Walsh, 2011:260) and the competency to pair them with specific ingredients (Gisslen, 2007:68) are therefore indispensable in providing acceptable sensory attributes to the prepared food. For example, due to differences in their properties, only fats with a high smoking point are suitable for deep-frying, as this method of cooking involves high temperatures (This, 2007:86). Furthermore, not all cooking techniques achieve the goal of healthy cooking and retaining the overall nutritive value of food (Culinary Institute of America, 2008:86). The proper incorporation and control of factors such as temperature and time in a particular cooking method is of the essence, as it will generally affect the nutritional value, palatability and safety of the food (Foskett et al., 2015:261).

Rudimentary cooking methods generally fall into two main categories, that is, moist and dry methods of cooking, depending on how heat is employed (Dark et al., 2011:191). In dry cooking methods that use fats and oils as a cooking medium, the use of unsaturated fats and fat replacers may result in a product that is healthier and with a lower energy value, relative to cooking with other types of fat (Paré, 2001:10). Information relating to consumer knowledge and application of cooking methods in relation to fat was not found in the literature search. However, considering the cooking methods cited by the male university students in the study by Francisky et al. (2004:28) – microwaving, toasting and grilling – it seems that students will tend to utilise easy and convenient cooking methods in their food preparation. This also implies that they prepare and/or utilise food for consumption that requires less pre-preparation.

2.1.2 Nutrition knowledge

While there is a general lack of reported literature and research regarding dietary fat food knowledge, there is some published research on dietary fat nutrition knowledge, though it is

limited. For this reason, and to provide perspective on the topic, reference will be made to the fat nutrition knowledge of age groups besides that of students in this section.

Dietary fat and oils are essential fatty acid sources crucial for fat-soluble vitamins (A, D, E and K) to be absorbed by the human body, among other important functions, and therefore they form part of a balanced diet (Gomber, 2007:62). However, both the type and amount of fat consumed by an individual can either be detrimental or beneficial to his/her health and are therefore paramount dietary considerations (National Research Council, 1989:159; Tate & Cade, 1990:33). Triglycerides, phospholipids and cholesterol (sterols) form the major components of dietary fat, with the triglycerides being absorbed by the body as fatty acid molecules (Lichtenstein et al., 1998:4). The structure of fatty acids, i.e. its chain length and whether or not double bonds are present, forms the basis for its classification (see Figure 2.1). All these aspects, in addition to the food sources of dietary fat, are important components in dietary fat knowledge (Boyle & Holben, 2013:111).

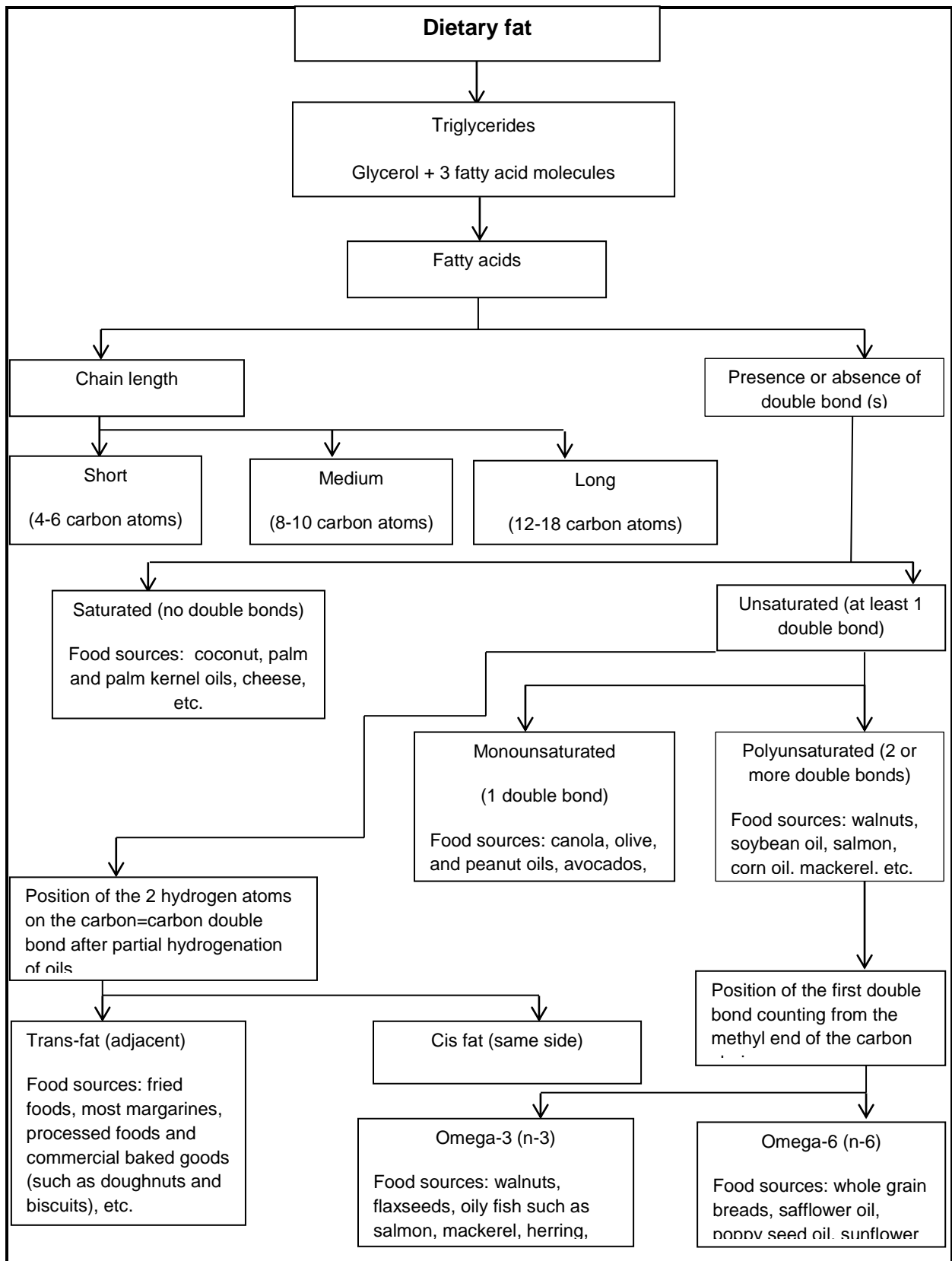


Figure 2.1: Conceptual framework of the classification of dietary fat, its components and food sources (Sources: Lichtenstein et al., 1998:4; Melina et al., 2004:138; Wanjek, 2005:407; Rosdahl & Kowalski, 2008:308)

A survey conducted by Parmenter et al. (2000:165) on an adult population (n = 1 040) from three counties (Essex, Lancashire and Oxfordshire) in England, exploring their nutrition knowledge, indicated general inaccuracies on the part of slightly less than a third of the respondents in classifying several foods as low or high in fat. In the same study, a large number of respondents (85%) exhibited a lack of knowledge in categorising a low-fat spread as a low-fat food and failed to perceive that in fact it is high in fat (Parmenter et al., 2000:166). Similarly, in appraising the nutrition knowledge of caregivers (n = 147) of children younger than 18 years of age from Cape Town, SA, Brown and Roman (2014:316) reported that a large percentage (72.6%) of the respondents also wrongly classified a low-fat spread as a low-fat food item, with about half of these respondents coming from the overweight group. Gottschall-Pass et al. (2007:123) assessed the nutrition knowledge among residents (n = 925) of Prince Edward Island, Canada, almost half (49.4%) of whom were young adults. A general failure to correctly classify foods with a high or low-fat, saturated fat and cholesterol content was reported among these respondents, and with regard to margarine and butter, 48% selected the former as low in fat compared to the latter, which is not the case (Gottschall-Pass et al., 2007:125). A similar result was reported by Gracey et al. (1996:187), when asking a group of 391 Australian teenagers aged from 15 to 16 to identify foods with a high- and a low-fat content from a food selection provided. About two-thirds (65.1%) of the males and half (56%) of the females failed to correctly identify the food with a high fat content, while approximately half of both the males (57.3%) and the females (58%) failed to identify the food with a low-fat content (Gracey et al., 1996:194).

While a considerable number (63.4%) of the respondents knew that dietary fat should be consumed in moderation, many had difficulty in answering questions to do with dietary fat quality in a study by Grunert et al. (2012:166). European consumers (n = 5 967) of various age groups responsible for their own food provision were assessed on their nutrition knowledge. Almost half (46.6%) of them incorrectly alleged that red meat contained low levels of saturated fat instead of high levels, and more than half either thought that they ought to avoid or consume less polyunsaturated fats as compared to other types of fat, or were completely unaware of the term “polyunsaturated” (Grunert et al., 2012:170). This is a matter of concern, as it is recommended that persons consume more poly- and monounsaturated fats, and less saturated fat, trans-fat and overall total fat, to maintain good health (Sizer et al., 2012:160). Comparably, Hendrie et al. (2008:1367) investigated the nutrition knowledge of an Australian adult community (n = 201) and found that in comparison with other nutrients, the respondents could not identify foods high in saturated fat among the options that were given, and that a substantial percentage (75%) of them were not aware of the fact that fat has the highest energy content in relation to other macronutrients. A somewhat similar finding was recorded in a study by Mazier and McLeod (2007:154), assessing the fat knowledge of first- and fourth-year St. Francis Xavier University students

registered for a science program. Approximately three-fifths of these students lacked knowledge of food sources high in saturated fat and monounsaturated fat, respectively (Mazier & McLeod, 2007:156).

Although the food industry is said to exploit trans-fats in order to enhance the sensory aspects and palatability of their final products for consumers (Watson, 2008:5), some authorities (Life, 2014:63; Clegg, 2015:109) consider that trans-fats have the worst effect on health compared to the other types of fat (including saturated fat). This is because trans-fat not only elevates the levels of low-density lipoprotein (LDL) cholesterol but also lowers the levels of high-density lipoprotein (HDL) cholesterol (Ascherio & Willett, 1997:1006), thereby posing a risk for heart disease (Hammaker, 2011:686). Trans-fat awareness and some knowledge of the food sources where it is normally found are fundamental if one is to lower one's risk of cardiovascular diseases (CVD) (Holli & Beto, 2014:201).

Jasti and Kovacs (2010:308) assessed the trans-fat knowledge of a multi-ethnic university student population in New York, USA, and reported a high (92%) trans-fat awareness. However, less than half knew that the consumption of food high in trans-fat elevates LDL cholesterol. As a result, it was concluded that a high trans-fat awareness does not imply real knowledge of the link between trans-fats and health (Jasti & Kovacs, 2010:310). In a study by Nasser et al. (2011:583), upon being asked whether or not they would stop consuming their favourite food if they were aware of the presence of trans-fatty acids in it, a significantly higher number of consumers in the age group of 18 to 40 years reported that they would not, compared to their counterparts in the age group of 41 to 60 years.

Due to its relationship with heart disease, consumer cognisance of cholesterol is indispensable to combat this cholesterol-related ailment (Pampel & Pauley, 2004:15). Nonetheless, when Dallongeville et al. (2000:28) evaluated the nutrition knowledge of middle-aged French men ($n = 361$), more than three-quarters (78%) could not correctly select the food containing cholesterol from the options that were given, with the majority (90%) presuming that peanut oil contained some level of cholesterol. Serra-Majem et al. (2007:1396) assessed an adult group ($n = 2\ 061$) aged between 18 and 75 years on their knowledge of food sources that contain cholesterol. Of the respondents falling within the young adult group, approximately a third and just above a third (35%) incorrectly thought that olive oil, and potatoes and bread, respectively, contain high levels of cholesterol (Serra-Majem et al., 2007:1399). A similar yet profound result was reported by Mirmiran et al. (2010:233) after evaluating the nutrition knowledge pertaining to cholesterol of 20- to 60-year-old adults ($n = 826$) from Tehran, Iran, with just more than half (53.1%) of these adults aged between 20 and 39 years. Although a sizeable percentage (64.8%) of the respondents knew how to define the term cholesterol, 85.2% and 75.3%, respectively, wrongly believed

that nuts and seeds, and bread and cereals, were sources of cholesterol (Mirmiran et al., 2010:237).

In 2004, a study assessed the nutrition knowledge of both black (n = 90) and white (n = 90) South Africans aged between 18 and 30 years (majority of the population sample), and those of 31 and above (minority of the population sample), from the Limpopo Province of SA. A lack of knowledge about the food sources of saturated and unsaturated fat was reported (Peltzer, 2004:26). A comparable result was obtained from a study conducted in Osun State, Nigeria, on both male (n = 250) and female (n = 150) civil servants regarding their knowledge of food sources and other nutrition-related factors (Olubayo-Fatiregun & Alla, 2007:36). The majority (91.2%) of the males and just more than half (58%) of the females failed to identify food sources of saturated fat, while a majority (90%) of the males and slightly more than two-fifths (44.7%) of the females incorrectly identified low-fat food sources (Olubayo-Fatiregun & Alla, 2007:38). Correspondingly, Van der Berg et al. (2012:1), investigating the nutrition knowledge of Fort Hare University's undergraduate students in the Eastern Cape Province, SA, found that half of the respondent sample was oblivious to the fact that peanut butter contains a large amount of fat. However, the same study (Van der Berg et al., 2012:4) found that the majority (92.6%) of the respondents had some knowledge of food sources high in dietary fibre, but were ignorant of the recommended number of daily portions of fruit to be consumed.

2.2 Knowledge assessment

In this section, only a brief overview of aspects of knowledge assessment is provided, as the study made use of a knowledge assessment tool rather than itself developing such a tool. The study required basic knowledge of these so as to ensure that the best tool was selected.

2.2.1 Classification of knowledge assessment methods

According to Kanwar et al. (1990:603), knowledge assessment methods can generally be classified into two generic categories, direct and indirect. When using the direct method of assessment, respondents are required to demonstrate their knowledge and dexterity in a palpable or apparent way, whereas the indirect assessment method entails that respondents provide a perception of their own knowledge and how they value it (Hersen, 2004:199). The direct method provides evidence of knowledge stored in the long-term memory of the respondent, while the indirect method does not, although it does provide additional information relating to knowledge (Kanwar et al., 1990:603). Two methods that could be considered when using the direct method to assess students' knowledge in a particular field of study are observing the student during an internship performance, or requiring the student to complete a standardised questionnaire to test their knowledge on paper (Saunders, 2011:164). In the indirect method of assessment, respondents can be asked in an interview

to rate, on a scale of one to ten, their knowledge regarding a specific topic (Bray & Kehle, 2011:207).

Stiggins et al. (2004:90) offers another classification of assessment methods, in terms of which they are divided into four basic classes, *viz.* “selected response, extended written response, performance assessment and personal communication”. The selected response and extended written response classification, as their names suggest, have more to do with the format of the assessment tool used to extract knowledge from the respondents, with the former comprising multiple-choice answers to be selected and the latter requiring answers to be formulated or constructed by the respondents (McMillan, 2001:10). Performance assessment entails observing the respondent while he/she is executing a certain task and in the process displaying skills and knowledge (Ananda, 2000:5). Unlike the other methods of assessment in the classification suggested by Stiggins et al. (2004:90), personal communication involves verbal interaction between the respondent and the assessor in a question and answer session conducted through, for example, an interview or discussion (Kottler & Gallavan, 2008:72).

The South African Qualifications Authority (2001:27) posits three methods of assessment: observation, evaluation and questioning. The process of observation is synonymous with performance assessment as described by Ananda (2000:5), above, while evaluation is an extension of performance assessment in which the assessor evaluates the process or product constructed by the respondent on completion of the demonstration or task (The South African Qualifications Authority, 2001:27). Questioning, as its name implies, entails the questioning of respondents, an umbrella term that encompasses the three assessment classes proposed by Stiggins et al. (2004:90), namely selected response, extended written response and personal communication. Each of the three types, like any other assessment method, uses specific instruments or tools. In some cases a single tool can be adjusted for use in different methods; for example, a questionnaire (The South African Qualifications Authority, 2001:28).

2.2.2 Knowledge items

Generally, a questionnaire is a collection of items used to elicit information from respondents on a particular subject. As is the case with any other assessment tool, the specific purpose of using the questionnaire should be clearly defined prior to its actual construction (Anderson & Morgan, 2008:100). One of the categories of information that can be elicited from respondents is knowledge (Wallace, 1998:124), and under this rubric an explicit content domain should be identified in order to specify the main objective to be achieved through the use of the questionnaire (Borg & Mastrangelo, 2008:77). In this study, the content domains of fat food knowledge and fat nutrition knowledge were identified as the main determinants of

the knowledge assessment. According to Aday and Cornelius (2006:195), the content of the questionnaire is just as crucial as its objectives, and should be precisely aligned with the aim of the study. For that to be done effectively, Brace (2013:10) suggests further dividing the content domain of the questionnaire into content sub-domains in order to cover every aspect, with individual questions constructed accordingly (see Figure 1.1 for the application of this in this study).

Knowledge questionnaire items are generally classified as either closed-ended or open-ended (McBurney & White, 2010:246). A closed-ended knowledge item compels the respondents to select the correct answer from a range of alternatives supplied to them, while an open-ended knowledge item enables the respondents to generate a correct answer to a question in their own words in the absence of pre-determined alternatives (Kothari, 2004:103; Johnson & Christensen, 2014:198; Babbie, 2015:249).

A multiple choice question is an example of a closed-ended knowledge test item (Kothari, 2004:103). These have been used comprehensively since the middle of the 20th century by researchers for knowledge assessment purposes (Mislevy, 1991:1). Educators tend to adopt this method of asking questions to assess the underpinning knowledge of learners on a particular topic taught in order to save stationery and time when marking (Shank, 2010:1). This type of test item comprises of a problem, also referred to as a stem, followed by a list of alternative answers (McMahon, 2006:16). The list consists of one correct answer together with a few incorrect ones which serve to distract those respondents who lack the requisite knowledge regarding the stem (McMillan, 2008:77). Respondents are required to select an option from those provided that best answers the stem (Osterlind, 2002:162). An ambiguous stem can yield an undesirable outcome, with respondents who possess the required knowledge failing to understand the problem and possibly selecting an incorrect alternative (Haladyna, 2004:108). Similarly, a set of incorrect alternatives that are far-fetched do not serve their purpose of distracting those lacking the relevant knowledge, thus also resulting in an unreliable outcome (Shank, 2010:1).

Multiple choice test items that are correctly crafted exhibit a number of advantages over open-ended test items in that their scoring system is extremely reliable (Epstein et al., 2002:188), accurate and resourceful (McDonald, 2002:83). This is particularly beneficial since this type of test item is often used to assess a large number of respondents (Enger & Yager, 2009:23). The scores from the multiple choice test items can be captured in a computer program relatively easily and allow both for advanced statistical analyses of the results as a whole and for exhaustive individual item analysis (Kuechler & Simkin, 2003:390; Babbie, 2015:249). The scoring is perceived to be reliable and objective owing to the fact that a multiple choice test item has only one correct answer, unlike if the respondents were using their own words (Krieg & Uyar, 2001:230). Multiple choice test items, though, also have

a number of limitations, such as the amount of time required for constructing the items. Generating plausible distractors is often a challenging task that requires a certain level of skill (McDonald, 2002:84; McMahon, 2006:16). The guessing of the correct answer by respondents is directly related to the number of possible alternatives that are provided for each item, and therefore the probability of respondents correctly identifying a correct answer by chance increases when the number of alternatives provided decreases (Yount, 2010:489). Another possible limitation is that the instrument is founded on the assumption that the build-up of segments of information in the long term memory can constitute knowledge (Enger & Yager, 2009:23).

A true-false test item is another type of closed-ended test item which Shrock and Coscarelli (2007:131) describe as a statement that is presented to respondents for them to indicate whether the statement is true or false. According to Ory and Ryan (1993:43), true-false test items can be classified into three basic forms depending on the number or form of alternatives provided, namely simple (consisting of two alternatives), complex (more than two alternatives and an added opinion regarding each alternative) or compound (the simple form plus an open-ended item). In terms of construction, true-false test items are easier and take less time than other closed-ended items such as multiple choice items (Shrock & Coscarelli, 2007:131). But McMahon (2006:28) warns that constructing effective true-false items to assess knowledge is often problematic because not all knowledge aspects can be assessed accurately using this type of test item. Another reason why this type of test item may be difficult to construct is that the true-false stems can be either too simple (when the stem is uncomplicated), or too difficult, if the stem is constructed in such a way as to effectively measure the knowledge of the respondent (Cunningham, 1998:69). Like multiple choice test items, true-false items are easily and reliably scored and computer programs can also be used with ease to apply statistical analysis to the overall results obtained, including item analysis (Glanz, 2009:194). The probability of the respondent guessing on a true-false test is fairly high (50%) as it is a one in two chance, resulting in a fairly high probability of yielding unreliable results (Cunningham, 1998:69; Shrock & Coscarelli, 2007:131; Yount, 2010:489). To nullify guessing, this form of test item construction may be mixed with an open-ended test item where the respondent is required to justify the alternative selected by providing a reason why they think the stem is either true or false, in their own words (Glanz, 2009:194). This is known as the compound form of the true-false test item (Ory & Ryan, 1993:43).

Open-ended items are often used in exploratory research when the primary aim is to discover more about a problem or topic in order to generate theory. Open-ended items are used in the event of the researcher not having enough knowledge on a particular topic, or lacking a clear understanding of the problem statement (Johnson & Christensen, 2014:199). The researcher cannot then provide pre-determined question responses for the respondents

without possibly overlooking extremely important responses relevant to the research that he/she may not be aware of (Rubin & Babbie, 2010:94). Shrock and Coscarelli (2007:129) observe that open-ended items are often used when the information to be gathered cannot be easily classified as either correct or incorrect. Generally, in knowledge assessment, closed-ended test items can be used to assess the underpinning knowledge of the respondents on facts across a specific domain while open-ended test items are used to assess the respondents' level of understanding with regard to essential concepts within that domain (Teddle & Tashakkori, 2009:237). Open-ended test items can be employed in three forms: as fill-in test items, short answer test items or essay test items (Kelly & Haber, 2006:108; Shrock & Coscarelli, 2007:147; Hale, 2012:138).

In a fill-in test item, the respondents are provided with an incomplete statement that precedes a blank line on which they are expected to complete the statement by generating the answer (Haladyna & Rodriguez, 2013:198). Instead of an incomplete statement, a question may be presented to the respondents for them to write the answer in the blank space following the stem (Shrock & Coscarelli, 2007:147). The answer is often a single word (Shermis & Di Vesta, 2011:172).

Short answer test items require the respondent to generate a correct answer in slightly more words than required by the fill-in item, ranging from a phrase to a paragraph or even a page in length (Kelly & Haber, 2006:108). Nonetheless, the response to a short answer item essentially has to be brief (Snowman & McCown, 2012:491). Both these test items are normally used to test the ability of the respondent to remember particular facts without being given a hint through the provision of predetermined alternatives (Hale, 2012:139).

An essay test item includes a broad stem that requires respondents to write lengthy responses which are normally longer than those expected for a short answer test item (Snowman & McCown, 2012:491). This type of test item is generally used when it is important to measure the respondents' writing skills or their depth of understanding of a particular content domain (Hale, 2012:139).

Although each type of open-ended item has its own advantages and disadvantages, open-ended items generally minimise the respondents' chances of guessing correct answers because of the absence of alternatives (Burke, 2009:149). While the quest for detailed information may be one of the major reasons in employing open-ended items, particularly the essay type, they may – when employed in a self-administered questionnaire – conduce to the respondent straying from the question and providing a lot of irrelevant information (Shultz et al., 2014:45). To curb such unwanted responses, Gliner et al. (2009:185) suggest that open-ended test items should be used in an interview rather than a self-administered questionnaire. Generally a questionnaire consisting of virtually all open-ended items takes

longer to complete and usually necessitates effort from the respondent. As a result fewer stems (questions) should be included compared to closed-ended items (McBurney & White, 2010:247). Closed-ended items, thus, cover more aspects of a particular content domain while taking less time to complete (Snowman & McCown, 2012:491).

In order to statistically analyse the data obtained from open-ended items using computer programs, the responses have to be scored before they can be inserted into a computer (Mitchell & Jolley, 2010:224). The process of scoring is often tedious as it requires the scorer to work through all the many different responses written by the respondents in their own words, then analyse, evaluate and categorise them according to similarities, before giving each category a unique score (Kothari, 2004:103; Ary et al., 2010:392). The responses may be extremely diverse, making it very challenging for the scorer to categorise and score each one (Mitchell & Jolley, 2010:276). Furthermore, the scoring of open-ended test items is inevitably subjective as it relies on the individual judgement of the researcher (Anderson & Morgan, 2008:77). This may yield unreliable results compared to the objectivity of the closed-ended scoring system, with its single standardised correct answer (Krieg & Uyar, 2001:230).

2.2.3 Knowledge item elements for creating plausible assessment tools or knowledge tests

Through attempts on the part of early researchers to reliably and validly (Wood & Zhu, 2006:53) measure knowledge and other psychological aspects of respondents (Juve, 2008:384), mathematical models such as the classical test theory (Kline, 2005:91), the item response theory (Franzen, 2000:8) and the Rasch model (Christensen et al., 2013:4) were developed.

2.2.3.1 Item analysis

After the respondents have completed a pool of closed-ended items constituting a 'test', the procedure whereby the respondents selected their responses from a list of possible answers provided and the individual test items making up the test are both evaluated to determine their quality. This is known as 'item analysis' (Siri & Freddano, 2011:189). Item analysis enables the detailed evaluation of the individual item attributes in order to determine the reliability and validity of the assessment tool, in a way that benefits both the respondent and the assessor (Mehta & Mokhasi, 2014:198). Connected to the reliability and validity of the assessment tool is the item difficulty index and the item discrimination index, which can both be measured through item analysis (Wilson, 2005:94). The item difficulty index is a calculation of the extent to which the test item is easy to answer by determining the proportion of respondents who correctly identified the answer to that item (Kaplan & Saccuzzo, 2009:171). Statistically this index is usually a number between zero and one: the higher the value, the higher the number of respondents who answered the item correctly

(Woolf, 2013:147). One of the uses of the item difficulty index is its contribution to the arrangement of knowledge items in an assessment tool (Osterlind, 2002:288). Robinson-Kurpius and Stafford (2006:113) argue that in order to encourage the respondent to complete the entire questionnaire, the knowledge items can be arranged starting from items with the highest difficulty indices and finishing with those with lowest difficulty indices (least difficult to most difficult).

Generally for a knowledge assessment tool to be considered valid, it has to be able to effectively measure the knowledge of respondents and this is where the function of the discrimination index or item discrimination comes in (Frey, 2006:123). In knowledge assessment, the discrimination index is a measure of the extent to which a particular item can properly discriminate between respondents who have considerable knowledge and those who do not, in spite of the item's difficulty index (Domino & Domino, 2006:32). In order to determine whether the respondents have either good or poor knowledge through a self-administered questionnaire, each particular item in the questionnaire should be capable of effectively discriminating respondents who have a high level of knowledge from those who do not (Robinson-Kurpius & Stafford, 2006:115). If an item cannot properly discriminate between these groups of respondents, then that item does not meet the objective of the assessment and is therefore considered invalid (Ary et al., 2014:228). The discrimination index is also known statistically as the D-value, and it is normally represented by a number between minus one and plus one (McDonald, 2002:224). A negative discrimination index on an item entails that those respondents with a high total score, responded to that particular item incorrectly. The higher the D-value the better the discriminatory power of an item, with a D-value of zero indicating that an item has no discriminatory power at all (Suen, 1990:76). Thus item discrimination is determined by observing the relationship between a respondent's total score and the score on each item (Schmidt & Embretson, 2003:431). Item analysis in terms of both item difficulty and item discrimination can be statistically measured using classical test theory, item response theory or the Rasch model (Kingston & Kramer, 2013:195).

In addition to the item difficulty and the item discrimination indices as major considerations in item analysis (Thomas et al., 2015:221), the distribution of answers to alternatives is a further consideration (Tuckman & Harper, 2012:219). It entails that the proportion of respondents who select each individual alternative as an answer to a stem can be used to determine the plausibility of distractors that were used in the list of alternatives (Meyer, 2014:43). According to Urbina (2014:252), those distractors that have not been selected by any of the respondents or that are often selected by respondents with a high level of competence ought to be discarded.

2.2.3.2 Validity

Generally, for a knowledge assessment carried out to be considered valid, it must have been able to effectively measure the type of knowledge intended to be assessed, by using a method that provided an accurate reflection of the actual state of a respondent's knowledge (Domino & Domino, 2006:66; Teddlie & Tashakkori, 2009:209; Rubin & Babbie, 2010:83; Tummons, 2011:38; Banks, 2012:43). Validity covers a number of aspects pertaining to the connection between an assessment tool and the objective of the assessment, and extends to a range of types, the common ones reported being face, content, criterion and construct validity (Ballantyne & Povah, 2004:16; Tummons, 2011:38).

Face validity involves the opinion of respondents on whether the assessment tool seems to measure what it is intended to measure, at face value (Franzen, 2000:35). Prior to the actual assessment, a representative sample of the respondents may be presented with a knowledge questionnaire and requested to go through all the test items in order for the assessor to elicit their perceptions (Ballantyne & Povah, 2004:16) on whether the questionnaire appears to measure knowledge (Ravid, 2015:209), and if they can comprehend each item fully (Franzen, 2000:35). Usually considered as a weak type of validity relative to the other types (Drost, 2011:116), face validity does not take into consideration the extent to which the assessment tool is in line with the objectives of the assessment (McDonald, 2002:28). Nonetheless, face validity is often used for the purposes of encouraging (Gliner & Morgan, 2000:320) and motivating (McDonald, 2002:28; Ravid, 2015:209) the respondent to complete the test. Although face validity may be considered relatively unsophisticated, it is essential to ensure that respondents comprehend the items in terms of content and the language used, as a lack of comprehension may reduce the motivation of respondents to complete the assessment, which in turn may affect the validity of the results (Toplis et al., 2005:16).

Content validity is an expansion of face validity (Monette et al., 2011:115), a measure of the degree to which the items constituting an assessment tool accurately cover all the relevant aspects of the domain being assessed (Tummons, 2011:38). According to Trochim et al. (2015:130), this type of validity is based on the assumption that an assessor has a correct description and understanding of all the subdomains that constitute the main domain to be assessed. Unlike the case of face validity, experts in the domain that is to be assessed are responsible for evaluating the content validity of an assessment tool (Dilorio, 2005:215; Teddlie & Tashakkori, 2009:210). Nonetheless, to reduce experts' subjective prejudice when assessing content validity, Banks (2012:43) maintains that they also have to be experts in measuring. When carried out properly, content validity eliminates the possibility of a knowledge assessment tool not yielding the actual knowledge state of the respondent due to

the failure of items to accurately represent each aspect of the domain being assessed (Mitchell & Jolley, 2010:157).

The extent to which knowledge content scores produced by, say, a self-administered questionnaire correlate with the same knowledge content measured in a completely different way, is referred to as criterion validity (Domino & Domino, 2006:56). Another way of determining the criterion validity of a standardised assessment, when the knowledge assessment tool is a newly developed one, is to compare the knowledge scores obtained from this new tool with those obtained from a well-established knowledge assessment tool. The higher the correlation between these two sets of scores, the greater the validity of the newly developed test (Banks, 2012:43). This type of validity is incorporated to a small extent in another type of validity called construct validity (Domino & Domino, 2006:55).

Construct validity is a type of validity associated with an assessment tool that measures the traits of a respondent not normally visible to the eye, such as knowledge (McDonald, 2002:25). Although a construct is not itself observable and cannot therefore be measured directly, it produces observable effects on a respondent's behaviour (Martella et al., 2013:80). Construct validity is therefore defined as a measure of the extent to which an assessment tool effectively measures the respondent's underlying trait that is the focus of the assessment (Ary et al., 2010:291). Since it is an underlying trait, a researcher normally describes the trait theoretically: for example, what it is, how it can be measured and the outcomes that are to be expected (Domino & Domino, 2006:55). Therefore, an assessment tool is said to have construct validity if it actually assesses what it is theoretically supposed to assess (Trochim et al., 2015:128). Consequently, construct validity distinguishes itself from other types of validity in that the process used to assess it and the information gathered from the process must all be within the designed theoretical framework (Domino & Domino, 2006:55). In terms of knowledge assessment, construct validity can be determined by assessing the extent to which the assessment tool can properly discriminate between respondents with a high level of knowledge and those with a lower level, which is linked to the discrimination index of the items contained within the assessment tool (Frey, 2014:20).

2.2.3.3 Reliability

Apart from the need for it to be valid, a knowledge assessment tool must also be reliable (Reeves, 2004:81). An assessment tool that is reliable produces consistent outcomes when employed more than once (Ember & Ember, 2009:153). For an assessment to be valid it has to be reliable, yet a tool can be reliable without being valid. For example, an assessment tool that is designed to measure a particular aspect of a knowledge domain can yield consistent results when employed more than once and over time, while all the knowledge items constituting the tool are actually measuring a different aspect of the knowledge domain

(Kothari, 2004:74; Matthews & Kostelis, 2011:195). Ember and Ember (2009:153) distinguish three types of reliability: test-retest, interobserver and interrater reliability. Although the concepts are similar, these three types of reliability are described by Sim and Wright (2000:131) as stability, equivalence and internal consistency. Generally, it is imperative that the level of reliability of an assessment tool be as high as possible regardless of the way in which it is measured, as this is directly related to the level of reliability of the test results (Berg & Latin, 2004:165).

In test-retest reliability, a self-administered knowledge questionnaire is used to assess respondents on one day and then the same questionnaire is administered again to the same respondents by the same assessor on a different day (Matthews & Kostelis, 2011:197). The waiting period between administering a test for the first time and for the second time typically varies between seven days and 28 days (Robinson-Kurpius & Stafford, 2006:124). The scores obtained from the different days are correlated and the higher the correlation the higher the stability of the assessment tool (Matthews & Kostelis, 2011:197). For measuring this type of reliability, the state of knowledge that a respondent has and which an assessor intends to assess should remain constant from the time the test is first administered until the test is administered for the second time (Kaplan & Saccuzzo, 2009:109).

Another method is for two different assessors to employ the same assessment tool using different administration methods on similar respondents and (ideally) on the same day. The extent to which the scores obtained by these assessors correspond with each other measures reliability with regard to equivalence (Hartas, 2010:72). Alternatively, the two assessors may use two different forms of an assessment tool that both measure the same content domain; that is, using items in one form that have the same difficulty index as the items in the other form, on the same respondents, and ideally at the same time (Goodwin & Goodwin, 1996:79). The purpose of equivalence reliability is to ascertain if an assessment yields consistent results when applied in a different form (Sim & Wright, 2000:131). The scores obtained by the respondents in both tests are correlated and the mean scores are also compared. The closer the scores are to each other the higher the equivalence reliability (Fink, 2013:66).

Internal consistency reliability is concerned with how well the different items in an assessment tool relate to each other – that is, if they consistently measure the same concept (Sharma & Petosa, 2014:110). One way of measuring the internal consistency of an assessment tool is to use the split-half method. For the split-half method, the items in a knowledge test assessing the same knowledge domain are split into two and then administered to the same respondents separately, after which the scores obtained from each half are correlated. The assessment is considered reliable if there is a relatively high positive correlation between these two sets of scores (Samarasekera et al., 2015:284). A summary

measure in calculating internal consistency reliability for a single test administration is Chronbach's alpha, which measures the extent to which all the items in an assessment tool correlate at the same time (Sharma & Petosa, 2014:110). It is computed by using the average of the single item to item correlations and adjusting for the total number of items (Dilorio, 2005:184).

While other types measure the reliability of an assessment tool, interrater reliability is concerned mainly with the degree to which an assessor is reliable (Jackson, 2015:86). This is particularly applicable in cases where both the assessment process and the findings obtained may be subjective, for instance, when observation is used as an assessment measure (Stemler & Tsai, 2008:30). Interrater reliability is a measure of the extent to which the results obtained by several assessors from evaluating the same respondent on a specific trait are in agreement (Jackson, 2015:86). When the results are in agreement, it can be concluded that the assessment tool is not dependent for its results on a particular assessor (Jones, 2006:33). This type of reliability is often applied when an assessment tool consists of open-ended test items, particularly the essay type, where the goal is to ensure that a respondent obtains the same score when assessed by different assessors (Wilson, 2005:57).

2.2.4 Use of assessment methods in reported dietary fat knowledge determinations

In order to ascertain the dietary fat knowledge of respondents, a number of studies have utilised diverse assessment methods, in accordance with their respective objectives (Peltzer, 2004:25; Gottschall-Pass et al., 2007:124; Hendrie et al., 2008:1366; Mazier & McLeod, 2007:15; Venter & Winterbach, 2010:76; Saulais et al., 2012:112). Table 2.1, below, provides a summary of some of these studies and the assessment methods they employed in assessing dietary fat knowledge or aspects thereof. None of the studies focused exclusively on the dietary fat food knowledge and dietary fat nutrition knowledge of respondents, as the present study does. Although the studies of Mazier and McLeod (2007:15) and Saulais et al. (2012:112) focused only on the knowledge of dietary fat among respondents, Mazier and McLeod (2007:15) combined several fat nutrition and a few fat food knowledge items in one section of their questionnaire. Saulais et al. (2012:112) as well as Venter and Winterbach (2010:76) only included fat nutrition knowledge items in the assessment. The remainder of the studies (Gottschall-Pass et al., 2007:124; Hendrie et al., 2008:1366; Peltzer, 2004:25) assessed respondents' knowledge of fat alongside their knowledge of other nutrients. Item analysis was performed on the items included in the assessment tool, and the validity and reliability of the assessment tool was determined in nearly all of these reported studies, suggesting that the knowledge measurement undertaken in these studies was highly credible.

Table 2.1: Dietary fat knowledge assessment methods as used in some reported studies

Subjects	Country	Content domains	Assessment method	Construction and evaluation			Reference
				Item analysis	Validity	Reliability	
First-year and fourth-year university students	Canada	Purchasing; recommendations; Food sources; Characteristics; Disease association	Selected-response questionnaire (multiple choice and true-false test items)	x	✓	✓	Mazier and McLeod (2007:15)
Adult consumers (mean age = 45 years)	France, Canada and USA	Food sources; Terminology; Dietary recommendations	One-on-one interviews (open-ended questions)	✓	x	X	Saulais et al. (2012:112)
Adults aged between 18 and 74 years	Canada	Dietary recommendations; Food sources; Food choices; Diet-disease relationships	Selected response questionnaire (multiple choice test items)	✓	✓	✓	Gottschall-Pass et al. (2007:124-125)
Young adults	Australia	Dietary recommendations; Food sources; Food choices; Diet-disease relationships	Selected-response questionnaire (multiple choice test items)	✓	✓	✓	Hendrie et al. (2008:1366)
Mid-adolescents	South Africa	Food sources and choice; Diet-disease relationships	Selected-response questionnaire (multiple choice test items)	✓	✓	✓	Venter and Winterbach (2010:76)

Table 2.1 (continued): Dietary fat knowledge assessment methods as used in some reported studies

Subjects	Country	Content domains	Assessment method	Construction and evaluation			Reference
				Item analysis	Validity	Reliability	
Young adults aged between 18 and 30 years	South Africa	Dietary recommendations; Food sources; Food choices; Diet-disease relationships	Mixed-method questionnaire (multiple choice mixed with short answer open ended test items)	✓	✓	✓	Peltzer (2004:25)

2.3 Consumption of foods rich in fat and fat intake of students

As the consumption of foods rich in fat of the student sample for this study was assessed and categorised and not the fat intake *per se*, information found related to the consumption of foods rich in fat forms the focus of this section of the literature review, with information on the fat intake *per se* of students and/or age groups representing young adults provided as support for the indication that the typical diet of a university student contains high levels of fat (Liedman et al., 2001:51; Ibrahim et al., 2014:411).

2.3.1 Consumption of foods rich in fat

Yahia et al. (2008:32) explored the eating habits of students (n = 220) studying at a university in Lebanon with an average age of 20 years, and found that almost three-fifths of the students consumed fried foods four or more times per week. More than half (53%) of these students reported consuming snacks on a daily basis (Yahia et al., 2008:34). A comparable result with regard to fried foods was reported in a study by Al-Rethaiaa et al. (2010:39), when the eating habits of Saudi Arabian university male students (n = 357) was investigated. Nearly half (47%) of these respondents reported a fried food consumption frequency of three times or more per week (Al-Rethaiaa et al., 2010:41). Likewise, Sakamaki et al. (2005:32) conducted a comparative study of the food habits of Japanese (n = 124) and Korean (n = 141) university students, and ascertained that more than half of both the Japanese (54%) and Korean (50.4%) students reported consuming fried food three to four times per week (Sakamaki et al., 2005:34).

A study comparing the fast food intake of adolescents and young adult females (n = 196), also from Saudi Arabia, was conducted by Al-Faris et al. (2015:2). Almost two-thirds of those who participated were adolescents and a third young adults. Parallel results were reported, with the majority of both the adolescents (78%) and young adults (81.2%) consuming fast foods at least once per week (Al-Faris et al., 2015:5). A sizeable percentage of both the adolescents (72.3%) and young adults (65.2%) in this study also consumed hamburgers containing beef or chicken more regularly than they did other fast foods (Al-Faris et al., 2015:3). In addition, the food consumption of first-year university students (n = 2 402) from Germany, Denmark, Poland and Bulgaria were investigated by El Ansari et al. (2012:28). A generally high consumption of foods rich in fat was reported among the university students in Bulgaria. Of the first-year Bulgarian students who participated in the study (n = 654), considerable percentages of 72% and 77% of the students reported a high consumption frequency of cakes and fast foods, respectively, several times per week or daily (El Ansari et al., 2012:31). The food consumption at breakfast among undergraduate students (n = 145) enrolled at Ankara University in Turkey with a mean age of 21 years, was reported in a study by Ozdogan et al. (2010:882). Slightly more than half (51%) of these respondents were responsible for their own food provision, and when assessed on how often they consumed certain food products (in terms of often, sometimes or never), the majority of these respondents (86.2%) often consumed cheese at breakfast time (Ozdogan et al., 2010:884).

In a study by Takomana and Kalimbira (2012:133), the food consumption of first-year students (n = 47) enrolled at the Bunda College of Agriculture in Malawi as they began the year of study was compared to their consumption at the end of their first year of college. At the beginning of year, slightly more than half (53.4%) of these students consumed margarine at least once per day; towards the end of their first year, the proportion increased to slightly less than three quarters (73.9%) consuming margarine at least once each day of the week (Takomana & Kalimbira, 2012:136). Students from Venda University, SA, often consumed fast foods that are high in trans-fat and saturated fatty acids for breakfast or as snacks (Ter Goon et al., 2013:1019). According to the Van der Berg et al. (2012:2) study on the eating practices of South African university students, above two-thirds (68.3%) of them consumed margarine, oil (or fat), bread and sugar on a daily basis, as opposed to less than a quarter who consumed fruits (23.6%) and even fewer (12.4%) who consumed vegetables daily. Furthermore, of those students who consumed milk daily (89.4%), a large percentage (77%) were reported to consume only full cream milk instead of low-fat or skimmed milk (Van der Berg et al., 2012:7).

2.3.2 Dietary fat consumption *per se*

Macronutrients are the major sources of energy in one's diet (Dietary Guidelines Advisory Committee, 2010:14), with dietary fat being the most energy-dense nutrient providing

approximately double the energy (37 kilojoules per each gram of fat) of that provided by the other two macronutrients (17 kilojoules per each gram by carbohydrates and protein, respectively) (Whitney & Rolfes, 2016:8). Regulating the energy intake from food is essential in order to achieve energy balance in the body (Dietary Guidelines Advisory Committee, 2010:13). Energy balance is important in weight management (McGuire & Beerman, 2013:323) and the overall long-term health of an individual (Haskell et al., 2012:421).

In an attempt to regulate the energy intake of individuals, the Institute of Medicine (2005:769) introduced “acceptable” percentage ranges of energy to be provided by each macronutrient in the diet. These ranges differ according to age group, with young adults recommended to have 20 to 35% of their daily energy coming from their total fat intake (Institute of Medicine, 2005:769). But in 2009, international experts came to a consensus regarding the energy percentage values related to fat in the diet, that applies to all persons from the age of two years upwards (Diekman et al., 2009:39). These recommendations have been adopted in SA (Smuts & Wolmarans, 2013:95). The recommendations agreed upon in SA (similar to those agreed upon by the international experts, for the total fat energy provision to be less than 30%) are provided in Table 2.2, below.

Table 2.2: Quantity and quality of dietary fat recommended for optimal health from the age of two years and above (Source: Smuts & Wolmarans, 2013:95)

Nutrient	Percentage recommended of the daily energy intake
Total fat	20 - 30 OR ≤ 30
Saturated fatty acids	$\leq 10^a$
Polyunsaturated fatty acids	6 - 10 (omega-6 fatty acids = 5 – 8 and omega-3 fatty acids = 1 – 2)
Monounsaturated fatty acids	~ 10
Trans-fatty acids	<1

^aThe energy provided by saturated fatty acids should be less than seven percent in individuals who are at risk of CVD.

The dietary intake of 918 students registered at the University of Valencia in Spain was assessed by Soriano et al. (2000:1250) through the use of a 24-hour recall. The energy contribution from the diet of these students provided by fat was 33.4% and 36.7% for males and females, respectively (Soriano et al., 2000:1251). Just as these values exceeded the dietary fat provision recommendations as presented in Table 2.2, indicating a diet high in fat, they were also reported to exceed the Spanish recommendations for energy to be provided by fat in the diet (Soriano et al., 2000:1256). A somewhat similar result was reported after the dietary intake of 130 first-year students attending a public university in northern Spain was

assessed by Irazusta et al. (2007:388), using a food record of up to three days. The mean fat energy intake of these students was 45.7% and 45.9% for the females and males respectively, far exceeding the recommended intake of 20% to 35% (Irazusta et al., 2007:390). Also the energy provided by saturated (13.4% and 13.3% respectively) and monounsaturated (21.9% and 22.3% respectively) fat for females and males (Irazusta et al., 2007:390) exceeded the recommendations as presented in Table 2.2. Another approximately similar result with regard to total fat energy intake was found in a study by Neslişah and Emine (2011:117), who assessed the energy and nutrient intake of 400 university students from Ankara, Turkey using a 24-hour recall. The percentage of energy supplied from fat was 32% and 35.4% of the total daily energy intake for males and females respectively (Neslişah & Emine, 2011:119), which also exceeds the recommendations presented in Table 2.2. Although their study did not measure these percentage values against specifically Turkish recommendations, Neslişah and Emine (2011:122) recommended a decrease in fat consumption for these students.

Tengvall and Ellegård (2007:79) assessed the dietary intake of 1 737 second-year students registered at the University of Gothenburg, Sweden, over a period of 13 years (from 1994 to 2006), through a three-day estimated food record that was conducted twice yearly. Although the mean total fat energy intake of these students was reported to be in agreement (29% for women and 30% for men) with the Nordic Nutrition Recommendations (25% - 35% as fat energy intake for both women and men), the mean energy obtained from saturated fat (12% for women and 13% for men) exceeded the recommendations (Tengvall & Ellegård, 2007:81). The same result with regard to saturated fat intake was reported after the dietary intake of 234 university students from the United Kingdom was assessed by Foster et al. (2015:320), also through the use of a three-day estimated food record. The mean percentage energy contribution of saturated fat from the diet of these students (12.2% for females and 10.8% for males) exceeded the recommendation of 10% (Foster et al., 2015:320), which is similar to that presented in Table 2.2.

The dietary intake of an urban adult population (n = 356) from the city of Gondar, Ethiopia was assessed by Amare et al. (2012:752) through the use of a 24-hour recall. Almost half (45.2%) of this adult population comprised young adults (Amare et al., 2012:754), and the mean percentage of energy that fat contributed to the total daily energy intake of this population group was 33.4% and 26.9%, for women and men respectively (Amare et al., 2012:757). This indicates that the fat energy intake of these women exceeded the recommendations as presented in Table 2.2, as well as the recommended figure of 15 to 30% energy for total fat proposed in that study (Amare et al., 2012:757). In SA, Naicker (2009:127) assessed the usual dietary intake of 250 adults from KwaZulu-Natal through the use of a quantitative FFQ. The mean percentage energy of total fat from the diet of these

adults was found to be more than that recommended (35% for men and 37% for women compared to the maximum of 30%) (Naicker, 2009:143). A comparable result was reported by Potgieter et al. (2014:35) after assessing the habitual nutrient intake of 11 rugby-playing students from Stellenbosch University, SA, through the use of a seven-day food record. The mean percentage energy of total fat from these students' diet was found to be more than that recommended (33.8% compared to the maximum of 30%), as was the mean percentage energy provided by saturated fat in their diet (11.2% compared to 10% and below) (Potgieter et al., 2014:38).

2.4 Dietary intake assessment

To achieve a specific objective concerning the dietary intake of individuals, a researcher may require a specified compilation of food and beverages consumed by respondents which can be obtained through a process often referred to as dietary intake assessment (Simko et al., 1995:165). Such an objective could be to determine the quality of the respondents' diet or the quantity of the different nutrients consumed (Thompson & Subar, 2013:5). Different objectives concerning the dietary intake of respondents may require different assessment methods (Jeor, 1997:211). In this section, as was the case in the section regarding knowledge assessment (see 2.2), only a brief overview of important aspects of the available dietary intake assessment methods is provided and not a detailed examination. The study did not itself pursue the development of a dietary intake assessment tool, but required basic knowledge of these so as to ensure that the best tool was selected.

2.4.1 Available assessment methods

All the available dietary intake assessment methods can broadly be divided up according to the nature of the respondents being evaluated, for instance, it could be a group of respondents such as a family household being evaluated as one, or it could be individual respondents (MacIntyre & Labadarios, 2000:313). Moreover, those methods that evaluate individual respondents can then be classified as retrospective, that is, the respondents are required to use their memory to recall food consumed previously; or as prospective, where the respondent's memory is not exercised and the assessment is done as food is actually consumed (McGuire & Beerman, 2013:36). Because of their pertinence to this study, the attributes of available methods that only assess individual respondents are discussed in Table 2.3, below. Note that the unquantified FFQ (as a brief screening questionnaire) used in this study to assess and categorise the consumption of food rich in fat by the study sample is presented as part of the FFQ as assessment method.

Table 2.3: Synopsis of the available dietary intake assessment methods (Sources: Krummel & Kris-Etherton, 1996:532; Jeor, 1997:245; Desai, 2000:451; Patterson & Pietinen, 2004:76; Ulijaszek, 2004:122; Gibson, 2005:59; Escott-Stump, 2008:868; Hu, 2008:88; Thompson & Subar, 2013:5; Willett, 2013:71; Neuhouser, 2014:556; Slimani et al., 2015:52)

Method	Description	Advantages	Disadvantages	Broad use
Dietary history	Assesses the usual meal pattern of a respondent normally through an exhaustive interview where the respondent is required to remember and provide detailed information about the food they consumed for a long period of time which generally ranges between several weeks to months.	Its ability to provide the usual meal pattern of a respondent for a lengthy period of time.	Time consuming with regard to length of the interview. It is usually difficult to standardise. The results obtained depend solely on how accurately the respondent remembers and the level of honesty in verbalising that which is remembered.	For medical purposes: in order to identify patients that may require assistance from dietitians. Can be used by the government as an aid in establishing food policies such as food fortification.
Dietary/food records	Often referred to as the 'gold standard', this method requires the respondents to individually record the food that they consume in a day or up to a maximum period of one week. The respondent normally will be in possession of the record so that the recording is done at every moment of consumption in order to eliminate the use of memory. In some instances the respondents may be required to weigh each food before consuming it or an assessor may assist them in how to estimate portion sizes.	Its ability to yield meticulous information with regard to food consumed, for example, portion sizes and brand names. A level of accuracy exists as the results do not depend on the memory of the respondent.	Only measures the food consumed by a respondent over a very short period of time and therefore may not be a true representation of usual intake. It can be strenuous for the respondent to complete. The likelihood of respondents altering their habitual intake exists when they are required to record their intake as they consume food and beverages.	Data received often used in sophisticated statistics for regression and correlation purposes.

Table 2.3 (continued): Synopsis of the available dietary intake assessment methods

Method	Description	Advantages	Disadvantages	Broad use
24-hour recall	Respondents are required to recall and then provide comprehensive information of all the food consumed for the past 24 hours for this method.	Since the time period is extremely short, respondents are likely to remember most of the food consumed.	<p>The information provided is limited to the past 24 hours and may not be a true representation of the respondent's usual food intake (to overcome this, multiple recalls can be conducted).</p> <p>The accuracy of the results also depends on how truthful the respondent is about the actual food consumed.</p>	To provide an approximation of the average dietary intake of respondents usually at a national level.

Table 2.3 (continued): Synopsis of the available dietary intake assessment methods

Method	Description	Advantages	Disadvantages	Broad use
Food frequency questionnaire (FFQ)	A rudimentary FFQ is made up of a list of foods and a section where the respondents indicate how often they consume the foods on the list provided. FFQ can either be brief (such as a screener for example) or comprehensive. A screener often involves a specific nutrient and is therefore shorter in length as the food included on the list only pertains to that particular nutrient whereas a comprehensive FFQ is longer as it assesses the intake of foods under each food group and is a representation of all or virtually all the nutrients. FFQs can also either be semi-quantified (where the respondents are also required to indicate the portion sizes of the food consumed) or non-quantified.	Provides a representation of usual intake. It is cheap to administer. It takes a short time to complete.	The information gathered depends on the memory of the respondents and may not be suitable for populations where remembering information may be problematic such as the elderly. The list of foods provided may not be suitable for every respondent.	Used in epidemiological studies for categorising respondents according to their level of nutrient or food intake such as high, medium or low intake. To identify some aetiologies of nutrition-related diseases.

2.4.2 Dietary intake screeners and indexes as assessment methods

Also referred to as an ‘abbreviated questionnaire’, a dietary intake screener is a cost-effective dietary intake assessment method that efficiently estimates a respondent’s usual intake of a specific dietary component (Smiciklas-Wright et al., 2014:521), while a dietary

index is generally constructed with the aim of assessing the dietary quality of a respondent (Smiciklas-Wright et al., 2014:525). A dietary screener can generally be described as a brief FFQ that assesses the frequency of intake (Martin-Biggers et al., 2015:1029) of a specific component of the diet that is of interest (Laraia et al., 2015:132) which often involves a short list of foods depending on that component of the diet (Contento, 2007:365; Slimani et al., 2015:56). It is normally used in situations that do not require a total diet assessment (Laraia et al., 2015:132).

A dietary index, in contrast, assesses the healthy eating patterns or overall diet quality of a respondent (Kourlaba & Panagiotas, 2009:2) and is generally developed according to nutrition guidelines or recommendations (Hu, 2008:109), with the Healthy Eating Index-2010 (Guenther et al., 2013:569) and the Dietary Approaches to Stop Hypertension index (Fung et al., 2008:714) being examples. Dietary intake screeners (Kris-Etherton et al., 2001:85; Contento, 2016:386) and indexes (Chiuve et al., 2012:1010; Harmon et al., 2015:588) both use a scoring system. Due to the focus of this study on assessing and categorising the dietary fat intake of respondents through the use of a screener, more information about dietary intake screeners (and not indexes) that specifically assess dietary fat intake and categorise the intake, together with information on how as assessment tools their validity and reliability were evaluated, are provided in Table 2.4 below.

Table 2.4: Synopsis of some available dietary intake fat screeners

Naming	Description	Scoring system	Validity	Reliability	Reference
Block Meat/Snack Screener	A fat screener comprising of 15 items that assesses frequency of intake of major sources of fat in an American diet and also provides information on total fat, saturated fat and cholesterol intake.	Points are allocated to each item according to the frequency of intake, as: zero, one, two, three and four for the frequency of once per month or less, 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 points are then summed to form a total score which ranges from zero to 60. Based on the total scores obtained, respondents can then be categorised according to their usual fat intake.	Validity was determined as the extent to which the fat intake of a respondent as categorised through the Block Meat/Snack Screener correlated with the fat intake of the same respondent as categorised through a 100-item valid ^a Block full (comprehensive) FFQ.	Not mentioned in the publication.	Block et al. (2000:285)

^a The Block full FFQ was previously found to be valid when its scores were correlated with results obtained from 12 days' worth of food records (Block et al., 1990:1327)

Table 2.4 (continued): Synopsis of some available dietary intake fat screeners

Naming	Description	Scoring system	Validity	Reliability	Reference
<p>The meats, eggs, dairy, fried foods, fats in baked goods, convenience foods, table fats, and snacks (MEDFICTS) dietary fat screener</p>	<p>Assesses fat intake to determine if it's in accordance with the total fat and saturated fat recommendations as well as targeted, food-based dietary guidelines.</p>	<p>Points are allocated in each MEDFICTS food category according to frequency of intake per week (as zero, three and seven for the frequency of rarely or never, three or fewer servings per week and four or more servings per week respectively) and also according to the different serving sizes (as one, two and three for a serving size that is small, average and large, respectively). Food category scores are then obtained from multiplying the frequency of intake score by the serving size score. These food category scores are then summed to produce a total score (maximum = 210). From these final scores, a respondent's diet can be categorised.^b</p>	<p>Validity was determined as the extent to which the fat intake of a respondent as categorised through the modified MEDFICTS correlated with the fat intake of the same respondent as obtained through three-day food records.</p> <p>Content validity of the modified MEDFICTS developed for South African scholars was determined by comparing the foods listed in the original MEDFICTS to those commonly consumed and available in SA, and those foods that were not were discarded from the list.</p>	<p>Test-retest reliability of the modified MEDFICTS screener was determined when the screener was administered twice to the same respondents and then defined as the extent to which the scores correlated.</p>	<p>Wenhold et al. (2014:87)</p>

^bInformation obtained from Kris-Etherton et al. (2001:85)

Table 2.4 (continued): Synopsis of some available dietary intake fat screeners

Naming	Description	Scoring system	Validity	Reliability	Reference
Dietary Instrument for Nutrition Education (DINE) as adapted by Packman and Kirk (2000:390)	A 14-item fat screener that assesses the frequency of intake of major sources of fat, particularly saturated fat in a British diet.	Scores are allocated to each food according to the frequency of intake, with fewer frequencies receiving low scores and <i>vice versa</i> . These scores are then summed to provide a total score which in turn is used to categorise a respondent, i.e. a score of less than 30 classifies a respondent into a low-fat group, 30 to 40 into a medium fat group, and more than 40 into a high fat group.	Validity was determined as the extent to which the fat intake of a respondent as categorised through the DINE fat screener correlated with the fat intake of the same respondent as obtained through four-day food records.	Not mentioned in the publication.	Packman and Kirk (2000:390)

2.4.3 Use of screeners in reported dietary fat intake determinations of students and mid-adolescents

The majority of the studies summarised in the section on the consumption of foods rich in fat and the fat intake of students (see 2.3) assessed the general nutrient intake of students, including the dietary fat intake alongside that of other nutrients. Very few studies assessed solely the intake of dietary fat among students.

To assess the dietary fat intake of respondents, past studies employed assessment methods that best suited their specific objectives, as shown in Table 2.5 below (Packman & Kirk, 2000:389; Sakamaki et al., 2005:34; Yahia et al., 2008:35; Venter & Winterbach, 2010:79; Dissen et al., 2011:284; Takomana & Kalimpira, 2012:136; Mullan et al., 2014:9; Nastaskin & Fiocco, 2015:44). Two of these studies (Packman & Kirk, 2000:389; Venter & Winterbach, 2010:79) explored solely the intake of dietary fat as the only nutrient of interest. The

remaining studies assessed the intake of dietary fat along with other nutrients (Sakamaki et al., 2005:34; Yahia et al., 2008:35; Dissen et al., 2011:284; Takomana & Kalimbira, 2012:136; Mullan et al., 2014:9; Nastaskin & Fiocco, 2015:44).

Table 2.5: Dietary fat intake assessments of students and mid-adolescents in reported studies using a screener as an assessment method

Subjects	Country	Dietary fat intake determination	Reference
Male university students (n = 56) with an average age of 23 years	United Kingdom	Main food sources especially those containing saturated fat	Packman and Kirk (2000:389)
Female university students (n = 265) with an average age of 20 years	Japan and South Korea	Fried food	Sakamaki et al. (2005:34)
University students (n = 220) with an average age of 20 years	Lebanon	Fried food	Yahia et al. (2008:35)
University students (n = 279) with an average age of 20 years	United States of America	Main sources of fat particularly those containing saturated fat and cholesterol	Dissen et al. (2011:284)
University students (n = 154) with an average age of 20 years	Australia	Main food sources especially those containing saturated fat	Mullan et al. (2014:9)
University students (n = 136) with an average age of 21 years	Canada	Main sources of fat particularly those containing saturated fat and cholesterol	Nastaskin and Fiocco (2015:44)
First-year university students (n = 47) with an average age of 19 years	Malawi	Food sources of saturated fat	Takomana and Kalimbira (2012:136)
Adolescents of an average age of 17 years	South Africa	Food sources of saturated fat, cholesterol and trans-fat or those recommended by experts to avoid or limit intake of in order to maintain health as consumption categories in relation to fat intake.	Venter and Winterbach (2010:79)

2.5 Health concerns related to a high dietary fat intake

According to the World Health Organisation (WHO), diet and nutrition are vital factors in promoting and maintaining good health, and, conversely, major determinants of developing chronic NCDs (World Health Organisation, 2003:4). These diseases normally emerge during adulthood after prolonged consumption of diets typically high in saturated fat, salt and sugar, especially diets regularly incorporating fast foods (Steyn & Damasceno, 2006:2290). In Cape Town alone, NCDs – diabetes mellitus, ischaemic heart diseases and cerebrovascular diseases – were responsible for a total of 4 764 deaths in 2011 (Lehohla, 2014:15).

Dietary habits are established at a young age and can have a substantial effect on an individual's health in the long run (Vuille & Schenkel, 2001:287; Maes & Lievens, 2003:517; Johansen et al., 2006:32). As mentioned earlier, the typical diet of a university student has been reported to be high in fat and low in fibre content (Liedman et al., 2001:51), making it a prominent risk factor for NCDs (Steyn & Damasceno, 2006:2290). Physicians used to focus more on the quantity and less on the quality of dietary fat among nutrients consumed (Haslam, 2007:32), but now there has been a shift in focus. The Dietary Guidelines Advisory Committee (2010:24) has recommended that, for the prevention of NCDs, more emphasis should be placed on the quality of dietary fat and less on its quantity. Specifically, intake of cholesterol, trans-fats and saturated fatty acids must be limited in order to maintain health. In SA, a revised food-based dietary guideline shifted from only recommending a moderate consumption of dietary fat to recommending the type of fat (quality) to be consumed sparingly (Smuts & Wolmarans, 2013:87). While a high consumption of foods that contain saturated fat and trans-fat, for example, is associated with several NCDs, consumption of food containing high levels of unsaturated fatty acids such as the polyunsaturates, particularly omega-3, and monounsaturated fats, have been reported to be beneficial to overall health (Balch, 2003:211). Though it is recommended that one consumes more of the beneficial fats and less of the fats detrimental to health, the total fat consumption must be within the current dietary guidelines (see Table 2.2) for daily total fat intake (Smuts & Wolmarans, 2013:95).

A link has been recognised worldwide between the consumption of diets high in fat (especially saturated fat and trans-fat), sugar and salt, but low in dietary fibre, and chronic disease incidence, such as CVD and some cancers (World Health Organization, 2003:4). What follows is a brief presentation of the main health concerns related to an excess dietary fat intake, focusing on the type of fat consumed.

2.5.1 Obesity

Effectively overtaking traditional health problems such as transmissible diseases and under-nutrition, obesity has become a major health concern globally (Rashidi et al., 2005:191).

Obesity is a condition involving the excessive accumulation of fat in the adipose tissue that may lead to serious health complications. In SA, the prevalence of obesity among adults is high, with more than half the female population and slightly more than a quarter of the male population being either obese or overweight (Kirsten & Karch, 2011:383). Epidemiological data produced by Bray et al. (2002:2488) supports an association between fat intake and obesity. This association is linked more to the energy that comes from fat than to the type of fat consumed (Willett, 2002:64). Insel et al. (2013:310) confirm that consuming an excess of energy-dense foods accompanied by a sedentary lifestyle leads to obesity. This is of concern as dietary fat is the most energy-dense nutrient, and generally those individuals who consume food rich in fat are in the long run likely to become obese (Lustig, 2010:247).

Although an overconsumption of foods rich in fat, which correlates to a high energy intake, can lead to obesity, other factors such as genetic influences may also independently contribute to an excess of body fat (Insel et al., 2013:311). Generally, the human body requires a certain amount of fat to enable it to store some and reserve it for energy and also to provide the right quantity of hormones (that are derived from fat) and cytokines (Wood, 2009:18). Excess body fat is primarily accumulated when an individual consumes an excess amount of foods rich in fat as well as other macronutrients (the excess of which is often converted to fat by the body). Since all excess energy consumed is stored by the body (Whitney & Rolfes, 2013:215; DeBruyne et al., 2015:141), this often leads to seepage of fatty acids into the blood (Wood, 2009:18). Due to its close proximity to major body organs, excess fat in the visceral adipose tissue (also known as central obesity) poses a greater health risk than that accumulated on the thighs and hips (Boyle, 2015:286).

The excess fatty acids (particularly from the visceral adipose tissue) that would have accumulated into the blood may build up in the muscle and liver (Wood, 2009:18). When metabolised, these fatty acids may elevate blood cholesterol levels and promote insulin resistance (Boyle, 2015:286). According to Derman et al. (2011:105), central obesity, a clinical sign of the metabolic syndrome, elevates the risk of several other diseases that include insulin resistance, hypertension and hyperlipidaemia. Consequently, obesity is considered a major risk factor for CVD (Derman et al., 2011:105) and type 2 diabetes (Tuomilehto et al., 2009:81).

2.5.2 Type 2 diabetes

Glucose is a monosaccharide that is vital in the human body's metabolism as an energy source (Sizer & Whitney, 2006:117; Smolin & Grosvenor, 2009:27). Due to its important function as a fuel, the homeostasis of glucose in the blood is controlled by hormones such as insulin and glucagon (Smolin & Grosvenor, 2009:27). Diabetes is directly associated with the hormone insulin, which is secreted when there is a rise in blood glucose level above the

norm, in order to regulate it (Thomas, 2013:3). Type 2 diabetes occurs when the body cannot produce insulin in sufficient amounts to be effective in its function of regulating high blood glucose levels (Goldstein & Mueller-Weiland, 2007:1). According to Statistics South Africa (2014:29), deaths in SA due to diabetes mellitus increased in number between 2011 and 2013.

Consumption of foods rich in fat is of major concern as fatty acids have the ability to alter insulin signalling among the other changes associated with impaired glucose metabolism (Risérus et al., 2009:44). The insulin resistance caused by a high fat diet is one of the causes of type 2 diabetes (Marshall & Bessesen, 2002:620). A case-control study by Thanopoulou et al. (2003:303) on the relationship between dietary fat intake and the development of diabetes, conducted on over 4 000 adults from six countries, reported a link between total fat and saturated fatty acid intake (from animal sources), and type 2 diabetes. The same study found that adults recently diagnosed with type 2 diabetes consumed diets high in saturated fat (Thanopoulou et al., 2003:305). Similarly, in a Dutch prospective cohort study done by Van de Laar et al. (2004:180), the majority of patients (n = 144) with newly diagnosed type 2 diabetes, also had a high intake of saturated fat. Additionally, a positive relationship between trans-fatty acid intake and type 2 diabetes was reported in a 14-year follow-up study conducted by Salmerón et al. (2001:1022) on over 84 000 women.

2.5.3 Cardiovascular diseases

All diseases affecting the heart and blood vessels are covered by the umbrella term CVD (Labarthe, 2011:3). According to statistics compiled for SA, CVD has been among the top ten leading causes of death from 2011 to 2013, with cerebrovascular disease (a type of CVD) and “other forms of heart disease” ranked four and six (out of ten), respectively, as leading causes of death (Statistics South Africa, 2014:27).

Hardy (2012:14) conducted a study of 583 participants who had no known history of CVD in order to evaluate their lifetime CVD risk. A high CVD risk was identified in participants under the age of 35 years relative to the rest of the participants, indicating that young people are most likely to develop CVD in the future (Hardy, 2012:14). Generally, a dietary pattern followed by an individual in the early stages of life may contribute greatly to CVD development in the future (Mikkilä et al., 2004:1039). Although CVD is a major health concern, it is quite simple to prevent, compared to other chronic illnesses (Li, 2013:70). This is one of the reasons why the current study focused on young adults who are still adjusting their diet in moving from dependency to independence, in order to guide them to adjust their dietary intake of fat in a healthy direction.

The type of fat consumed by an individual is directly associated with heart health (Gomber, 2007:61). In an effort to determine the relationship between the intake of different types of fat

and CVD, Oh et al. (2005:672) followed over 70 000 women who initially had no CVD for two decades, recording and updating their medical history and dietary behaviours every two years. After the set period of 20 years came to an end, the intake of excess total fat, particularly saturated and trans-fat, were found to increase the risk of CVD, whilst an intake of polyunsaturated fat in fairly high quantities relative to the other types of fat, was reported to decrease the risk of CVD (Oh et al., 2005:676). Reddy and Katan (2004:180) corroborate that the qualitative proportion of fat in the diet has a major role in increasing the likelihood of CVDs such as CHD.

It has been reported that a high consumption of foods rich in saturated fat (fat solid at room temperature) may cause the liver to convert most of the saturated fat into cholesterol (Kleiner & Greenwood-Robinson, 2007:66; Micozzi, 2014:435). Similarly, Steyn (2007:11) maintains that a diet high in saturated and trans-fatty acids as well as cholesterol-rich foods, may contribute to elevated blood cholesterol levels. Generally, elevated blood cholesterol levels have been associated with thicker artery walls, hence constituting a major risk factor for CVD (Kleiner & Greenwood-Robinson, 2007:66; Steyn, 2007:11; Schaefer, 2010:1). Labarthe (2011:361) details the association between CVD and other NCDs such as type 2 diabetes, etc., with the insulin resistance associated with type 2 diabetes also linked to the consumption of a high-fat diet (Marshall & Bessesen, 2002:620), and in particular a high intake of saturated fat (Thanopoulou et al., 2003:305; Van de Laar et al., 2004:180).

2.5.4 Cancer

On a simple level, cancer can be defined as a disease that is caused when cells in the body grow abnormally (Wodarz & Komarova, 2005:1). Obesity has been reported to be one of the key risk factors of cancer (Key et al., 2004:192). The association between dietary fat and cancer generally varies according to the type of fat consumed: the consumption of saturated fat and trans-fat is associated with an increased risk of cancer (Thomson & Chen, 2008:35), while an intake of omega-3 fatty acids is associated with a reduced risk of cancer (Thomson & Chen, 2008:34).

In order to ascertain the relationship between different types of dietary fat and breast cancer, a large sample of over 337 000 European women's diet and how it affects the development of breast cancer was evaluated in a study by Sieri et al. (2014:1). A follow-up was done on these women after 11 years and over 10 000 of them were identified as having been newly diagnosed with breast cancer. The gathered data showed that those women who consumed more saturated fat than others had a significantly higher risk of developing breast cancer (Sieri et al., 2014:3). Blank et al. (2012:597) investigated the association between the dietary fat intake of 151 552 American women and the development of ovarian cancer, and after a nine year period of follow-up, some of the women (n = 695) had developed ovarian cancer.

Statistically those who consumed diets with the highest total fat relative to other women had a 28% chance of developing ovarian cancer, and consumption of food sourced from animals showed a positive association with ovarian cancer development in contrast to that sourced from plants (Blank et al., 2012:598).

2.5.5 Brain and mental health

Research conducted on both animals and humans has reported a significant cognitive decline following the consumption of a diet high in fat (Freeman et al., 2014:243). Holloway et al. (2011:748) determined the effect of a high fat diet on cognitive functions among healthy university students (n = 16) from Oxford, England, by randomly assigning them to consume either a diet high in fat or a balanced diet, for five days in both cases while measuring cognitive functions in both groups. Cognitive functions relating to concentration and speed of visual processing, information processing and memory significantly deteriorated in those respondents who had consumed a diet high in fat compared to those who had consumed a balanced diet (Holloway et al., 2011:751). An approximately similar result on the effect of a high fat diet on cognition was reported by Edwards et al. (2011:1088), who measured the cognitive functions of sedentary adults (n = 20) also from Oxford, England, while they consumed a balanced diet for three days, and then after they had consumed a high fat diet for seven days. The power of concentration as well as the levels of calm and alertness significantly decreased in these adults following the consumption of a high fat diet (Edwards et al., 2011:1092).

With regard to memory, diets which are high in fat lead to neuroinflammation, which in turn causes memory impairment (Watson et al., 2013:39). Also, the level of the “brain-derived neurotrophic factor”, which is essential in promoting long-term memory (Bekinschtein et al., 2008:2711), diminishes after an individual consumes a diet that is high in fat (Pistell et al., 2010:29). Li et al. (2013:1001) observe that a high fat diet leads to impairment in neurovascular coupling and in the function of arteries that supply blood to the brain. Furthermore, consuming a high fat diet for a long period of time may lead to focal brain ischemia, mainly in the cortex region, which as a result causes neurological impairments in the regions affected by the diminished blood and oxygen supply (Langdon et al., 2011:82).

2.5.6 Other

Recent studies conducted on animals have provided new corroborations on the detrimental effects of high fat diets. In a study conducted by Ghoneim et al. (2015:507) on animal models in order to determine the effects of a diet that is high in fat on the liver, it was concluded that consumption of a high fat diet may alter both hepatobiliary transport, i.e. the transport system involving the uptake of toxins by the liver from the bloodstream and their excretion into bile, and the metabolism of compounds that are both endo- and exogenous in nature by the liver.

According to an animal-based study that ascertained the effect of a high fat diet on the bone marrow, a high fat diet alters the mesenchymal stem cells found in the bone marrow and these alterations may in turn affect the process by which blood cell components are formed (Cortez et al., 2013:379). Consumption of an extremely high fat diet, comprising about 60% total fat energy, is in addition likely to cause osteoarthritis, particularly that of the knee (Griffin et al., 2012:443).

According to yet another animal-based study, a high fat diet has different effects on the intestinal functions and their parameters depending on the type of fat that is prominent in that high fat diet (Lam et al., 2015:1429). While a high fat diet with a high level of omega-3 fatty acids in it was reported not to have any damaging effects on the intestines and their metabolic system, a high fat diet with a high level of saturated fatty acids in it was reported to cause major intestinal deterioration by increasing the permeability of the intestinal wall, particularly that of the colon (Lam et al., 2015:1436). A similar finding with regard to how different types of fat incorporated in a high fat diet affect the intestines differently was reported in a study conducted by Ananthakrishnan et al. (2014:776) on humans (170 805 women from Boston, USA). This study reported that a high fat diet in which trans-fatty acids are prominent may increase the risk of ulcerative colitis, while a high fat diet in which omega-3 fatty acids are prominent may reduce the risk of ulcerative colitis (Ananthakrishnan et al., 2014:776). Using animal models, Beyaz et al. (2016:53) determined the effect of a diet high in fat on both intestinal stem and progenitor cells, two types of cells that are responsible for maintaining a balance between the process of cell proliferation and cell differentiation (Mistry et al., 2012:127). According to this study, a high fat diet was reported to alter the function of these two types of cells, resulting in an imbalance between cell proliferation and differentiation, a condition likely to lead eventually to carcinogenesis (Beyaz et al., 2016:53).

2.6 Relationship between food and nutrition knowledge, and dietary behaviour

Literature and research reports concentrating solely on dietary fat food and nutrition knowledge and dietary fat consumption were found to be scarce. This section thus focuses more generally on the relation between nutrition knowledge and dietary behaviour.

Globally speaking, nutrition education is a medium for providing nutrition information and guidance on healthy diets to different consumer groups (Sahyoun et al., 2004:58; Powers et al., 2005:129; Morgan et al., 2010:1932); however, it is rarely provided to university students (Pei Lin & Wan, 2012:4). According to Farthing (1991:36), there are external and internal factors influencing the food behaviour of young adults, with food and nutrition knowledge being one of the external factors. The influence of nutrition knowledge on the general quality of dietary consumption is considered to be multifaceted, involving numerous variables that range from demographic characteristics to environmental factors (Wardle et al., 2000:272). It

is essential to apprehend the relationship between nutrition knowledge and dietary behaviour, as nutrition is the cornerstone for sustaining health and preventing various chronic diseases (Spronk et al., 2014:1714).

In cognitive psychology, knowledge has been divided into declarative and imperative knowledge (Dickson-Spillman & Siegrist, 2011:54). Declarative knowledge consists of the knowledge of concepts and facts (Jones & Idol, 2013:515), while imperative knowledge is the knowledge of how to complete certain tasks or actions (Jones & Idol, 2013:516). Imperative knowledge is therefore more likely to cause a change in behaviour than declarative knowledge (Dickson-Spillman & Siegrist, 2011:54). The discrepancy between these two sub-sections of knowledge has been applied of late to nutrition knowledge (Worsley, 2002:579; Appoh, 2004:226; Sarmugam et al., 2013:26). In this regard, declarative fat food knowledge involves, for instance, the knowledge that foods that contain unsaturated fat are better choices than those containing saturated fat (Silverstein et al., 2006:79). Imperative fat food knowledge would include the ability to select the food that contains unsaturated fat, given the many options of available food products. Also by way of illustration, declarative fat nutrition knowledge is being aware of the daily dietary guideline (Smuts & Wolmarans, 2013:96) that a diet should obtain less than 30% energy from dietary fat intake, while imperative fat nutrition knowledge would extend to the ability to incorporate dietary fat sparingly into the daily diet (both in food preparation and in consuming food products with a lower fat content) so as actually to follow the guideline. This study assessed both declarative and imperative fat food and nutrition knowledge, but focused on imperative knowledge as the link between knowledge and application. Generally speaking, in order to maintain and revel in a healthy lifestyle, it is essential to procure and implement sufficient food and nutrition knowledge (Elhassan et al., 2013:25).

There are contradictions in the literature on the relationship between nutrition knowledge and dietary intake. Past studies by Saegert and Young (1983:103) on nutrition knowledge and healthy food consumption of 601 randomly selected adults, and by Read et al. (1988:571) on the compliance of adolescents with the dietary guidelines, both conducted in the USA, concluded that nutrition knowledge is highly and positively related to a healthier dietary intake. But a study on adolescents' views on food and nutrition carried out by Story and Resnick (1986:188), also conducted in the USA, found an insignificant correlation between the two concepts. In comparison with these studies, slightly more than a decade later Pirouznia (2000:89) conducted a study in an American college on the link between the nutrition knowledge and eating behaviour of students. He reported that the significance of the association between nutrition knowledge and dietary intake differs according to students' level of study (Pirouzina, 2000:94). At university level, a highly positive association between nutrition knowledge and dietary intake was found among first-year students, as opposed to

their older student counterparts, i.e. fourth-year students (Emrich & Mazier, 2009:187). This evidence supports the current study's focus on first-year students.

The relationship between the nutrition knowledge of Croatian university students (n = 1 005) and their dietary consumption was reported in a study by Krešić et al. (2009:1048). Generally, those students whose daily consumption was in accordance with the dietary recommendations obtained higher scores for the nutrition knowledge test completed, compared to those whose daily intake did not accord with the dietary guidelines. This demonstrated a positive relationship between nutrition knowledge and behaviour (Krešić et al., 2009:1050). Similarly, in order to determine if dietary knowledge has an impact on dietary behaviour, the dietary intake among two groups (those who had received nutrition education and those who had not) of university students from the University of Connecticut, USA, was compared by Ilich et al. (1999:89). With regard to dietary fat, the students who had received nutrition education consumed less saturated fat and cholesterol, and more polyunsaturated fats, than those who had not received any form of nutrition education (Ilich et al., 1999:89). In relation to nutrition labelling knowledge, McLean-Meynsse et al. (2012:138) found an association between not using labelling information on trans-fat and elevated consumption of fried foods. A generally positive association between nutrition knowledge and dietary behaviour was also reported by Alaunyte et al. (2015:20) after analysing the nutrition knowledge and eating practices of student athletes (n = 21) from the United Kingdom. Also among student athletes, a positive interrelationship between nutrition knowledge and consumption was detected by Ali et al. (2015:293) when this was evaluated for student athletes (n = 71) from a university in Muscat, Oman. The students who were categorised as having average nutrition knowledge reported better eating practices than those categorised as having poor nutrition knowledge (Ali et al., 2015:295).

The consumption of whole-grain foods among American undergraduate students (n = 80) was assessed before and after attending a nutrition course on the prevention of diseases in a study by Ha and Caine-Bish (2011:263). The percentage of students who consumed whole grain food products increased by 31% after they had attended the nutrition course, indicating a positive relationship between knowledge and intake (Ha & Caine-Bish, 2011:265). A somewhat similar result was obtained by Kolodinsky et al. (2007:1409), who assessed the dietary guideline knowledge and consumption expression of this knowledge among first-year students (n = 200) enrolled at a university in the USA. The students who obtained higher knowledge scores from a dietary guidelines' knowledge test consumed the daily recommended quantities of whole grains to a greater extent than those who did not obtain high knowledge scores (Kolodinsky et al., 2007:1411). Comparably, first-year students (n = 35) from West Carolina University, USA, decreased their total fat and saturated fat intake after receiving nutrition education both in a traditional way and through motivational

interviews, although only the decrease among those students (n = 17) who received the education traditionally was proven to be statistically significant (Tallant et al., 2015:25).

Students (n = 28) from a private Californian university in the USA exhibited a statistically significant difference in their consumption of dairy food that is rich in fat before and after obtaining nutrition knowledge from a food and society four-year programme, with a decreased intake of high fat dairy foods on completion of the programme (Hekler et al., 2010:544). Likewise, undergraduate students (n = 80) registered at an American university who attended a basic nutrition course, which lasted for three months and three weeks as part of a study by Ha et al. (2009:51) that aimed to assess their beverage intake before and after the completion of the course, on completion of the course revealed a statistically significant increase in the consumption of fat-free milk (Ha et al., 2009:52). An equivalent trend between nutrition knowledge and dietary behaviour was also noticed by Geaney et al. (2015:106) after evaluating the nutrition knowledge and consumption of adult employees (n = 828) from Ireland. The employees who scored higher in the nutrition knowledge test also reported a better quality diet, the opposite being true for those who scored poorly in the nutrition knowledge test (Geaney et al., 2015:109).

In SA, Venter and Winterbach (2010:76) assessed the dietary fat nutrition knowledge and fat intake of adolescents (n = 168) with an average age of 17 years studying at public schools, and a significant positive association between the two concepts was noted: the adolescents who scored poorly in the dietary fat nutrition knowledge test were also reported as having a high fat intake (Venter & Winterbach, 2010:79). In the Eastern Cape, SA, adolescents' (n = 98) dietary knowledge and intake was evaluated by Oldewage-Theron et al. (2015:138). In the study adolescents with higher nutrition knowledge were also reported to consume low-fat diets (Oldewage-Theron et al., 2015:150). In the Limpopo Province, SA, the dietary knowledge and intake of indigenous food among nine- to fourteen-year-old school children (n = 154) was assessed by Mbhatsani and Mbhenyane (2011:211) before and after teaching the respondents about good nutrition practices. A general improvement in the respondents' consumption of fruit and vegetables was detected after they had received the information, indicating a positive association between dietary knowledge and behaviour (Mbhatsani & Mbhenyane, 2011:225).

A similar result regarding fruit and vegetables was reported in a study by Dissen et al. (2011:284) after the nutrition knowledge and dietary behaviours of undergraduate students (n = 279) registered at a university in New Jersey, USA, were appraised. A significantly positive relationship between dietary knowledge and the consumption of fruit and vegetables was found among these students (Dissen et al., 2011:288). The association between the nutrition knowledge and behaviour of primary school children (n = 573) in Southern Brazil was similarly assessed by Triches and Giugliani (2005:542). Those school children who were

more knowledgeable about nutrition than others also reported consuming healthier meals than those who were less knowledgeable (Triches & Giugliani, 2005:544).

Conversely, a study evaluating the dietary intake of female students (n = 36) enrolled in a nutrition-related course at a university in northern Canada conducted by Strawson et al. (2013:139) reported that the dietary intakes of the majority of these nutrition students did not meet the dietary guidelines; they therefore concluded that nutrition education may not necessarily lead to a change in behaviour (Strawson et al., 2013:142). Also, in the dietary histories of 139 students from Coventry University in England (taken whilst they were registered at the university), no significant differences were found between the total fat and saturated fat intake of students who attended health-related courses and those who did not (Shah et al., 2011:304). That study included all the food groups in its investigation and did not focus on dietary fat knowledge and intake specifically (Shah et al., 2011:304), which may have affected the results specific to dietary fat. After doing considerable research, Spronk et al. (2014:1723) conclude that studies conducted on larger population groups using validated tools to measure the association between nutrition knowledge and food consumption often detect a positive association.

2.7 Summary

The university phase is a time when students are generally shifting from a life of dependency to one of independence. This independence often involves the responsibility of providing one's own food, and since the quality of diet that students follow during this stage carries the risk of conducing to the development of NCDs in late adulthood, it is imperative that students adjust to university life in a wholesome way through making healthy food choices. 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, as noted in this chapter, a general deficiency of food and nutrition knowledge has been reported among students world-wide.

Past literature focusing on specifically fat food knowledge was found to be scanty. Nevertheless, the food knowledge of students in terms of food choice and purchasing, food storage, food preparation and cooking methods was discussed. Although some students read the fat and energy content on food labels when purchasing food, a lack of knowledge of how to interpret the information was prevalent. Most students in addition develop tactics to reduce the time and energy spent on cooking, due to (an alleged) lack of time. This is of particular concern as meals prepared at home tend to be lower in saturated fat and trans-fat compared to those that are bought. Apart from a lack of time, a lack of knowledge about food preparation and cooking methods was also adduced as a reason why some students were not likely to cook; the more food preparation and cooking competence a student had, the more likely it was that the student would cook. Among those who had some form of food

preparation proficiency, females were found to be more knowledgeable than males. However, their proficiency tended towards the baking of sweet food products such as cakes and cookies, which are considered to be high in fat.

Dietary fat is absorbed by the body in the form of fatty acids, and these fatty acids can be classified into different types according to their structure. Not all types of fatty acids are beneficial to the body. Some fats, particularly saturated fat and trans-fat, are detrimental to health when consumed above the recommended quantities. As both the type and amount of fat consumed by an individual can be either detrimental or beneficial to his or her health, knowledge of the different types of fat and their individual food sources, and of how each type affects one's health, is indispensable to making healthy food decisions. All these aspects, including the ability to implement one's knowledge by making good food choices, were considered in this chapter under the rubric of fat nutrition knowledge.

A lack of knowledge about dietary fat quality seems to be a problem among students. The majority of the students in the studies reported in this chapter could not identify the foods high in saturated fat, unsaturated fat (particularly monounsaturated fat) and cholesterol. Some students were under the impression that they were to avoid or consume less polyunsaturated fat compared to other types of fat, while others were not aware of the different types of fat. This is of concern as nutritionists recommend that persons consume more polyunsaturated and monounsaturated fats, while consuming less saturated fat and trans-fat in order to maintain good health. The level of trans-fat awareness seems to be quite high among students, although the majority lack knowledge of diet-disease relationships in relation to trans-fat and saturated fat.

In order to determine the fat food and nutrition knowledge of students, an assessment method and tool that best suits the objectives of the study should be employed. A number of available knowledge assessment methods (direct and indirect), together with the different knowledge items (closed and open-ended), were discussed in this chapter. The answers of respondents who complete a questionnaire can be analysed using item analysis in order to retain the items most suitable for establishing a knowledge assessment tool. The assessment tool to be administered to the respondents has to be reliable (ability to produce consistent results) and valid (ability to measure what is intended) in order to be accurate.

The diets that students are following are generally associated with the consumption of foods that are high in fat, including saturated fat, trans-fat and cholesterol. The intake of these types of fat is often through the consumption of fried foods (source of total fat and trans-fat), margarine (source of saturated fat and trans-fat) and full-cream milk (source of saturated fat and cholesterol), with consumption varying from occasionally to frequently each week. The intake of food among respondents can be assessed through the use of a dietary history, food

record, 24-hour recall or FFQ, perhaps using a brief FFQ as a screening questionnaire, depending on the objectives of the study.

Once the food and nutrition knowledge and food intake of students has been assessed, the relationship between them will determine the likelihood of nutrition education yielding dietary change. As observed in this chapter, there has been a contradiction in the past literature with regard to the association between nutrition knowledge and dietary behaviour, with some researchers finding a significantly positive association and others reporting no association at all. The use of standardised assessment tools and a reasonably large sample are advisable in order to obtain an accurate picture.

Although there has been a contradiction in the literature regarding the association between nutrition knowledge and consumption, fat food knowledge and fat nutrition knowledge may affect the intake of dietary fat differently since they involve different knowledge-related aspects (see Figure 1.1). No study other than the current one has focused on assessing the fat food knowledge and fat nutrition knowledge of students separately, and then relating the two concepts to the students' fat intake. It could be that fat food knowledge is more likely to impact on the consumption of foods rich in fat than the fat nutrition knowledge; this would induce nutrition educators to focus on fat food knowledge rather than on fat nutrition knowledge, assuming their objective is to change dietary fat consumption behaviour. It is hoped that this study will provide information relevant to this.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 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 (see Addendum A). Permission was also obtained from the CPUT head of the residences department to approach the sample group where they resided. The head of the residences department provided a letter approving the research (see Addendum B) to the residence managers of all the self-catering residences where the study was to be conducted. All the respondents selected for participation in the study were individually informed of the survey within their respective residence rooms, and participated voluntarily and anonymously after signing a consent form (see Addendum C). The consent form contained further information about the study, providing a reason for why these particular respondents had been chosen; signing it was the respondents' formal way of agreeing to take part. A copy of their signed form was given to each respondent to keep.

3.2 Type of study and study design

A quantitative method of research was employed in this study. Quantitative research involves the measurement of a variable of interest among respondents (Bless et al., 2006:43; Durrheim & Painter, 2006:132; Gravetter & Forzano, 2009:147), using standardised assessment methods (Flick, 2011:11) in order to obtain data which can be analysed (using statistics) and presented in numerical form (Gravetter & Forzano, 2009:147; Teddlie & Tashakkori, 2009:5; Dunn, 2010:42). The results obtained are typically objective and can be generalised (Durrheim & Painter, 2006:132), mainly because quantitative research normally involves fairly large samples (Flick, 2011:252) and standardised methods of assessment (Flick, 2011:11). A standardised questionnaire was used in this study, and although the information to be collected did not naturally appear in numerical form, numerical data was obtained through coding the responses to the items (questions) in the questionnaire. The study can also be described as a cross-sectional survey, meaning that it involved the collection of data among respondents "at a single point in time from a sample drawn from a specified population" (Dumont, 2008:25).

3.3 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. Researchers have recommended that first-year

university students should be targeted for nutrition education (Pei Lin & Wan, 2012:12) and physical activity (Deliens et al., 2013:162) intervention programs, as they are in the process of adjusting to the university environment and experiencing independence in life for the first time. Emrich and Mazier (2009:187) conclude that nutrition education is more likely to result in a favourable change in consumption among first-year students compared to students at other levels of study, serving to improve their overall diet quality and reduce their risk of chronic diseases 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.

In addition to the sample being purposive – that is, a sample not selected at random (Bryman, 2012:418) – stratified sampling was used to select respondents from a population of 451 first-year students (in 2015) residing in the five self-catering residences. In stratified sampling, “the population is divided into subpopulations (strata) based on one or more classification criteria. Random samples are then drawn from each stratum in the population. These samples are then pooled to form a stratified sample” (Defusco et al., 2011:106). The stratified sample of 225 students (error of confidence interval = 0.250%; normal probability = 0.975; $Z^2pq = 0.9604$; width of interval = 0.50%; Sekaran & Bougie, 2000:295) was 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 (see Table 3.1). To obtain the sample of 225 students, every second student in a residence considering the student bed allocation was invited to participate.

Table 3.1: Stratified student sample representation of total student population

Residence	Total student population		Stratified student sample	
	n	%	n	%
1	111	25	56	25
2	84	19	43	19
3	54	12	27	12
4	160	35	79	35
5	42	9	20	9
Total	451	100	225	100

3.4 Questionnaire construction

The questionnaire consisted of four sections, the first three of which comprised an assessment tool chosen for use because it had dietary fat as its content domain and was appropriate for South African use, for the study group and for the study objectives of this consumer science-based research.

The first section (Section A) assessed the students' dietary fat food knowledge. It consisted of 25 multiple-choice questions with three alternative answers (see Addendum D). This norm-referenced, valid and reliable test was developed by Hanekom et al. (2014:5) to determine the food knowledge of first-year students at a university of technology in the Western Cape, SA. In its developmental process, two knowledge questionnaires were constructed (as 'tests'), a section of each focusing on food fat as a knowledge domain. The items within both food knowledge questionnaires were assessed for content and face validity, with the first questionnaire developed having four-answer responses and the second questionnaire having three-answer responses (Hanekom et al., 2014:3). The pool of items forming the first questionnaire was administered to two sample groups, but both delivered an insufficient number of items to be retained in order to be considered a reputable 'test'. This was mostly as a result of the responses to numerous items not being selected as answers by the required number of members of the sample groups (Hanekom et al., 2014:4). The second pool of items constructed and administered to a further sample group formed the final test, as an adequate number of items was retained after the application of item analysis to the answered items, with these items meeting the set criteria for the item difficulty index, the discrimination index, the item-to-total correlation and the answer distribution (Hanekom et al., 2014:6). These items met the items analysis criteria, the final test, thus delivering construct validity and internal consistency reliability. The test focused on the choice, purchase, preparation and cooking methods of fats (and oils), as well as fruits and vegetables, as dietary constituents (Hanekom et al., 2014:5). For the purposes of this study, only the fat food knowledge section of the test was used, as in the developmental process an adequate number of items was retained, covering each of the dietary constituents as content domains to form separate, norm-referenced, valid and reliable tests (Hanekom et al., 2014:5). Due to the developmental process incorporating the application of item analysis and the retained items constituting a knowledge measure found to have validity and reliability, plausible results from its use were anticipated.

The second section (Section B) sought to determine the respondents' dietary fat nutrition knowledge. It comprised a test with 18 multiple-choice questions with four alternative answers (see Addendum D). This norm-referenced valid and reliable test 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, 2008:135), which makes the test appropriate for use in this study. In its developmental process the pool of items constructed, which had been subjected to content and face validity evaluations, was administered to the sample group once. An adequate number of items was retained after the application of item analysis to the answered items, with these items meeting the set criteria for the item difficulty index, the discrimination index, the item-to-total correlation and the answer distribution (Venter, 2008:135). In the final test,

these items met the items analysis criteria, which delivered construct validity and internal consistency reliability (Venter, 2008:136). Due to its developmental process incorporating the application of item analysis and the retained items found to present a valid and reliable knowledge measure, plausible results could also be expected from the use of this test. Although the test dates back to 2008, several more recent studies (Abrahams et al., 2011:1752; Azemati et al., 2013:12; De Pinho et al., 2013:102) have made use of the included items to assess dietary fat nutrition knowledge. 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, as discussed in the previous chapter, toward a focus on the quality of dietary fat rather than just the quantity (Dietary Guidelines Advisory Committee, 2010:24; Smuts & Wolmarans, 2013:87). The test accommodates this shift, with ten (56%) of the included questions covering the quality of dietary fat.

The third section (Section C) incorporated questions from a screening questionnaire (adapted from Block) supplied by the South African Medical Association Dyslipidaemia Nutrition Working Group (2000:185). 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 foods rich in fat (see Addendum D). As the reliability and validity of this section of the questionnaire was seemingly not determined after being adapted (Venter & Winterbach, 2010:76), a comparison was conducted between the foods listed on the screening questionnaire and those usually consumed by adults in SA as a whole (Mauder & Labadarios, 2000:626), 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 Province, SA, were included in the screening questionnaire – i.e., nine of the ten, nine of the nine and seven of the nine dietary fat food sources, as determined through a food procurement and household inventory questionnaire (Mauder & Labadarios, 2000:586), 24-hour-recall (Mauder & Labadarios, 2000:294), and quantitative FFQ (Mauder & Labadarios, 2000:476), respectively. The screening questionnaire was also used in a South African study to determine the dietary fat intake of mid-adolescents attending public schools (Venter & Winterbach, 2010:75). In that study, the food listed in the screening questionnaire was also compared to that recorded in the National Food Consumption Survey as food that children in SA generally consume (Venter & Winterbach, 2010:77). Although the score obtained from this third section of the questionnaire 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. The 15 meats and snacks included on the list as food sources rich in fat include fatty meats such as red meat (n = 1),

chicken with skin (n = 1) and processed meats (n = 3), confectionary (n = 2), fast foods (n = 1), deep-fried potato (n = 2), margarine/butter and hard cheeses (n = 2). These are all food products listed under the South African Heart Association and the Lipid and Atherosclerosis Society of Southern Africa's guidelines as food to be reduced in order to limit the intake of saturated fat, trans-fat and cholesterol, both as a preventative measure and as part of improving the condition of dyslipidaemia (Klug et al., 2015:31). Mozaffarian et al. (2011:2871) agree that the intake of foods such as processed meats, hydrogenated fats and oils and baked confectionaries (all of which are listed in the screening questionnaire as Section C of the questionnaire) is to be reduced, in order to lower saturated fat, trans-fat and cholesterol intake and thus improve heart health.

The last section (Section D) of the questionnaire (see Addendum D) included 10 questions on demographic and other information pertaining to the respondents, questions obtained from previous questionnaires constructed for survey use through the academic programme. The last question on information regarding the name of the course for which the respondent was registered was an open-ended item. Although open-ended, all the courses which the respondents indicated were listed and a code provided for each course for the purposes of the quantitative analyses.

3.5 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 pilot study was conducted in circumstances that were as similar as possible to that of the actual data collection. The purpose of the pre-test was to assess if the respondents understood the questions properly and if they managed to follow instructions on their own without needing additional clarification. Unlike in the case of the final data collection, the respondents who took part in the pre-testing provided comments on the pilot test as they completed the questionnaire. Since the tests and screening questionnaire included were constructed assessment tools, not much adjustment to the content was anticipated. The average total time taken for completion was approximately 30 minutes (from 15 to 45 minutes, with the mean time being 29 minutes). The rest of the feedback received from the respondents during the pre-testing is listed in Table 3.2 below.

Table 3.2: Feedback obtained on the pre-testing of the questionnaire

Response/feedback	n (N=23)	%
Did not understand the meaning of the words 'unsaturated, saturated, hydrogenated and trans-fatty acids' and therefore could not understand the questions where these terms were used <i>(these terms were included in questions A24, B9 and B11)</i>	10	43.5
Were confused by the word 'cholesterol' and hence could not understand questions where this term was used <i>(this term was included in questions A5 and B10)</i>	7	30.4
Did not understand the word 'searing' <i>(this term was included in question A6)</i>	6	26
Did not understand the questions on different levels of energy in food and were confused as to what was meant by 'lowest energy value/highest energy value', etc. <i>(these terms were included in questions A15, A23 and B18)</i>	2	8.7
"I do not understand the whole section B"	1	4.3
"I have never heard of any of the foods listed as answers (Orley whip, Bulgarian yoghurt and Mascarpone cheese)" <i>(these answers were part of question A13)</i>	2	8.7
Did not understand the meaning of the word 'pastry' and therefore could not understand the question where this word was included in a stem of the multiple choice question <i>(this term was included in question A14)</i>	1	4.3
Despite of the instructions written on the questionnaire before each section, some students wrote their answers in the boxes supposed to be used ' For office use only'	4	17.4
Never heard of the food called 'French toast' <i>(this term was included in question A8)</i>	1	4.3
Never heard of the food called 'veal' <i>(this food was part of question A20)</i>	1	4.3
Mentioned that the questionnaire was too long	3	13

Only those feedback responses that were provided by three or more respondents were taken into consideration for question and response changes, since the first two sections of the questionnaire (from which the majority, 9 out of 11, of the feedback responses arose) were valid and reliable developed tools, both tests having been applied, like this study, to higher education students as sample groups.

The fat nutrition knowledge section of the questionnaire incorporated questions on the quality of fats rather than the quantity of fat, meaning that it included terms such as saturated, cholesterol, trans-fatty acids, unsaturated and hydrogenated fatty acids – which were also the terms that confused or were not familiar to a number of the respondents, as shown in

Table 3.2. 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, 2010:76) was added to the answers of all 18 questions in Section B of the questionnaire (see Addendum D) so as not to discourage those respondents who were unfamiliar with the terms from completing the whole questionnaire. The 'don't know' option was also added to those questions that did not include the above-mentioned terms, so that the whole section could have the same response pattern. To eliminate the possibility of many respondents selecting only the 'don't know' option throughout the whole section, the respondents were instructed to select that option only if they were not familiar with a word in a question.

The face validity of question six in Section A was improved since some respondents 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 (see Section A, Addendum D).

Despite the written instructions for respondents to circle the letter that preceded the answer on each question, some however, wrote their answers in the area that was meant "for office use only", as indicated in Table 3.2. The phrase "clearly circle the letter" under the written instructions for completion of the questionnaire was underlined and the font size of the phrase "for office use only" increased slightly to attract the respondents' attention. The area meant for 'office use only' was also shaded. In addition, all these changes formed part of the verbal explanation of the study to respondents during the actual data collection, when they were individually informed to circle the letter and also not to write anything in the shaded area.

Although three respondents thought the questionnaire was too long, all three were willing to complete the whole questionnaire again if it was presented to them a second time. To avoid overwhelming respondents with a lot of pages and therefore discouraging them from taking part in the study, the questionnaire was printed back-to-back for the actual data collection to reduce the number of total pages. In addition, as part of the verbal explanation, the importance of the study was emphasised to the respondents, in order to motivate and encourage them to complete the whole questionnaire.

3.6 Conducting the study

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 was collected in one self-catering residence at a time. When the required stratified sample from a particular residence was obtained, the researcher moved on to another self-catering residence. While the data was being collected in each residence, the manager of that residence was made aware of the fact that the study was being conducted.

Every second student according to bed allocation was approached individually and informed about the survey and its purpose, before being requested to participate and sign the consent form, a copy of which remained with him or her. 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, the researcher remained close by, but not too close to intimidate them. Bornman (2009:451) remarks that if the researcher is too close to the respondents while they are completing a survey, they are most likely to feel intimidated. Also, the anonymity of the survey might be threatened, resulting in respondents being dishonest in their responses. The respondents were all thanked after they had completed the questionnaire.

3.7 Data analysis

After the data was collected, the completed questionnaires were scored. Standard scores were compiled for each of the first three sections of the questionnaire. The dietary fat food and nutrition knowledge tests (first and second sections of the questionnaire, respectively) were firstly scored dichotomously in terms of correct/incorrect answers (as one and nil), after which a total score for each respondent for each test was determined and the total score obtained categorised. For the dietary 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., 2014:13). The standard scores for the dietary fat nutrition knowledge test were also adapted to represent score categories, with a score of seven or below indicating a poor score, a score of eight to 12 an average score, and a score of 13 or higher, a good score (Venter, 2008:137).

The questions included in these two knowledge tests were also used for assessing imperative and declarative knowledge. To achieve accuracy in categorising the knowledge as imperative or declarative, investigator 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 researcher 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, 2011:54).

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 respondent consumed foods high in fat. The standard score system was adapted to represent score categories, with scores of more than 27 representing 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, 2000:185).

The respondents' standard scores obtained were grouped to represent the respective categories within dietary fat food knowledge, dietary fat nutrition knowledge and consumption of foods rich in fat category representations. The Pearson's chi-square test at a significance level of five percent was applied to these categorical findings to determine associations between the respondents' dietary fat food knowledge and consumption of foods rich in fat, dietary fat nutrition knowledge and consumption of foods rich in fat, and dietary fat food and nutrition knowledge. The Pearson's chi-square test was additionally applied to determine the influence of the respondent's demographic and other information on the findings regarding fat food knowledge, fat nutrition knowledge and the consumption of foods rich in fat.

CHAPTER FOUR

RESULTS

4.1 Respondent sample size and faculty representation

Thirty of the invited respondents did not answer all the questions in the questionnaire. Their questionnaires were as a result rejected. To reach the sample target of 225, a further 30 first-year students, selected by bed allocation (every second student excluding those who had already participated), were invited to participate. The final stratified student sample representation for the self-catering residences ($n = 5$) was the same as that presented in Table 3.1. Just over half (55.6%) of the respondents were registered in the faculty of business and management sciences, while near equal percentages of the respondents were registered in the faculties of education (3.6%) and health and wellness sciences (1.3%), and the faculties of engineering (12.9%) and informatics and design (16.9%). The remaining respondents (9.8%) were registered in the faculty of applied sciences.

4.2 Respondent demographic and lifestyle characteristics

The final sample was composed in its entirety of students from the black population group. 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%). Almost three-quarters (74.2%) of the respondents perceived their own body weight status to be optimal ('normal'), while a near equal percentage considered themselves to be underweight (10.2%) and slightly overweight/overweight (14.7%). 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%). More than half (54.2%) of the respondents indicated that they had never consumed dietary supplements, while a near equal percentage indicated that they consumed dietary supplements either seldom (19.6%), fairly regularly or regularly (13.3%) or when remembered (12.9%) (see Table 4.1, below).

Table 4.1: Demographic and lifestyle characteristics of the respondent sample

Demographic and lifestyle characteristics	Total stratified sample (N = 225)	
	N	%
Gender		
Female	115	51.1
Male	110	48.9
Physical activity		
Physically active ^a	113	50.2
Not physically active	112	49.8
Smoking status^b		
Non-smoker (have never smoked)	183	81.3
Current smoker (smoked in the last 12 months or quit in the past year)	32	14.2
Former smoker (quit smoking more than a year ago)	10	4.4
Consumption frequency of dietary supplements^c		
Never	122	54.2
Seldom	44	19.6
When remembered	29	12.9
Fairly regularly	18	8.0
Regularly	12	5.3
Perception of own body weight status		
Underweight	23	10.2
Optimal/normal body weight	167	74.2
Slightly overweight/overweight	33	14.7
Obese	2	0.9

^a Physically active, described as 'regular moderate exercise e.g. walking or cycling or strenuous exercise e.g. jogging, football and vigorous swimming, for 4 hours or more per week' (Source: Hoffman & Collingwood, 2015:31)

^b Source: Yusuf et al. (2004:941)

^c Dietary supplements described as 'a vitamin, mineral, herbal, plant extract, amino acid, metabolite, constitute, or extract, or a combination of any of these substances' (Source: Fortin, 2009:328)

4.3 Respondent dietary fat food knowledge

The dietary 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.

4.3.1 Test item scores

The test items in the dietary fat food knowledge test were arranged according to their difficulty indices, i.e. starting with those with the lowest difficulty indices and proceeding to those with the highest (Van der Vyver, 2013:68). Among the first ten questions, only

questions one to nine were included among the top ten questions answered correctly by most of the respondents, ranging from 52% (for question 6) to 80.4% (for question 1) of the respondents. The exception was question 22, which was also included among the top ten best answered questions (answered correctly by 59.6%), ranking number seven in the answered question list. Questions 14 and 17 were poorly answered (answered correctly by 28.4% and 30.2% of the respondents, respectively), as was question 23 (answered correctly by 29.8% of the respondents) (see Table 4.2).

Table 4.2: Number and percentage of the respondents (N = 225) who correctly and incorrectly answered the test items in the dietary fat food knowledge test^a

Question	Question description	Type of knowledge assessed ^b	Answers				Ranking ^c
			Correct		Incorrect		
			N	%	N	%	
1	What to do with unpleasant smelling oil	Imperative	181	80.4	44	19.6	1
2	Name of cooking method used when food is submerged in hot oil	Declarative	171	76.0	54	24.0	2
3	Type of fat best to use for deep frying	Imperative	145	64.4	80	35.6	6
4	Preferred oil choice to use when making Greek salad	Imperative	158	70.2	67	29.8	5
5	Kilojoule representation on a food label	Declarative	159	70.7	66	29.3	4
6	Healthiest way of cooking beef steak	Imperative	117	52.0	108	48.0	10
7	Best descriptor of a fat replacer	Declarative	162	72.0	63	28.0	3
8	Ingredients needed when making French toast	Imperative	132	58.7	93	41.3	8
9	What smoking oil indicates when shallow-frying	Imperative	124	55.1	101	44.9	9

^a Source: Hanekom et al. (2014:5)

^b 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

^c Ranked from best to worst answered questions

Table 4.2 (continued): Number and percentage of the respondents (N = 225) who correctly and incorrectly answered the test items in the dietary fat food knowledge test^a

Question	Question description	Type of knowledge assessed ^b	Answers				Ranking ^c
			Correct		Incorrect		
			n	%	N	%	
10	Oil that promotes heart health	Imperative	104	46.2	121	53.8	15
11	Reason for fried potatoes being greasy	Imperative	116	51.6	109	48.4	11
12	Best fat choice when making shortbread biscuits	Imperative	91	40.4	134	59.6	19
13	Fresh cream replacer for a lower energy provision	Imperative	109	48.4	116	51.6	14
14	Best fat to use when making pastry	Imperative	64	28.4	161	71.6	25
15	Type of canned tuna that has the lowest energy value	Imperative	113	50.2	112	49.8	12
16	Statement best describing margarine labelled 'Halaal'	Declarative	112	49.8	113	50.2	13
17	Why butter rather than margarine is chosen when cooking	Imperative	68	30.2	157	69.8	23
18	How to reduce the energy content when preparing spaghetti bolognese	Imperative	101	44.9	124	55.1	16
19	Meaning of 'breading'	Declarative	87	38.7	138	61.3	22
20	Meat (per 100g) with the lowest fat content	Imperative	92	40.9	133	59.1	18
21	Cooking method when oil just covers base of pan without completely covering the food	Declarative	95	42.2	130	57.8	17
22	Why deep fried food are first breaded or battered	Imperative	134	59.6	91	40.4	7
23	Cold dessert with the lowest energy value	Imperative	67	29.8	158	70.2	24
24	Fat that may contribute to heart disease	Declarative	90	40.0	135	60.0	20
25	Cut of pork that will hold moisture during cooking	Imperative	88	39.1	137	60.9	21

^a Source: Hanekom et al. (2014:5)

^b 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

^c Ranked from best to worst answered questions

Most (72%) of the test items were considered by the review panel to assess imperative fat food knowledge, while the rest (28%) were considered to assess declarative fat food knowledge (see Table 4.2). Among the top ten questions answered correctly, the majority (70%) of these questions was considered by the review panel to assess imperative fat food knowledge, while 30% were considered to assess declarative fat food knowledge. With regard to the 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 (see Table 4.2).

4.3.2 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., 2014:13) (see Table 4.3).

Table 4.3: Dietary fat food knowledge scores of the respondents (N = 225)

Descriptive statistics	Respondent score	Norm score categories ^a	Respondent score category achievement	
			N	%
Mean ± SD ^b	12.80 ± 3.85			
Median	13	Good /Above average (≥18)	29	12.9
Minimum	4	Average (12-17)	109	48.4
Maximum	23	Poor/Below average (≤11)	87	38.7

^a Obtained from the dietary fat food knowledge test developed by Hanekom et al. (2014:13)

^b Standard deviation

4.4 Respondent dietary fat nutrition knowledge

As with the dietary fat food knowledge, the dietary 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.

4.4.1 Test item scores

The test items in the dietary fat nutrition knowledge test were also ranked according to their difficulty indices, starting with the least difficult and ending with the most difficult (Venter, 2008:137). The first five questions were answered best by the respondents compared to the other questions, with question one ranking number one in the answered ranking list followed by question five, both of which were answered correctly by almost half (49.8% and 46.2% respectively) of the respondents. The rest of the questions were answered correctly by only about a tenth (13.8% for question 10) to a third (35.6% for question 17 and 30.2% for question 9) of the respondents. More than half the respondents could not answer any of the questions correctly. The questions that were answered correctly by the same number of respondents were allocated the same ranking in the ranking list (see Table 4.4).

Table 4.4: Number and percentage of the respondents (N = 225) who correctly and incorrectly answered the test items in the dietary fat nutrition knowledge test^a

Question	Question description	Type of knowledge assessed ^b	Answers				Ranking ^c
			Correct		Incorrect		
			n	%	N	%	
1	Lowest to highest fat listed foods	Imperative	112	49.8	113	50.2	1
2	Food with the highest fat content per 100g	Imperative	89	39.6	136	60.4	3
3	Food item not containing cholesterol	Imperative	82	36.4	143	63.6	5
4	Food item which is high in omega-3 fatty acids	Imperative	86	38.2	139	61.8	4
5	Trans-fatty acid containing food item	Imperative	104	46.2	121	53.8	2
6	Cholesterol containing food item	Imperative	55	24.4	170	75.6	10 ^d
7	Food item with the lowest fat content per 100g	Imperative	55	24.4	170	75.6	10 ^d
8	True fact of cholesterol	Declarative	60	26.7	165	73.3	9

^a Source: Venter (2008:135)

^b 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

^c Ranked from best to worst answered questions

^d Questions allocated the same ranking as those questions that were also answered correctly by the exact same number of respondents

Table 4.4 (continued): Number and percentage of the respondents (N = 225) who correctly and incorrectly answered the test items in the dietary fat nutrition knowledge test^a

Question	Question description	Type of knowledge assessed ^b	Answers				Ranking ^c
			Correct		Incorrect		
			n	%	N	%	
9	'Good' fats in the diet	Declarative	68	30.2	157	69.8	8
10	Products usually containing cholesterol	Declarative	31	13.8	194	86.2	14
11	Dietary factor most associated with high blood cholesterol levels	Declarative	46	20.4	179	79.6	12 ^d
12	Energy content of fat compared to that of starch	Declarative	46	20.4	179	79.6	12 ^d
13	Most appropriate margarine to protect against heart disease	Declarative	55	24.4	170	75.6	10 ^d
14	Monounsaturated fat containing oil	Imperative	70	31.1	155	68.9	7
15	Oils that should not be allowed in a diet used for the treatment of coronary heart disease	Imperative	44	19.6	181	80.4	13
16	Food item with the lowest fat content per serving slice	Imperative	53	23.6	172	76.4	11
17	Food item high in saturated fat	Imperative	80	35.6	145	64.4	6
18	Food item with the highest energy content per 100g	Imperative	46	20.4	179	79.6	12 ^d

^a Source: Venter (2008:135)

^b 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

^c Ranked from best to worst answered questions

^d Questions allocated the same ranking as those questions that were also answered correctly by the exact same number of respondents

Two-thirds (66.7%) of the test items were considered by the review panel to assess imperative fat nutrition knowledge, with the remaining third (33.3%) assessing declarative fat nutrition knowledge (see Table 4.4). All of the first five questions best answered by the respondents were considered by the review panel to assess imperative fat nutrition knowledge. Among the lowest ranked questions (those allocated a rank of 10 to 14) in the answered question list (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 (see Table 4.4).

4.4.2 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 (the norm score for poor/below-average achievement was seven or below) (Venter, 2008:137). Some (17.3%) of the respondents achieved an average score, and only a few (1.8% or four respondents) an above-average/good score (see Table 4.5).

Table 4.5: Dietary fat nutrition knowledge scores of the respondents (N = 225)

Descriptive statistics	Respondent score	Norm score categories ^a	Respondent score category achievement	
			N	%
Mean ± SD ^b	5.25 ± 2.80			
Median	5	Good/Above average (≥13)	4	1.8
Minimum	1	Average (8-12)	39	17.3
Maximum	16	Poor/Below average (≤7)	182	80.9

^a Obtained from the dietary fat nutrition knowledge test developed by Venter (2008:137)

^b Standard deviation

4.5 Respondent consumption of foods rich in fat

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

4.5.1 Intake of foods rich in fat

Approximately half the respondents either indicated that they did not consume hamburgers or cheeseburgers (54.7%), or cold cuts, lunch meats, ham (with fat), etc. (52.0%) once or less than once per month. A third as well as a quarter (25.8%) of the respondents consumed these items respectively two to three times per month. Approximately 40% of the respondents also indicated that they either did not consume bacon or pork sausages (43.1%) and ice cream (41.8%) at all, or consumed these items once or less than once per month. Around a third of the respondents indicated that they consumed bacon or pork sausages (30.2%) and ice cream (35.1%) two to three times per month. Similarly, roughly a third of the respondents indicated that they consumed red meat, i.e. beef and mutton (39.1%), doughnuts, cakes, cookies, puddings, etc. (34.7%), hot dogs, frankfurters, salami, Russians, sausages (29.8%), potato chips ('slap chips') (28.9%) and potato crisps, corn chips, popcorn, etc. (26.7%), two to three times per month.

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 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. Just more than a quarter (28.4%) of the respondents indicated that they consumed eggs three to four times per week (see Table 4.6).

Table 4.6: Consumption frequency of foods rich in fat by the respondents (N = 225) based on a screening questionnaire^a

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

^aScreening questionnaire (adapted from Block) acquired from the South African Medical Association Dyslipidaemia Nutrition Working Group (2000:185)

Table 4.6 (continued): Consumption frequency of foods rich in fat by the respondents (N = 225) based on a screening questionnaire^a

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	%
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

^aScreening questionnaire (adapted from Block) acquired from the South African Medical Association Dyslipidaemia Nutrition Working Group (2000:185)

4.5.2 Consumption category classification

A near equal percentage of the respondents' fat intake, based on their consumption frequency of foods rich in fat, was categorised as being desirable (29.3%) or high (27.1%) in fat, and included the majority of the respondents. Less than half of the respondents' (47.5%) diet was either desirable in terms of fat consumption or contained food items low in fat, compared to more than half (52.5%) that either followed a typical Western diet, a diet quite high in fat or a diet high in fat. Looking more closely at the last three categories (the typical Western diet, a diet quite high in fat and a diet high in fat), the respondents who followed the typical Western diet and a diet quite high in fat combined (25.4%) were nearly equal to those that followed a diet high in fat (27.1%) alone (see Table 4.7).

Table 4.7: Respondents' (N = 225) consumption of foods rich in fat score category classification

Category classification ^a	Respondent score category classification	
	n	%
Desirable fat intake (≤17)	66	29.3
Diet with low-fat food choices (18-21)	41	18.2
Typical Western diet (22-24)	33	14.7
Diet quite high in fat (25-27)	24	10.7
Diet high in fat (>27)	61	27.1

^aAcquired from the screening questionnaire (adapted from Block) standard categories provided by the South African Medical Association Dyslipidaemia Nutrition Working Group (2000:185)

4.6 Respondent dietary fat food knowledge and their biographic factors

No significance ($p > 0.05$) was found in the association between the gender of the respondents and their dietary fat food knowledge scores, or between the respondents' perception of their own body weight status and their dietary fat food knowledge scores. A near equal percentage of both the male and female respondents obtained a poor dietary fat food knowledge score (56.3% and 43.7% respectively) and an average and above-average dietary fat food knowledge score (44.2% and 55.8% respectively). Most of the respondents who obtained poor (78.2%) or average and above-average (71.7%) dietary fat food knowledge scores also perceived themselves to be of optimal/normal body weight. A near equal percentage of respondents who obtained a poor or an average and above-average dietary fat food knowledge score also either perceived themselves to be underweight (10.3% and 10.1% respectively) or overweight and obese (11.5% and 18.1% respectively) (see Table 4.8).

Table 4.8: Association between the respondents' dietary fat food knowledge scores and their biographic factors (N = 225)

Biographic factors	Total	Dietary fat food knowledge score categories				P-value ^f
		Poor (n = 87)		Average and above average ^a (n = 138)		
	N	n	%	n	%	
Gender						
Female	115	38	43.7	77	55.8	0.077
Male	110	49	56.3	61	44.2	
Perception of own dietary fat knowledge compared to that of other students						
Less ^b	97	43	49.4	54	39.1	0.035
About similar	86	35	40.2	51	37.0	
More ^c	42	9	10.3	33	23.9	
Major source of food and nutritional information						
At home/family	111	43	49.4	68	49.3	0.019
Media ^d	52	23	26.4	29	21.0	
Friends	25	14	16.1	11	8.0	
School subjects such as Consumer Studies and Life Orientation	37	7	8.1	30	21.7	

The following question responses and dietary fat food knowledge score categories were combined due to low cell counts: ^a 'Average' and 'above average' dietary fat food knowledge categories; ^b 'Much less' and 'somewhat less' question responses; ^c 'Somewhat more' and 'much more' question responses; ^d 'Articles in magazines, books, internet' and 'television and radio' question responses; ^e 'Slightly overweight/overweight' and 'obese' question responses

^f Pearson's chi-square test

Table 4.8 (continued): Association between the respondents' dietary fat food knowledge scores and their biographic factors (N = 225)

Biographic factors	Total	Dietary fat food knowledge score categories				P-value ^f
		Poor (n = 87)		Average and above average ^a (n = 138)		
	N	N	%	n	%	
Perception of own body weight status						
Underweight	23	9	10.3	14	10.1	0.406
Optimal/Normal body weight	167	68	78.2	99	71.7	
Overweight and obese ^e	35	10	11.5	25	18.1	

The following question responses and dietary fat food knowledge score categories were combined due to low cell counts: ^a 'Average' and 'above average' dietary fat food knowledge categories; ^b 'Much less' and 'somewhat less' question responses; ^c 'Somewhat more' and 'much more' question responses; ^d 'Articles in magazines, books, internet' and 'television and radio' question responses; ^e 'Slightly overweight/overweight' and 'obese' question responses

^f Pearson's chi-square test

However, a significant difference ($p < 0.05$) was found between the respondents' perception of own dietary fat knowledge compared to that of other students and their actual dietary fat food knowledge scores, and between the respondents' major source of food and nutritional information and their dietary fat food knowledge scores. Of those respondents who obtained a poor dietary 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 dietary fat food knowledge score who did so. Among those respondents who obtained a poor dietary fat food knowledge score, only a few (8.1%) 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 dietary fat food knowledge score, more respondents (21.7%) had acquired their food and nutritional information from school subjects. In general, the respondents' family was the major source of food and nutritional information for those respondents that obtained a poor (49.4%) and an average and above-average (49.3%) dietary fat food knowledge score, followed by the media for those who obtained a poor (26.4%) dietary fat food knowledge score (see Table 4.8).

4.7 Respondent dietary fat nutrition knowledge and their biographic factors

No significance ($p > 0.05$) was found in the association between the respondents' gender and their dietary fat nutrition knowledge scores, the respondents' major source of food and nutritional information and their dietary fat nutrition knowledge scores, and the respondents' perception of their own body weight status and their dietary fat nutrition knowledge scores. An approximately equal percentage of female and male respondents obtained a poor dietary

fat nutrition knowledge score (49.5% and 50.5%, respectively), and an average and above-average score (58.1% and 41.9%, respectively). Family was the major source of food and nutritional information among most of the respondents who obtained a poor dietary fat nutrition knowledge score (51.6%) and an average and above-average dietary fat nutrition knowledge score (39.5%). While among those respondents who obtained a poor dietary fat nutrition knowledge score, family as the major source of food and nutritional information was followed by the media (24.2%), and among those who obtained an average and above-average dietary fat nutrition knowledge score, family as the major source of food and nutritional information was followed by school subjects (30.2%). This did not provide for a significant difference ($p = 0.054$). Most of the respondents who obtained a poor or an average and above-average dietary fat nutrition knowledge score also perceived their body weight status to be optimal/normal (72.5% and 81.4% ,respectively) (see Table 4.9).

Table 4.9: Association between the respondents' dietary fat nutrition knowledge scores and their biographic factors (N = 225)

Biographic factors	Total	Dietary fat nutrition knowledge score categories				P-value ^f
		Poor (n = 182)		Average and above average ^a (n = 43)		
		n	%	n	%	
Gender						
Female	115	90	49.5	25	58.1	0.305
Male	110	92	50.5	18	41.9	
Perception of own dietary fat knowledge compared to that of other students						
Less ^b	97	85	46.7	12	27.9	0.006
About similar	86	70	38.5	16	37.2	
More ^c	42	27	14.8	15	34.9	
Major source of food and nutritional information						
At home/family	111	94	51.6	17	39.5	0.054
Media ^d	52	44	24.2	8	18.6	
Friends	25	20	11.0	5	11.6	
School subjects such as Consumer Studies and Life Orientation	37	24	13.2	13	30.2	
Perception of own body weight status						
Underweight	23	21	11.5	2	4.7	0.355
Optimal/Normal body weight	167	132	72.5	35	81.4	
Overweight and obese ^e	35	29	15.9	6	14.0	

The following question responses and dietary fat nutrition knowledge score categories were combined due to low cell counts: ^a 'Average' and 'above average' dietary fat nutrition knowledge categories; ^b 'Much less' and 'somewhat less' question responses; ^c 'Somewhat more' and 'much more' question responses; ^d 'Articles in magazines, books, internet' and 'television and radio' question responses; ^e 'Slightly overweight/overweight' and 'obese' question responses.

^f Pearson's chi-square test

However, 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 dietary fat nutrition knowledge scores obtained. Among respondents who obtained a poor dietary 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 who achieved an average and above-average dietary fat nutrition knowledge score who perceived their own dietary fat knowledge to be less than that of other students. Similarly, among the respondents who achieved an average and above-average dietary fat nutrition knowledge score, about a third (34.9%) perceived their own dietary fat knowledge to be more than that of other students, compared to only roughly a tenth (14.8%) of respondents who obtained a poor dietary fat nutrition knowledge score (see Table 4.9).

4.8 Respondent consumption of foods rich in fat and their biographic factors

No significance ($p > 0.05$) was found in associations between the respondents' gender, their perception of their own food intake, their major source of food and nutritional information, or their perception of their own body weight status, and their score categories in respect of their consumption of foods rich in fat. A near equal percentage of females and males followed a diet quite high/high in fat (52.9% and 47.1%, respectively), a typical Western diet (51.5% and 48.5%, respectively), and a diet low in fat (49.5% and 50.5%, respectively). Among the respondents who followed a diet quite high/high in fat, a typical Western diet or a diet low in fat, most of them (63.5%, 60.6% and 54.2%, respectively) perceived themselves as consuming foods popular with and consumed by most students of similar age. Family (49.4%, 51.5% and 48.6%) followed by the media (27.1%, 18.2% and 21.5%) were the major sources of food and nutritional information among those who followed a diet quite high/high in fat, a typical Western diet or a diet low in fat, respectively. Among those respondents who followed a diet quite high/high in fat, a typical Western diet or a diet low in fat, an approximately equal percentage acquired their food and nutritional information either from friends (10.6%, 15.2% and 10.3%, respectively) or school subjects such as Consumer Studies and Life Orientation (12.9%, 15.2% and 19.6%, respectively). Also, among those respondents who consumed a diet quite high/high in fat, a typical Western diet or a diet low in fat, most of them (75.3%, 66.7% and 75.7%, respectively) perceived their own body weight status to be optimal/normal, followed by those who perceived their own body weight status to be overweight and obese (14.1%, 21.2% and 15.0%, respectively) (see Table 4.10).

Table 4.10: Association between the respondent consumption of foods rich in fat and their biographic factors (N = 225)

Biographic factors	Total	Consumption of foods rich in fat score categories						P-value ^e
		Diet quite high/high in fat ^a (n = 85)		Typical Western diet (n = 33)		Diet low in fat ^b (n = 107)		
		n	%	n	%	n	%	
Gender								
Female	115	45	52.9	17	51.5	53	49.5	0.895
Male	110	40	47.1	16	48.5	54	50.5	
Perception of own food intake								
Consume foods popular with and consumed by most students of similar age	132	54	63.5	20	60.6	58	54.2	0.415
Consume foods considered healthier choices than those consumed by most students of similar age	93	31	36.5	13	39.4	49	45.8	
Major source of food and nutritional information								
At home/family	111	42	49.4	17	51.5	52	48.6	0.811
Media ^c	52	23	27.1	6	18.2	23	21.5	
Friends	25	9	10.6	5	15.2	11	10.3	
School subjects such as Consumer Studies and Life Orientation	37	11	12.9	5	15.2	21	19.6	
Perception of own body weight status								
Underweight	23	9	10.6	4	12.1	10	9.3	0.857
Optimal/Normal body weight	167	64	75.3	22	66.7	81	75.7	
Overweight and obese ^d	35	12	14.1	7	21.2	16	15.0	

The following question responses and foods rich in fat score categories were combined due to low cell counts: ^a Foods rich in fat score categories representing 'a diet quite high in fat' and that of 'a diet high in fat'; ^b Foods rich in fat score categories representing 'a diet with low-fat food choices' and that of 'a desirable fat intake'; ^c 'Articles in magazines, books, internet' and 'television and radio' question responses; ^d 'Slightly overweight/overweight' and 'obese' question responses

^e Pearson's chi-square test

4.9 Association between the respondent dietary 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.

4.9.1 Respondent dietary fat food knowledge and their consumption of foods rich in fat

No significance ($p > 0.05$) was found in the association between the respondents' dietary 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 dietary 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 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 4.11).

Table 4.11: Association between the respondents' dietary fat food knowledge and their intake of foods rich in fat (N = 225)

Consumption of foods rich in fat score categories	Dietary fat food knowledge score categories				P-value ^d
	Poor (n = 87)		Average and above average ^a (n = 138)		
	n	%	n	%	
Diet quite high/high in fat ^b (n = 85)	31	35.6	54	39.1	0.772
Typical Western diet (n = 33)	12	13.8	21	15.2	
Diet low in fat ^c (n = 107)	44	50.6	63	45.7	

The following score categories were combined due to low cell counts: ^a 'Average' and 'above average' dietary fat food knowledge categories; ^b 'A diet quite high in fat' and 'a diet high in fat' fat intake score categories; ^c 'A diet with low-fat food choices' and 'a desirable fat intake' fat intake score categories

^d Pearson's chi-square test

4.9.2 Respondent dietary fat nutrition knowledge and their consumption of foods rich in fat

A significant difference ($p < 0.05$) was found between the respondents' dietary fat nutrition knowledge score categories and their consumption of foods rich in fat score categories. Among respondents who obtained a poor dietary 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 above-average dietary fat nutrition knowledge category score (65.1%). Correspondingly, among the respondents who achieved an average and above-average dietary 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 dietary fat nutrition knowledge score following these same dietary fat intakes (41.2% and 15.4%, respectively) (see Table 4.12).

Table 4.12: Association between the respondents' dietary fat nutrition knowledge and their intake of foods rich in fat (N = 225)

Consumption of foods rich in fat score categories	Dietary fat nutrition knowledge score categories				P-value ^d
	Poor (n = 182)		Average and above average ^a (n = 43)		
	n	%	n	%	
Diet quite high/high in fat ^b (n = 85)	75	41.2	10	23.3	0.034
Typical Western diet (n = 33)	28	15.4	5	11.6	
Diet low in fat ^c (n = 107)	79	43.4	28	65.1	

The following score categories were combined due to low cell counts: ^a 'Average' and 'above-average' dietary fat nutrition knowledge categories; ^b 'A diet quite high in fat' and 'a diet high in fat' fat intake score categories; ^c 'A diet with low-fat food choices' and 'a desirable fat intake' fat intake score categories

^d Pearson's chi-square test

4.9.3 Respondent dietary fat food knowledge and their dietary fat nutrition knowledge

A significant difference ($p < 0.001$) was found between the dietary fat food knowledge scores obtained by the respondents and their dietary fat nutrition knowledge scores. Among those respondents who obtained poor dietary fat food knowledge category scores, only a few (3.4% or 3 respondents) achieved average and above-average dietary fat nutrition knowledge category scores, while among those respondents who obtained average and above-average dietary fat food knowledge category scores, far more (29%) attained average and above-average dietary fat nutrition knowledge category scores (see Table 4.13).

Table 4.13: Association between respondents' dietary fat food knowledge and their dietary fat nutrition knowledge (N = 225)

Dietary fat nutrition knowledge score categories	Dietary fat food knowledge score categories				P-value ^c
	Poor (n = 87)		Average and above average ^a (n = 138)		
	n	%	n	%	
Poor (n = 182)	84	96.6	98	71.0	0.000
Average and above average ^b (n = 43)	3	3.4	40	29.0	

The following score categories were combined due to low cell counts: ^a 'Average' and 'above-average' dietary fat food knowledge score categories; ^b 'Average' and 'above-average' dietary fat nutrition knowledge score categories

^c Fisher's exact test

CHAPTER FIVE

DISCUSSION

The discussion firstly deliberates the findings of the three subsidiary objectives of the research, relating to the dietary fat food knowledge, dietary fat nutrition knowledge and consumption of foods rich in fat of first-year students living in self-catering residence at a UoT, Cape Town, SA. This is followed by consideration of the three main objectives of the research: to investigate the associations between the students' dietary fat food knowledge and their consumption of foods rich in fat, their dietary fat nutrition knowledge and their consumption of foods rich in fat, and their dietary fat food knowledge and their dietary fat nutrition knowledge.

5.1 Respondent dietary fat food knowledge

The literature search revealed no reported studies on the dietary fat food knowledge of students or indeed of any other populations. Hence the results obtained from this study could not be compared with findings from other studies. Nevertheless, an overview of the students' dietary fat food knowledge and its associated biographic factors, as gleaned from the results of the study, is presented and discussed below.

The respondents seemed to be reasonably knowledgeable about this aspect of dietary fat as their mean dietary fat food knowledge score fell into the 'average' category. However, the majority of the respondents performed poorly on test items that assessed imperative dietary fat food knowledge, the type of knowledge more likely to lead to a change in dietary behaviour (Dickson-Spillman & Siegrist, 2011:54). The respondents aptly assessed their own dietary fat knowledge as gathered through their fat food knowledge scores. More students who perceived themselves to have more fat knowledge than other students indeed achieved an average and above-average fat food knowledge score, as compared with those who perceived themselves to have less 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 with those who did not. The students' gender and how they perceived their own body weight status had no association to the level of fat food knowledge that they had.

5.2 Respondent dietary fat nutrition knowledge

5.2.1 Content domain 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 18 of the knowledge test questions. The students' difficulty with this range of questions was confirmed when the majority of them scored poorly in the assessment. The respondents did not answer the imperative knowledge questions in the assessment well. Venter and Winterbach (2010:76) 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 $6.45 (\pm 2.65)$ out of 18 points, which represented a generally poor/below-average level of fat nutrition knowledge (Venter & Winterbach, 2010:77) similar to that found in this study (5.25 ± 2.80). Likewise, first-year female black students from the University of the North, SA, scored poorly (mean percentage = 40.7%) in an overall nutrition knowledge test (Steyn et al., 2000:53). In contrast, a study by Al-Isa and Alfaddagh (2014:448) conducted on male students ($n = 378$) from the Kuwaiti University reported a mean percentage dietary fat knowledge of 52.7%. Congruently, in a study conducted by Elhassan et al. (2013:25) on female students ($n = 350$) from the Ahfad University, Sudan, the mean percentage dietary fat knowledge score recorded was 54%. But these studies (Elhassan et al., 2013:25; Al-Isa & Alfaddagh, 2014:448) included only a few test items on dietary fat as they were aimed at assessing the overall nutrition knowledge of these 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.

When the respondents' perception of their own dietary fat knowledge was compared with their fat nutrition knowledge scores, it was found that their perceptions were again apt. The students who suspected that their own dietary fat knowledge was less than that of other students also scored poorly in the fat nutrition knowledge test. It should be noted that, generally speaking, individuals have a tendency to over-estimate their own knowledge (Alba & Hutchinson, 2000:123; Atir et al., 2015:1295). The students' gender, where they acquired their food and nutritional information, and how they perceived their own body weight status were not found to be significantly associated with the level of fat nutrition knowledge that they had. How learners perceived their own body weight status was also found not to be significantly associated with their level of fat nutrition knowledge in the study by Venter and Winterbach (2010:78). However, a significant difference was found between respondents' gender and their nutrition knowledge scores in studies conducted by Parmenter et al. (2000:168), Gottschall-Pass et al. (2007:126), Hendrie et al. (2008:1367) and Labban (2015:75), and between respondents' gender and their fat nutrition knowledge scores in the study conducted by Venter and Winterbach (2010:77). In all these studies, females scored significantly higher than males. A significant association was also found between the learners' level of fat nutrition knowledge and their source of nutritional information in the study by Venter and Winterbach (2010:78).

5.2.2 Content sub-domain knowledge

Due to the limited number of published studies that assessed the fat nutrition knowledge of respondents *per se*, the results pertaining to fat nutrition knowledge obtained in this study are discussed below in terms of the fat nutrition knowledge content sub-domains and the results obtained from past studies.

5.2.2.1 Disease association

A recent study that assessed the general nutrition knowledge of students ($n = 990$) from four universities in Syria reported a below-average knowledge achievement for them on disease association-related questions, reflected in a mean score of 6.30 (± 0.10) out of a maximum of 20 points in the disease association knowledge section (Labban, 2015:75). Comparably, in this study less than a third of the respondents correctly answered the disease association-related questions, a similar result to that reported in the Syrian university study (Labban, 2015:75). The disease association-related questions were also poorly answered by the mid-adolescents in the Venter and Winterbach (2010:77) study, when only 17.9% and 20.8% of them, respectively, correctly answered the two disease association-related questions.

5.2.2.2 Food source

On assessing the dietary fat knowledge of students ($n = 215$) enrolled at a university in Canada, Mazier and McLeod (2007:156) reported a mean knowledge score of 40% with regard to the food sources of fat. This low score was also found in this study in relation to students' knowledge of the food sources of fat. With regard to the question about identifying a food item high in saturated fat, a near equal percentage of students correctly answered this question in the study by Mazier and McLeod (2007:156) and in this study (38% and 35.6%, respectively). Similarly, an Australian adult community ($n = 201$) generally could not identify the foods high in saturated fat (compared to other nutrients) among the food options that were provided in a knowledge assessment tool administered by Hendrie et al. (2008:1367). Comparably, in SA, assessing the nutrition knowledge of young adults ($n = 180$) from the Limpopo Province, Peltzer (2004:26) reported that less than 35% of these respondents correctly answered questions relating to food sources of saturated and unsaturated fat.

The majority of respondents in this study answered the questions about the food sources of cholesterol incorrectly, a finding also reported in a study conducted by Dallongeville et al. (2001:28) on middle-aged men ($n = 361$) in France, and by Mirmiran et al. (2010:233) on 20- to 60-year-old adults ($n = 826$) from Iran, where a mean percentage of 78% and 80.3% of respondents, respectively, answered the questions about the food sources of cholesterol poorly. By and large, just above half of the mid-adolescents ($n = 168$) in the South African study by Venter and Winterbach (2010:77) answered the questions relating to the food

sources of cholesterol incorrectly. However, when asked to select the milk or milk product from the list provided that did not contain cholesterol (i.e. soya bean milk), most (66.7%) of these mid-adolescents selected the correct answer (Venter & Winterbach, 2010:77), compared to only about a third (36.4%) of the respondents in this study, when presented with the same question.

Regarding food sources of omega-3 fatty acids, Harel et al. (2001:12) asked adolescents (n = 1 117) from public schools in Rhode Island, USA, to identify marine sources of omega-3 fatty acids. Many (67%) of the adolescents knew that salmon, for example, was a source of omega-3 fatty acids. However, in this study, and also in the study by Venter and Winterbach (2010:77) on South African mid-adolescents, only 38.2% and 21.4%, respectively, of the respondents could identify a food item high in omega-3 fatty acids from the list provided. It may be that the disparity between these findings and that of Harel et al. (2001:12) can be attributed to how the respondents were tested. In the study by Harel et al. (2001:12), the respondents were required to identify marine sources of omega-3 fatty acids, whereas in this study and in the study by Venter and Winterbach (2010:77) the respondents were asked to identify a food high in omega-3 fatty acids from a diverse list, i.e., one which included not only marine sources. It may be deduced that the item difficulty indices of the questions could have been different.

As previously mentioned in this study, trans-fat can be detrimental to health (Hammaker, 2011:686), and knowing the food sources of trans-fat is indispensable if one is to avoid consuming or to consume less of this type of fat (Holli & Beto, 2014:201). But in this study, less than half of the respondents could identify a food source of trans-fat. The question requiring respondents to identify a trans-fat food source was also poorly answered by mid-adolescents from SA (correctly answered by a mere 37.5%), as presented in the study by Venter and Winterbach (2010:77).

5.2.2.3 Food choice

In this study, about a third of the respondents answered fat food choice-related questions correctly. Correspondingly, when college athletes (n = 190) at a university in the southern part of the USA were required to select a snack and a meal low in fat, only 37% and 42%, respectively, made the correct selection (Dunn et al., 2007:4). The study by Labban (2015:75) that assessed the general nutrition knowledge of students (n = 990) from four universities in Syria reported a below-average knowledge achievement on food choice-related questions, reflected in a mean score of 2.68 (\pm 0.04) out of a maximum of 10 points in the food choice knowledge section of the assessment. On average, just below half of the mid-adolescents (n = 168) in the South African study by Venter and Winterbach (2010:77) correctly answered the fat food choice-related questions. The percentage spread of correct

answers in this section was wide, ranging from 25% to 69% (Venter & Winterbach, 2010:77), meaning that some mid-adolescents were considerably more knowledgeable than others in dealing with fat food choice-related questions. In this study, most of the respondents did not know the correct answers to any of the fat food choice-related questions.

5.3 Respondent consumption of foods rich in fat

Past studies (Liedman et al., 2001:51; Ibrahim et al., 2014:411) have indicated that the diet of students is typically high in foods rich in fat. This study provides corroboration that students' diets are generally high in fat, as evidenced by the finding that more than half the respondents followed a typical Western diet, a diet quite high in fat, or a diet high in fat. This may be attributed to the high consumption of fast and fried foods by students, as supported in studies conducted by Sakamaki et al. (2005:34), Yahia et al. (2008:34), Al-Rethaiaa et al. (2010:41), Abdel-Megeid et al. (2011:624), Azadbakht and Esmailzadeh (2012:206), El Ansari et al. (2012:31), Bipasha and Goon (2013:63) and Al-Faris et al. (2015:5). With regard to the consumption of fast foods, Azadbakht and Esmailzadeh (2012:206) assessed the dietary habits of female students (n = 289) registered at the Isfahan University of Medical Sciences, Isfahan, Iran, finding that exactly half the students consumed fast foods at least twice a week, while 49% consumed high fat snacks more than twice a week. Comparably, of a sample of young adult females (n = 196) from Saudi Arabia (Al-Faris et al., 2015:2) and first-year students (n = 654) from Bulgaria (El Ansari et al., 2012:28), most reported consuming fast foods at least once per week (Al-Faris et al., 2015:5) or numerous times per week, or even daily (El Ansari et al., 2012:31). Out of 197 students enrolled at four different universities in Dhaka, Bangladesh, 39.6% and 40.1% consumed fast foods at least five days per week and three to four days per week, respectively, (Bipasha & Goon, 2013:63). In relation to the consumption of fried foods, the eating habits of students from Lebanon (n = 220) and Saudi Arabia (n = 357) were assessed by Yahia et al. (2008:34) and Al-Rethaiaa et al. (2010:41), respectively, while those of students from Japan (n = 124) and Korea (n = 141) were assessed by Sakamaki et al. (2005:34). Approximately half the students in Lebanon and Saudi Arabia reported consuming fried foods three times or more per week (Yahia et al., 2008:34; Al-Rethaiaa et al., 2010:41), and in Japan and Korea three to four times per week (Sakamaki et al., 2005:34). Correspondingly, in a study by Abdel-Megeid et al. (2011:624) on the eating habits of male (n = 132) and female (n = 180) students registered at the King Saud University, Riyadh, Saudi Arabia, 53% of the males and 43.8% of the females reported a fatty and fried foods' consumption frequency of three or more times per week. The screening questionnaire employed in this study consisted of fast/fried foods and high fat snacks such as hamburger/cheeseburger, fried chicken (with skin), potato chips ("slap chips"), potato crisps and doughnuts, cake, cookies, puddings, etc. The consumption of fast/fried foods and high fat snacks by the students in this study is discussed below.

While just under a third of the respondents in this study indicated that they consumed potato chips (“slap chips”, fried chicken (with skin) and eggs once or twice per week, Nigerian students (n = 82) registered at a university in Malaysia were reported to mostly consume French fries (potato chips) and eggs for breakfast, French fries and chicken for lunch, and again for dinner (Abubakar et al., 2016:50). This striking difference in the frequency of consumption of potato chips, fried chicken and eggs among the students in these two studies may presumably be attributed to the fact that the students were outside of their own food culture and most likely not familiar with other and possibly healthier food options available in Malaysia (Abubakar et al., 2016:50). Nonetheless, comparable findings with regard to the consumption frequencies of potato crisps were reported in this study, as well as in the studies conducted by Van den Berg et al. (2013:449) 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 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. (2013:449) 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. (2013:449). This contrasts with the five consumption frequency options provided to respondents in this study.

The majority (85.8%) of the students assessed by Okeyo (2009:62) reported monthly consumption of cakes and biscuits; similarly, relative to the other consumption frequency options, the highest proportion of respondents in this study (about a third) indicated that they consumed doughnuts, cakes, cookies, puddings, etc. two to three times per month. However, in the study by Van den Berg et al. (2013:449), a majority (87.6%) of the students reported a weekly consumption of cakes and biscuits. Interestingly, most (72%) of the Bulgarian students from the study by El Ansari et al. (2012:31) indicated that they consumed cakes numerous times per week or daily.

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 students in other studies conducted in SA by Ntuli (2005:151), Okeyo (2009:62) and Van den Berg et al. (2012:7), and in Malawi by Takomana and Kalimbira (2012:133). 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. (2012:7); 77% of these students also reported daily consumption of full-cream milk.

With regard to the influence of the respondents' biographic factors on their consumption of foods rich in fat, no significance was found in associations between the respondents' gender, their perception of their own food intake, their major source of food and nutritional information, their perception of their own body weight status, and their consumption of foods rich in fat. A study by de Souza Fernandes et al. (2016:40) also found no significance between the gender of students (n = 244) registered at a public university in Brazil and their consumption of fats and oils. However, a significant difference was found between the gender of students (n = 200) from four different universities in Malaysia and their fat intake (Hakim et al., 2012:80), as well as between the gender of students (n = 497) registered at the Beirut Arab University in Lebanon and their consumption of fast foods (El-Kassas et al., 2015:423). In each case a higher intake was reported for males than for females. There was also no significance found in the study by Venter and Winterbach (2010:79) in the association between their mid-adolescent learner respondents' perception of their own food and beverage intake or their perception of their own body weight status and their fat intake. But a significant difference was found between these mid-adolescent learners' major source of nutritional information and their fat intake, with those learners who followed diets with a lower fat contribution having obtained their nutritional information from a school subject in addition to family and friends (Venter & Winterbach, 2010:79).

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

The results from this study indicated that the respondents' dietary fat food knowledge was not associated to 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., 2012:48), 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, 2001:481), and this might eclipse that individual's fat food knowledge when it comes to food selection. In support of this factor, Eperu and Al Shammary (2014:72) found that when 100 students (45 males and 55 females) from the University of

Hail, Saudi Arabia, were asked what they looked for when they purchased food items, most of them (64.4% of the males and 66.7% of the females) said that they looked for their favourite foods. Interestingly only a few of the students in the study indicated that they looked for healthy foods (7.2%) and considered nutrition labels (3.9%) in order to make a food purchasing decision (Epuru & Al Shammary, 2014:72).

Since young adults in general report that they devote most of their time to personal and professional undertakings (Koszewski & Kuo, 1996:1286), a lack of time (Marquis, 2005:55) resulting in a quest for convenience foods has become a commonplace response from this age group (Armstrong et al., 1991:224; Candel, 2001:15). This has been reported in a number of studies (King et al., 2007:111; van Zyl et al., 2010:127; Avram & Oravitan, 2013:57). Avram and Oravitan (2013:57) explored the reasons for selecting foods contributing to an unhealthy diet among students (n = 435) enrolled at a university in Timisoara, Romania. They reported that the majority (75%) of these students gave “lack of time” as the reason for their food selection. Likewise, King et al. (2007:111) assessed the barriers to healthy eating among students (n = 204) from a university in the USA. They also reported that “time” followed by “convenience” were the major barriers to healthy eating cited by these students. It is important to note that only a few students (21.6%) in the study by King et al. (2007:111) mentioned “lack of knowledge” as a barrier to healthy eating. Similarly, in SA, Van Zyl et al. (2010:127) investigated factors influencing fast food intake among young adults (n = 341) residing in Johannesburg. They also reported that “time limitations” followed by “convenience” were the main reasons provided by these young adults for their purchasing of fast food.

Intrinsic factors such as the taste of food can also influence an individual’s eating habits, as revealed in the following studies. “Taste” was the third main reason for purchasing fast foods cited by young adults in the South African study by Van Zyl et al. (2010:127). Al-Faris et al. (2015:7) probed the factors influencing fast food consumption of both adults and adolescents (n = 196), of whom about a third were young adults. They reported that “delicious taste” was the main reason cited by the young adults for their consumption of fast foods. In the same study (Al-Faris et al., 2015:7), when asked about the issues that concern them most about fast foods, most of the young adults (62.3%) responded with “hygiene and safety”, while a mere 4.3% indicated “nutritional value”. This finding suggests that these young adults were not concerned about the nutritional value of fast foods, and that their food knowledge did not affect their fast food consumption. In support of this conclusion, King et al. (2007:111) in their study found that taste was a greater barrier to healthy eating than a lack of knowledge.

Other factors that have been reported as influencing the eating habits of young adults or students include “price” (King et al., 2007:111; Avram & Oravitan, 2013:57; Epuru & Al Shammary, 2014:72; Al-Faris et al., 2015:7), “attractive advertisements” (Al-Faris et al.,

2015:7), “availability” and “peer influence” (King et al., 2007:111). 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 dietary fat food knowledge and their consumption of foods rich in fat.

Because of the lack of data pertaining to the effect of food skills and behaviours on the dietary intake of adolescents, Vaitkeviciute et al. (2014:656) conducted a systematic review of the relationship between food literacy and dietary intake in this lifecycle stage. Their definition of “food literacy” incorporated aspects of knowledge, skills (such as cooking) and behaviours (such as shopping and preparation) associated with food planning, management, selection, preparation and eating (Vaitkeviciute et al., 2014:650, 654). Utilising a number of studies relating to nutrition knowledge as the measure of food literacy, Vaitkeviciute et al. (2014:652) determined that food literacy may positively affect the dietary intake of adolescents, but concluded that to establish the relationship between them required more research. There was a dearth of research measuring all the aspects of what could be included within the concept of food literacy, and comprehensive assessment methods needed to be developed and validated (Vaitkeviciute et al., 2014:655).

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

Unlike the case of respondents’ dietary 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 dietary fat nutrition knowledge positively influences behaviour in terms of the consumption of foods rich in fat.

A study that assessed the dietary fat nutrition knowledge and fat intake of mid-adolescents in Cape Town, SA, also found a significant association between the respondents’ dietary fat nutrition knowledge and their fat intake (Venter & Winterbach, 2010:79). 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, 2010:79). Venter and Winterbach’s study (2010:76) is the only one to our knowledge that has specifically assessed the dietary fat nutrition knowledge and fat intake of respondents. The other studies discussed

in this chapter either assessed the general nutrition knowledge or fat knowledge, incorporating some aspects of fat food knowledge and fat nutrition knowledge (as defined in this study) in their single knowledge test.

Oldewage-Theron et al. (2015:150) evaluated the nutrition knowledge and intake of adolescents from the Eastern Cape Province, SA, and found that those adolescents who achieved higher nutrition knowledge scores followed diets lower in fat content. In a study by Wardle et al. (2000:272) that investigated the nutrition knowledge and intake of an adult population (n = 1 040) in England, a significant correlation between their nutrition knowledge and fat intake was reported. Those adults who achieved higher nutrition knowledge scores consumed significantly less fat than those adults who achieved lower nutrition knowledge scores (Wardle et al., 2000:272). Similarly, Dallongeville et al. (2001:31) assessed the nutrition knowledge and fat intake of middle-aged men (n = 361) from France and reported that those respondents with higher nutrition knowledge scores had a significantly lower intake of total fat, saturated fat and monounsaturated fat of animal origin compared to those with lower nutrition knowledge scores. Comparatively, the data obtained from a male student population (n = 56) at the Leeds Beckett University, England, showed that those students who achieved higher nutrition knowledge scores had a lower fat intake compared to those who obtained lower nutrition knowledge scores – however, the difference reported was not significant (Packman & Kirk, 2000:392).

Instead of testing the nutrition knowledge of respondents and comparing it to their fat intake, some studies have compared the fat intake of respondents before and after they received nutrition education, basing the research on the assumption that the respondents would have gained nutrition knowledge and that the knowledge gained would have resulted in their lowering their fat intake. Thus the fat intake of students from the University of Connecticut and West Carolina University, USA, was evaluated before and after they had received nutrition education in two studies conducted by Ilich et al. (1999:89) and Tallant et al. (2015:25), respectively. The intake of total fat (Tallant et al., 2015:25), saturated fat (Ilich et al., 1999:89; Tallant et al., 2015:25) and cholesterol (Ilich et al., 1999:89) indeed decreased among these student groups after they had acquired nutrition education. A statistically significant decrease in the consumption of high fat dairy foods and a statistically significant increase in the consumption of fat-free milk among students were also reported in studies conducted by Hekler et al. (2010:544) and Ha et al. (2009:52), respectively, after the students had received nutrition education.

However, in a study by Sha et al. (2011:304), nutrition knowledge seemed not to significantly affect the fat intake of students (n = 139) from the university of Coventry in England, since no significant differences were found between the total fat and saturated fat intake of those students who had received nutrition education and those who had not. It might be assumed

that the lack of association came about because the study by Sha et al. (2011:304) focused on the general nutrition knowledge and diet of students and not specifically dietary fat.

Significantly, a review by Spronk et al. (2014:1723) concluded that when studies employ validated tools to measure the relation between nutrition knowledge and food consumption on larger population groups, they are more likely to detect a positive association. Axelson and Brinberg (1992:245) had also previously pointed out that knowledge will only be a good predictor of dietary behaviour when the assessed knowledge resembles the aspects of the dietary behaviour being studied.

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. Various factors that may have hindered their fat food knowledge from influencing their dietary behaviour have been discussed, above (see 5.4). The content sub-domains of the dietary 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 (see Figure 1.1). 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 the fear of illness and disease, compared to the knowledge of raw food preparation or cooking methods. Although young adults/students themselves may not be concerned about illness/disease (Nasser et al., 2011:583), they may come from households where illness/disease is a concern since there is an increasing burden of NCDs in SA. According to the WHO 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 often is the onset of an illness/disease that causes a change in eating behaviour (Thomson & Foster, 2014:144). This may consequently have impacted the fat nutrition knowledge of some students, in particular those from households where illness/disease is prevalent.

5.6 Association between the respondent dietary fat food knowledge and dietary fat nutrition knowledge

A significant association between the respondent dietary fat food knowledge and dietary 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. The students themselves in this study aptly perceived their own dietary fat knowledge as reflected in their fat food knowledge

scores (see 5.1) as well as in their fat nutrition knowledge scores (see 5.2). To our knowledge this is the first study to have determined the association between the dietary fat food and the dietary fat nutrition knowledge of respondents. Hence this particular finding could not be compared with results from past studies.

5.7 Strengths and limitations of this study

5.7.1 Strengths

Although the study included only first-year students in self-catering residence as respondents, this research is to our knowledge the first to assess in a single study the dietary fat knowledge of respondents as dietary fat food knowledge and dietary fat nutrition knowledge separately, and then to associate these two concepts with the respondents' consumption of food sources rich in fat. The findings revealed that it was the respondents' fat nutrition knowledge and not their fat food knowledge that significantly influenced their dietary behaviour, as reflected in their consumption of foods rich in fat. This information is particularly important for nutrition educators. In the past, in order to engender a change in dietary behaviour of individuals with regard to their fat intake, they might have focused on dietary fat knowledge as a whole. Now, as a result of this study, nutrition educators may be inclined to focus more on fat nutrition knowledge than fat food knowledge to achieve their objectives.

This finding provides a platform for further research in the area of fat food knowledge and fat nutrition knowledge and their associations with fat intake, and to shed light on why fat food knowledge seemed not to affect the consumption of foods rich in fat to the extent that fat nutrition knowledge did.

5.7.2 Limitations

This study was limited to first-year students from the self-catering residences of a particular UoT in Cape Town, SA. It did not extend to those students not residing in self-catering residences who might also be responsible for their own food provision. Students from other academic levels of study and from other UoTs or traditional universities in other cities in SA were also not covered in this study. Relying only on the memory of individual respondents possibly served to limit the accuracy of the assessment of their consumption of foods rich in fat. In a future study, the researchers might consider getting the students to complete the screening questionnaire on more than one occasion, or even ask them to keep food records to assist in the analysis of their dietary fat intake.

An additional limitation to the study might stem from the exclusion of questions in the questionnaire relating to the food purchasing and preparation activities of the students, which might have furnished useful information on their self-catering practices. A comparison

between food purchase and preparation activities when previously still at school, and food purchase and preparation activities in the university self-catering residence could also have yielded interesting information. But, as the pre-testing of the questionnaire demonstrated, respondents found the time required to complete the questionnaire more than long enough. The addition of questions relating to food purchasing and preparation activities would have increased the burden upon respondents to an unacceptable degree.

CHAPTER SIX

CONCLUSIONS

The association between the dietary fat knowledge and consumption of foods rich in fat among first-year students in self-catering residence at a UoT, Cape Town, SA, was determined. Their dietary fat knowledge was assessed in terms of their dietary fat food knowledge and their dietary fat nutrition knowledge, after which the association of these two concepts with their consumption of foods rich in fat was ascertained. The students had average fat food knowledge and poor/below-average fat nutrition knowledge. The latter result is supported by research findings that students are not well informed about various aspects of fat nutrition knowledge, such as its disease associations (Labban 2015:75), food sources (Peltzer, 2004:26; Mazier & McLeod, 2007:156) and choices (Dunn et al., 2007:4; Labban, 2015:75). The questions assessing imperative fat food and fat nutrition knowledge were generally answered poorly by the students compared to the questions that assessed declarative fat food and fat nutrition knowledge. Where the students acquired their food and nutritional information (e.g. from school subjects) was also found to be associated with their fat food knowledge level, but not with their fat nutrition knowledge level. The students' gender and how they perceived their own body weight status provided no association with the level of fat food knowledge or fat nutrition knowledge that they had.

Relative to the other food sources rich in fat included in the screening questionnaire, the students' consumption frequencies indicated that full-cream milk, margarine/butter and eggs were the three food items most consumed. Full-cream milk and margarine/butter as food sources of fat have been identified as having high consumption frequencies among students in other studies (Takomana & Kalimbara, 2012:133), including South African ones (Ntuli, 2005:151; Okeyo, 2009:62; Van den Berg et al., 2012:7). On the other hand, hamburgers and cheese burgers, along with cold cuts, lunch meats, ham (with fat), etc. and ice cream were the three food item listings in the screening questionnaire that were reported as consumed least. The students' dietary intake of fat was categorised as being desirable (low) and high in almost equal proportions, but more students either followed a typical Western diet, a diet quite high in fat or a diet high in fat, than those who either followed a diet with low-fat food choices or representing a desirable fat intake. This reflects the general finding that the typical diet of a student is high in fat (Liedman et al., 2001:51; Al-Rethaiaa et al., 2010:41; Chourdakis et al., 2011:379; El Ansari et al., 2012:30; Ibrahim et al., 2014:411; Al-Faris et al., 2015:3). No significance was found in associations between the respondents' consumption of foods rich in fat and their gender, their perception of their own food intake,

their major source of food and nutritional information, or their perception of their own body weight status.

No association was found between the students' fat food knowledge and their consumption of foods rich in fat. However, a significant association was found between the students' fat nutrition knowledge and their consumption of foods rich in fat. This corroborates the widely-reported finding that nutrition knowledge has an effect on the dietary behaviour of students (Ilich et al., 1999:89; Packman & Kirk, 2000:392; Ha et al., 2009:52; Hekler et al., 2010:544; Tallant et al., 2015:25) as found for adolescents (Steyn, 2010:62; Venter & Winterbach, 2010:79; Oldewage-Theron et al., 2015:150). Most of the students who achieved an average and above-average fat nutrition knowledge score followed a diet with low-fat food choices and a desirable fat intake. In contrast, among the students who followed a diet quite high in fat and a diet high in fat, more achieved a poor fat nutrition knowledge score than those who achieved an average and above-average fat nutrition knowledge score. A significant association was also found between the students' fat food knowledge and their fat nutrition knowledge. The majority of students who obtained a poor fat food knowledge score also obtained a poor fat nutrition knowledge score. 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" (Vaitkeviciute et al., 2014:650). "Food literacy" embraces food planning, management, selection, preparation and eating, all factors that shape an individual's food intake and dietary pattern.

CHAPTER SEVEN

RECOMMENDATIONS

Among the main objectives of this study was to ascertain the association between the dietary fat knowledge (separated into dietary fat food knowledge and dietary fat nutrition knowledge) and the consumption of foods rich in fat by first-year students in self-catering residence. 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, the students with higher fat nutrition knowledge scores being more prudent in their 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 educators, whose objective is to reduce students' consumption of foods high in certain fats, place greater emphasis on fat nutrition knowledge than fat food knowledge if they are to achieve their objective. Educational efforts should also be targeted at those students who perceive themselves to be not as knowledgeable as others, as this study found that, given the fat food and fat nutrition knowledge scores they achieved, these students had an accurate perception of their fat knowledge.

A recent study conducted by Tallant et al. (2015:22) showed that when first-year students were taught nutrition by senior students as part of the nutrition course, it was effective in inciting a dietary change. When educating students, thus, nutrition educators should consider a peer-to-peer method for more effective results. But as van den Berg et al. (2013:451) point out, 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. Based on this information, 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 advertisements on campus television, etc., may help to create such an environment. In an attempt to provide a supporting environment through nutrition education provision and encouraging students to apply the nutritional information when making food choices, Cousineau et al. (2006:23) developed a web-based interactive but tailored nutrition education program, in which the health promotion strategies or messages included were developed according to a specific student's responses to a questionnaire. This resulted in customised nutrition information relevant and compelling to that particular student (Cousineau et al., 2006:26). However, to get students to apply their food and nutrition knowledge in their food selection and consumption may not be a simple undertaking. As previously mentioned, the food choices of young adults may be determined

by several factors (Steptoe et al., 1995:276; Brevard & Ricketts, 1996:36; Pan et al., 1999:54; Nicklas et al., 2001:602; Papadaki & Scott, 2002:455; Marquis, 2005:55). While convenience, taste and the cost of the food seem to be the foremost considerations among students when it comes to food selection and consumption (Driskell et al., 2005:799), factors such as their food preparation skills and the available facilities are additional potential barriers to their eating more healthily (Betts et al., 1997:76; Deliens et al., 2014:59).

Among the subsidiary objectives of this study was to categorise the students' dietary fat knowledge (in terms of fat food knowledge and fat nutrition knowledge) as poor or below average, average and good or above average. The study findings 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. It has been suggested, above, that South Africans should ideally learn about good nutrition at an earlier life stage, as schoolchildren, through attending school and residing at home. 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, 2010:63). 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, 2012:4). It is important to include nutrition education in health programmes aimed at university students, especially first-year students responsible for their own food provision. 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 resulting dietary intake (Cousineau et al., 2006:23). Food choice behaviour adopted during this transition phase is also likely to influence life-long eating behaviour (Savage et al., 2007:25). It is widely recognised that sufficient time and practice are needed for individuals to acquire the necessary information and skills to incorporate new behaviours into their lifestyles (Food and Nutrition Division, Food and Agriculture Organization of the United Nations, 1997:334).

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, perhaps adding food and nutrition knowledge of other pertinent dietary constituents in relation to dietary intake. Although this study found no significant association between the fat food knowledge and fat intake of these students in terms of their consumption of foods rich in fat, a study by Laska et al. (2012:1156) found an association between food preparation in early adulthood (between 19 to 23 years of age) and a better dietary quality in the mid- to late twenties. Also, in a study by Leal et al. (2011:283), those adolescents who had better cooking habits and skills also

evinced a closer adherence to Mediterranean diet principles, which emphasise the quality of dietary fat more as opposed to the quantity. Probing the different dietary 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 be categorised. This might provide insight into the integrative framework of dietary fat food knowledge and support the appeal by Vaitkeviciute et al. (2014:649) for research to be undertaken to address the connectedness between food literacy, which includes food knowledge, and dietary intake.

Furthermore, as relying on students' memory in assessing their fat intake was one of this study's limitations, it is recommended that future studies employ food records as the method for dietary fat intake assessment. These food records could also be utilised to investigate the intake of various dietary constituents, besides that of total fat intake, and their associations with food knowledge or even 'food literacy' (Vaitkeviciute et al., 2014:650). However, to accomplish this, a valid and reliable assessment tool (or more likely tools) might have to be developed, as even for dietary fat the two knowledge tests used in this study could not be combined to provide a representation of dietary fat knowledge *per se*; broader representation was inevitable due to the individualised categorical exemplifications in each test. 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., 2000:272; Ganasegaran et al., 2012:48). 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, 2010:62).

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ADDENDUM A

**Ethics approval granted by the Cape Peninsula University of Technology
Faculty of Applied Sciences Research Ethics Committee**



Enquiries:
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6 February 2015

Ms L Ranga
Department of Biotechnology and Consumer Science
CPUT

Dear Ms Ranga

Association between the dietary fat knowledge and consumption among first year students in self-catering residence at a university of technology, Cape Town, South Africa (Ref. 3/2015)

The Ethics Committee has considered your application for Ethics approval after satisfactory amendments to your research protocol as proposed by the Ethics Committee of the Faculty of Applied Science. Ethics approval for the project is hereby granted.

We wish you every success with your research.

Yours sincerely

A handwritten signature in cursive script, appearing to read "M. Opperman".

Prof Maretha Opperman (RD (SA))

ADDENDUM B

Information letter to the head of the residences department and the obtained study permission



Dear Ms Ranga

Your letter dated 05 August 2014 has reference:

Permission is granted subject to adherence to ethical considerations and further consultation with Residence Coordinators

Regards,



Temba Hlasho

HOD: Residences

Room 6.17 Masimanyane residence
22 Sir Lowry Road
Cape Town
8000

Head of Department Residences
Cape Town residence central office
Cape Peninsula University of Technology: Cape Town campus

5 August 2014

Dear Mr Loki Manise

RE: APPROVAL REQUEST FOR MTECH RESEARCH STUDY AMONG FIRST-YEAR STUDENTS IN SELF-CATERING RESIDENCE

Research has shown that university students, particularly students responsible for their own food choices and food provision, customarily consume convenient and fast foods which are high in fat content. Since high fat consumption is one of the major risk factors to chronic diseases, students represent an at risk group for future health distress. Research findings furthermore indicate that although students are aware of the link between fat consumption and disease, such as coronary heart disease, their lack of knowledge about the fat content of food impairs their ability to confidently adopt the healthy lifestyle practice of reducing fat consumption. Therefore, an understanding of the dietary fat knowledge and its association with the dietary fat consumption among university students in self-catering residences is imperative if health and nutrition intervention strategies such as education are to be introduced to them.

A MTech Consumer Science: Food and Nutrition research study entitled '*Association between the dietary fat knowledge and consumption of first-year students in self-catering residence at a university of technology, Cape Town, South Africa*' (HDC 1.1 documentation submitted), seeks to examine the two conceptions namely, the dietary fat knowledge and the dietary fat consumption separately (as subsidiary objectives) of first-year students residing in self-catering residences before the association between those two conceptions is concluded (as main objective). However, for this research to be undertaken, your approval will be greatly valued.

We therefore, kindly ask for a brief meeting to discuss the research and obtain the necessary permission to conduct this research on first-year students residing in self-catering residences of the CPUT Cape Town campus with possible addition of the Bellville campus. For more information about the research, the research proposal along with the participant information leaflet and consent form and the questionnaire will be provided to you on finalisation of the Faculty of Applied Sciences
Department of Agricultural and Food Sciences

sample size (envisaged stratified sampling still needs to be addressed through discussion with yourself) for review.

Kind regards with appreciation of your assistance,

Ms Leocardia Ranga [REDACTED]

Student: MTech Consumer Science: Food and Nutrition, Cape Town campus

Dr Irma Venter [REDACTED]

Supervisor: Programme Consumer Science: Food and Nutrition, Cape Town campus

Faculty of Applied Sciences
Department of Agricultural and Food Sciences

ADDENDUM C

Participant information and consent form



PARTICIPANT INFORMATION AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT

The association between dietary fat knowledge and consumption of foods rich in fat among first-year students in self-catering residence at a university of technology, Cape Town, South Africa

Principal Investigator:

Leocardia Ranga

MTech Consumer Science: Food and Nutrition

Department: Biotechnology and Consumer Science, Faculty of Applied Sciences,

Cape Peninsula University of Technology (CPUT): Cape Town campus

Email: [REDACTED]

Research study supervisor:

Ass. Prof. I Venter

Cape Peninsula University of Technology (CPUT): Cape Town campus

Email: [REDACTED]

You are invited to take part in a research study. Please read the information presented below which explains what the study entails. Your participation is voluntary and you are free to decline to take part at any time. This study has been approved by the Faculty of Applied Sciences Research Ethics Committee, CPUT.

Introduction and purpose of the study

The South African population typically follow diets that are high in dietary fat. Foods rich in dietary fats, if not consumed sparingly starting from an early age, may contribute to the development of chronic diseases in the later adult life. Among the persons at risk for chronic disease development in later life are university students. University students are facing the task of making their own food decisions which may result in a high dietary fat intake. Since first year students are at the beginning of the young adult life phase, there is a greater chance of them changing towards healthy eating behaviours if exposed to guidance in this regard. This research study will determine if there are any associations between the dietary fat food and nutrition knowledge and the consumption of foods rich in fat of first year students responsible for their own food provision. If associations are found between these conceptions, then food and nutrition education can be contributory to support food choices and dietary habits to keep up a healthy lifestyle by having an impact in the reduction of specifically a high fat intake.

Why have you been chosen to participate?

First-year students in self-catering residence are at the beginning of the young adult life phase and in transition from a dependent to a more independent lifestyle where they face the task of making their own food choices.

What you will be required to do

Should you choose to participate in this study, you will be asked to voluntarily and anonymously complete a questionnaire. The questions for sections A and B of the questionnaire are multiple choice and respectively related to food and nutrition knowledge. The next section entails food intake

screening questions where you are asked how often you consume a particular food. In the last section of the questionnaire you will be asked to answer a few demographic and lifestyle related questions.

Benefits of taking part in this research

There is no direct personal benefit from taking part in this study. However, it may broaden your food and nutrition awareness and provide information to institutions such as universities to consider food and nutrition education for first-year students on arrival at university. In the long run this may be beneficial to support public health in South Africa.

Risks of taking part in this research

There are no known risks to your participation in this study.

Confidentiality of information gathered from this research

All information collected during the study will be kept confidential, used for research purposes only, and if published in a scientific journal, the identity of the participants' will remain confidential as the information presented will be that of the participant group and not an individual. The researcher alone will be involved in capturing of the data on a password protected computer.

Permission to withdraw

Taking part in this study is voluntary. You may choose not to take part in this study, or if you decide to take part, you may change your mind and withdraw from the study without any consequences.

Will there be any form of remuneration and are there any costs involved?

You will not be paid to take part in this research study nor are there any costs involved if you participate.

For queries and additional information:

Should you have any further queries or require any additional information regarding this research study, you may contact the researcher on [redacted] or at [redacted] or Ass. Prof. Irma Venter on [redacted] or at [redacted].

Consent to participate in this research

If you are willing to participate in the study, please sign the consent form below. Your signature below indicates that you have read this consent form, including the details of the study and have had all your questions answered.

Declaration:

By signing below, I agree to take part in a research study entitled *The association between dietary fat knowledge and consumption of foods rich in fat among first-year students in self-catering residence at a university of technology, Cape Town, South Africa*

Signed at (place).....on (date).....2015.

.....Signature of participant
Signature of Investigator

ADDENDUM D

Self-administered dietary fat knowledge and consumption questionnaire

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF BIOTECHNOLOGY AND CONSUMER SCIENCE

PROGRAMME: CONSUMER SCIENCE: FOOD AND NUTRITION

**QUESTIONNAIRE: DIETARY FAT KNOWLEDGE AND CONSUMPTION
OF FOODS RICH IN FAT AMONG FIRST-YEAR STUDENTS IN SELF-
CATERING RESIDENCE**

The South African population typically follow diets that are generally high in dietary fat. Dietary fats, if not consumed sparingly starting from an early age, may contribute to the development of chronic diseases in the later adult life. Among the persons at risk for chronic disease development in later life are university students. University students are facing the task of making their own food decisions which may result in a high dietary fat intake. The major objective of this study is to ascertain if there is an association between the dietary fat knowledge and consumption of foods rich in fat of first-year students at a university of technology. In addition to questions on dietary fat knowledge and consumption, the questionnaire also includes questions on respondent demographics and lifestyle.

This questionnaire is part of an MTech Consumer Science: Food and Nutrition study. Your participation in this study is highly appreciated, as this will aid further research in this field.

The questionnaire consists of 4 sections, with mostly multiple choice questions, and should take approximately 30 minutes (ranging from 15 to 45 minutes) of your time to complete. The questionnaire information will remain anonymous and be treated as confidential.

Please do not write your name on the questionnaire.

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2015

SECTION A: Dietary fat food knowledge

Instructions for completion:

Please answer all the questions. Only one letter (a, b or c) may be chosen as your answer. Clearly circle the letter that precedes your answer on the questionnaire.

- | | For office use only |
|--|----------------------------|
| 1. If you find that the oil you use for frying has an unpleasant smell, what should you do?
a) Heat it up and cool down before using.
b) Throw away and do not use.
c) Strain the oil before using. | <input type="text"/> A1 |
| 2. Which cooking method is used when food is submerged in hot oil?
a) Sautéing
b) Deep-frying
c) Stir-frying | <input type="text"/> A2 |
| 3. Which type of fat is the best to use for deep-frying?
a) Sunflower oil
b) Butter
c) Olive oil | <input type="text"/> A3 |
| 4. Which one of the following is the preferred choice to use when making a Greek salad?
a) Sunflower oil
b) Canola oil
c) Olive oil | <input type="text"/> A4 |
| 5. When reading food labels, a kilojoule is a unit of:
a) energy.
b) cholesterol.
c) total fat. | <input type="text"/> A5 |
| 6. What will be the healthiest way to cook beef steak?
a) Quickly cook all sides (seared).
b) Crumb and fry in a little oil (crumbed).
c) Batter and fry in oil (battered). | <input type="text"/> A6 |
| 7. Which one best describes a fat replacer?
a) An ingredient with no energy value and a sweet taste.
b) An ingredient that can provide some of the functions of fat in food, but with a lower energy value.
c) An ingredient that is less expensive than fat. | <input type="text"/> A7 |

Continue on next page...

8. When making *French toast*, which of the following ingredients do you need?
 - a) Milk, sugar, eggs and butter.
 - b) Milk, sugar, eggs and olive oil.
 - c) Milk, sugar, eggs and cream.

9. When shallow-frying, smoking oil is an indication that:
 - a) the oil has become too hot to use.
 - b) there is not enough oil in the pan.
 - c) water is mixed with the oil in the pan.

10. When buying oil to promote heart health, choose:
 - a) sunflower oil.
 - b) vegetable oil.
 - c) canola oil.

11. What could the reason be for fried potatoes being too greasy?
 - a) Frying temperature too low.
 - b) Not frying for long enough.
 - c) Frying temperature too high.

12. Which one of the following fats is the best choice when making shortbread biscuits?
 - a) Low-fat spread
 - b) Block margarine
 - c) Butter

13. Which product can be used in the place of fresh cream to lower the energy value when making a sauce?
 - a) Orley Whip
 - b) Bulgarian yoghurt
 - c) Mascarpone cheese

14. The best fat to use when making pastry is:
 - a) soft margarine.
 - b) olive oil.
 - c) butter.

15. Which one of the following types of canned tuna has the lowest energy value?
 - a) Tuna in salted water.
 - b) Tuna in sunflower oil.
 - c) Tuna in salad dressing.

16. Which one best describes margarine labelled as 'Halaal'?
 - a) Margarine made from only vegetable fats.
 - b) Margarine made from only vegetable fats and marine fats.
 - c) Margarine made from only olive oil.

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A8

A9

A10

A11

A12

A13

A14

A15

A16

Continue on next page...

- | | |
|---|---|
| <p>17. Why should butter rather than margarine be chosen when cooking?</p> <p>a) Butter is healthier than margarine.
b) Butter gives a better flavour to foods.
c) Butter can be heated to a higher temperature.</p> <p>18. To reduce the energy content of spaghetti bolognese use:</p> <p>a) lean beef mince.
b) regular beef mince.
c) use half soya and half regular mince.</p> <p>19. 'Breading' foods to be deep fried means:</p> <p>a) coating the food with crumbs.
b) frying the food with dry spices.
c) coating the food in flour and egg.</p> <p>20. Which one of the following meats (per 100g) has the least fat?</p> <p>a) Pork shoulder
b) Veal shoulder
c) Lamb shoulder</p> <p>21. Which cooking method is used when just enough oil is used to cover the base of the pan, but not enough to completely cover the food?</p> <p>a) Pan searing
b) Deep-frying
c) Shallow-frying</p> <p>22. Why should most foods intended to be deep fried firstly be breaded or battered?</p> <p>a) Prevents the food from becoming greasy during cooking.
b) Helps to dry out the food during cooking.
c) Helps to flavour the oil used for deep-frying.</p> <p>23. Which one of the following cold desserts has the lowest energy value?</p> <p>a) Frozen yoghurt
b) Ice cream
c) Sorbet</p> <p>24. When reading a food label, which one of the following fats may contribute to heart disease?</p> <p>a) Unsaturated fatty acids
b) Polyunsaturated fatty acids
c) Trans fatty acids</p> <p>25. When buying pork, which of the following will hold moisture during cooking?</p> <p>a) Cuts with a good layer of fat on the exterior.
b) Cuts with no visible fat on the exterior.
c) Vacuum packed cuts.</p> | <p>For office use only</p> <p><input type="text"/> A17</p> <p><input type="text"/> A18</p> <p><input type="text"/> A19</p> <p><input type="text"/> A20</p> <p><input type="text"/> A21</p> <p><input type="text"/> A22</p> <p><input type="text"/> A23</p> <p><input type="text"/> A24</p> <p><input type="text"/> A25</p> |
|---|---|

Continue on next page and Section B

SECTION B: Dietary fat nutrition knowledge

Instructions for completion:

Please answer all the questions. Only one letter (a, b, c, d or e) may be chosen as your answer. Only use the 'Don't know' option/answer if you are not familiar with a word in a question. Clearly circle the letter that precedes your answer on the questionnaire.

1. Which of the following lists of food items is ranked from the **lowest to the highest** fat content per serving of the same weight?
 - a) Beef steak; Tuna fish; Pork sausage
 - b) Tuna fish; Beef steak; Pork sausage
 - c) Pork sausage; Beef steak; Tuna fish
 - d) Beef steak; Pork sausage; Tuna fish
 - e) Don't know

2. Which of the following foods has the **highest fat** content per 100g?
 - a) Avocados
 - b) Bananas
 - c) Potatoes
 - d) Raisins
 - e) Don't know

3. Select the milk or milk product from the list that does **not** contain cholesterol:
 - a) Soya bean milk
 - b) Low fat (2%) milk
 - c) Plain bulgarian yoghurt
 - d) Feta cheese
 - e) Don't know

4. Which of the following foods is high in omega-3 fatty acids?
 - a) Chicken with skin
 - b) Beef with fat
 - c) Fatty fish
 - d) Shellfish
 - e) Don't know

5. Which one of the following will contain trans fatty acids?
 - a) Cottage cheese
 - b) Hard margarine
 - c) Boiled egg
 - d) Low fat (2%) milk
 - e) Don't know

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B1

B2

B3

B4

B5

Continue on next page...

6. Select the cholesterol containing food item from the list below:

- a) Margarine
- b) Baked beans
- c) Sunflower oil
- d) Frankfurter sausage
- e) Don't know

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B6

7. Which one of the following has the **lowest fat** content per 100g?

- a) Baked potato
- b) Potato salad
- c) Mashed potato
- d) Roast potato
- e) Don't know

B7

8. Which of the following is **true** of cholesterol?

- a) It is essential to the human diet.
- b) It is found in plant products.
- c) It provides energy to the body.
- d) It is manufactured in the body.
- e) Don't know.

B8

9. Which of the following is indicated to be the "**good**" fats in the diet?

- a) Saturated fatty acids
- b) Unsaturated fatty acids
- c) Trans fatty acids
- d) Hydrogenated fatty acids
- e) Don't know

B9

10. Which products usually contain cholesterol?

- a) Plant products.
- b) Animal products.
- c) Food products containing fat or oil.
- d) Processed food products.
- e) Don't know.

B10

11. The dietary factor most associated with high blood cholesterol levels is a high intake of:

- a) cholesterol.
- b) food fat.
- c) saturated fat.
- d) unsaturated fat.
- e) Don't know.

B11

12. The energy content of fat compared to that of starch can be indicated as

- a) about half that of starch.
- b) slightly lower than that of starch.
- c) slightly higher than that of starch.
- d) about double that of starch.
- e) Don't know.

B12

Continue on next page...

13. The **most** appropriate margarine to protect against heart disease is one
- a) that is labelled "unsaturated plant oil".
 - b) that contains hydrogenated plant oil as the first ingredient.
 - c) that is solid and sold in a brick.
 - d) that is advertised as containing "no cholesterol".
 - e) Don't know.
14. Which of the following oils can be classified as a monounsaturated fat?
- a) Olive oil
 - b) Sunflower oil
 - c) Palm kernel oil
 - d) Maize oil
 - e) Don't know
15. Which of the following oils should **not** be allowed in the diet used for the treatment of coronary heart disease?
- a) Sunflower oil
 - b) Olive oil
 - c) Coconut oil
 - d) Canola oil
 - e) Don't know
16. Which of the following foods has the **lowest fat** content per serving slice?
- a) Jam roll
 - b) Baked cheese cake
 - c) Apple pie
 - d) Milk tart
 - e) Don't know
17. A food high in saturated fat is
- a) olives.
 - b) chocolate.
 - c) peanut butter.
 - d) almonds.
 - e) Don't know
18. Which of the following foods has the **highest energy** content per 100g?
- a) Potato
 - b) Bread
 - c) Meat
 - d) Butter
 - e) Don't know

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B13

B14

B15

B16

B17

B18

Continue on next page and Section C

SECTION C: Consumption of foods rich in fat

Instructions for completion:

Mark an 'X' in the box that represents how often you eat that specific food. Only one box per each row of food type is to be marked.

Frequency	Never/Once or less than once per month ⁰	2 - 3 times per month ¹	1 - 2 times per week ²	3 - 4 times per week ³	5+ times per week ⁴	For office use only
1. Hamburger or cheeseburger						C1
2. Red meat, e.g. beef and mutton						C2
3. Fried chicken (with skin)						C3
4. Hot dogs, frankfurters, salami, Russians, sausages						C4
5. Cold cuts, lunch meats, ham (with fat), etc.						C5
6. Salad dressings, mayonnaise, etc.						C6
7. Margarine or butter						C7
8. Eggs						C8
9. Bacon or pork sausages						C9
10. Cheese or cheese spread						C10
11. Full-cream milk						C11
12. Potato chips ('slap chips')						C12
13. Potato crisps, corn chips, popcorn, etc.						C13
14. Ice-cream						C14
15. Doughnuts, cake, cookies, puddings, etc.						C15

Continue on next page and Section D

SECTION D: Demographic and lifestyle information

Instructions for completion:

Please answer all the questions. Only one letter may be chosen as your answer. Clearly circle the letter that precedes your answer on the questionnaire.

1. How would you describe your general dietary fat knowledge compared to that of other students?
 - a) Much less
 - b) Somewhat less
 - c) About similar
 - d) Somewhat more
 - e) Much more

2. Which one of the following options best describes your own food intake?
 - a) Consume foods popular with and consumed by most adults of your age (similar food intakes as most of your friends, family and/or other students).
 - b) Consume foods considered healthier choices than those consumed by most adults of your age (or most of your friends, family and/or other students).

3. Where/From whom did you learn mostly about food choices?
 - a) At home with family.
 - b) Articles in magazines, books, internet, etc.
 - c) Friends.
 - d) Television or radio.
 - e) School subjects such as Consumer Studies and Life Orientation

4. Are you currently physically active?
(Being active means regular moderate exercise [e.g. walking or cycling] or strenuous exercise [jogging, football and vigorous swimming] for 4 hours or more per week)
 - a) Yes
 - b) No

5. What is your smoking status?
 - a) Non-smoker (have never smoked)
 - b) Current smoker (smoked in the last 12 months or quit in the past year)
 - c) Former smoker (quit smoking more than a year ago)

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D1

D2

D3

D4

D5

Continue on next page...

6. How often do you take dietary supplements (a vitamin, mineral, herbal, plant extract, amino acid, metabolite, constitute, or extract, or a combination of any of these substances)?

- a) Never
- b) Seldom
- c) When I remember
- d) Fairly regularly
- e) Regularly

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D6

7. How would you describe your body weight status?

- a) Underweight
- b) Optimal/Normal body weight
- c) Slightly overweight/Overweight
- d) Obese

D7

8. Do you have a family history of any of the following chronic diseases of lifestyle:

8.1 Cardiovascular disease?

- a) Yes
- b) No
- c) Don't know/Unsure

D8.1

8.2 Diabetes mellitus type 2?

- a) Yes
- b) No
- c) Don't know/Unsure

D8.2

8.3 Obesity/Overweight?

- a) Yes
- b) No
- c) Don't know/Unsure

D8.3

9. Your gender?

- a) Female
- b) Male

D9

10. Fully indicate the course/programme you are studying below:

D10

Thank you for your participation in this study.