



**DEVELOPMENT OF A FOOD KNOWLEDGE TEST FOR FIRST-YEAR
STUDENTS AT A UNIVERSITY OF TECHNOLOGY IN THE
WESTERN CAPE, SOUTH AFRICA**

by

Raché van der Vyver

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Supervisor: Dr I Venter

Co-supervisor: Ms L du Toit

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Signed

September 2013
.....
Date

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ABSTRACT

Objective: To develop a valid and reliable test to determine the food knowledge of first-year students at a university of technology (UOT) in the Western Cape, South Africa.

Design: Two preliminary food knowledge tests were developed covering the content domains, namely fruit and vegetables and fats and oils, as these topics attend to the areas of concern in the dietary intake of young adults. Both tests consisted of multiple-choice questions and incomplete statements compiled following the test item construction rules. The items of both tests were evaluated by experts in the field of food science and nutrition to ensure item content and face validity. Both tests were independently administered to two sample groups represented by knowledgeable students (having food-orientated subjects as part of their course) and less knowledgeable students (not having food-orientated subjects as part of their course syllabus) at a UOT in the Western Cape, SA for the item analysis and test construct validity and reliability determinations. The second preliminary test incorporating three response alternatives was developed as the number of items retained after the item analysis of the first preliminary test incorporating four alternatives was less than the envisaged number of about 20 items.

Results: After the item analysis of the first preliminary test (n = 72 items) only 10 and 13 items were respectively retained after two administrations to two sample groups. The second preliminary test (n = 135 items) completed by knowledgeable (n=119) and less-knowledgeable (n=91) student sample groups delivered 74 items after its item analysis across the two content domains, namely fruit and vegetables (n=49) and fats and oils (n=25). The test was found valid, with a significant difference ($p < 0.001$) in the knowledge scores between the two sample groups (Mann-Whitney test, $z = 9.74$) and highly reliable (K-R20 and Cronbach's alpha = 0.934).

Conclusions: The test being a valid and reliable assessment tool can be used to determine the food knowledge of first-year students at a UOT in the Western Cape, SA, across the two content domains to establish if guidance and possible teaching is necessary to equip them with basic food knowledge to support them in their food provision.

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LIST OF ABBREVIATIONS

AIDS	Acquired immune deficiency syndromes
BMI	Body mass index
CANKAP	Comprehensive Assessment of Nutritional Knowledge, Attitudes and Practices
CDL	Chronic diseases of lifestyle
CFA	Confirmatory factor analysis
CPUT	Cape Peninsula University of Technology
EFA	Exploratory factor analysis
FBDGs	Food Based Dietary Guidelines
FFQ	Food frequency questionnaire
FGP	Food Guide Pyramid
FNA	Functional Needs Assessment
g	Grams
HIV	Human immunodeficiency virus
HOD	Head of Department
IDI	Item difficulty index
kg	Kilograms
KR	Kuder-Richardson formula
MS	Microsoft
NEP	Nutrition Education Programme
NET	Nutrition Education Tools
SA	South Africa
SU	Stellenbosch University
TLHS	Tufts Longitudinal Study
UK	United Kingdom
UOT	University of Technology
USA	United States of America
USDA	United States Department of Agriculture
WHO	World Health Organisation

CLARIFICATION OF BASIC TERMS AND CONCEPTS

Dietary behaviour / Dietary habits / Dietary practices	The term diet refers to the usual food and beverage consumption of an individual on a daily basis (Sizer & Whitney, 2011:GL7). According to the Oxford Student's Dictionary the term practice refers to "doing an activity many times" in order for it to become "a habit or custom" or "the usual or expected way of doing something in a particular situation" (Oxford Student's Dictionary, 2011:543). For the purpose of this study dietary practice refers to a young adult's repeated intake of specific foods, on a daily basis over a period of time for it to have become the habit or custom for that individual. In this study the terms dietary behaviour, dietary habits and dietary practices are therefore used interchangeably.
Food knowledge	Food is described as the "carrier of nourishment" (Sizer & Whitney, 2008:GL7). The Collins English Dictionary provides various descriptions for knowledge which are as follows: "the state of knowing"; "specific information about a subject"; "the facts known by a person or a group of people"; along with "familiarity gained by experience of learning" (Butterfield, 2003:902). For the purpose of this research food knowledge refers to knowing specific information about food as subject, which entails theoretical and practical aspects related to food as carrier of nourishment such as food choice, purchasing, storage, preparation and cooking. All these aspects link to the nutritional value of food (Bennion & Scheule, 2000:300).
Food preparation	For the purpose of this research food preparation refers to the preparation of food items for consumption that includes food choice, purchasing, storage, food preparation and cooking methods.
Healthy eating	Nutrients are consumed adequately to support daily body needs and activities of daily living, as well as any increased metabolic demand, to promote growth and development, maintain general health and assist in protection from disease

and illness (Mahan & Escott-Stump, 2000:354). Healthy diets share three basic characteristics, namely adequacy, variety and balance (Brown, 2011:5).

Nutrition	“The science of foods and the nutrients and other substances they contain, and of their actions within the body including ingestion, digestion, absorption, transport, metabolism and excretion. A broader definition includes social, economic, cultural and psychological implications of food and eating” (Whitney & Rolfes, 2011:GL16).
Nutrition knowledge	For the purpose of this research nutrition knowledge refers to knowing specific information about nutrients and other substances found in food and their role in health and the prevention of disease.
Programme	Higher education qualification at a university of technology in the Western Cape, South Africa (SA).
Student(s)	Individuals enrolled to study for a specific higher education qualification.
Young adult(s)	The adolescent years are between 12 and 19 years of age, whereas the adulthood years are between 25 to 55 years of age (Mahan & Escott-Stump, 2000:265, 272). For the purpose of this research young adults can, therefore, be described as between 19 and 25 years of age.

CHAPTER 1

INTRODUCTION

1.1 Statement of the research problem

The debate about the state of contemporary home cooking skills has intensified in recent years. Globally there have been changes in lifestyle patterns which, together with new technologies and the availability of pre-prepared and convenience foods, have led to changes in dietary practices. Families and individuals live in a fast-paced society with home-prepared meals not produced on a regular basis (Soliah, Walter & Antosh, 2006: 729). It has been documented that Americans have shifted towards eating out more and cooking less at home since 1965 (Smith, Ng & Popkin, 2013: 45). The overall amount of time spent on food preparation has decreased, as fewer people cook daily and those who cook spend less time on cooking (Smith *et al.*, 2013: 49). Even those who cook, rely more heavily on packaged and convenience foods, for example pasta sauces and frozen pizzas (Smith *et al.*, 2013: 50). These changes may have influenced individuals' cooking abilities (Short, 2003: 13; Chenhall, 2010: 10) and have led to the growing concern that nations with "cooking illiterates" (Azanza, 2001: 515; Feely, Pettifor & Norris, 2009: 118; Brown, 2011: 6; Van der Horst, Brunner & Siegrist, 2011: 239), i.e. individuals unsure of specific cooking techniques and lacking in confidence to apply techniques and cook certain foods, are being nurtured (Caraher, Dixon, Lang & Carr-Hill, 1999: 590).

As young adults move into an independent living situation upon entering tertiary education, their risk for unhealthy dietary practices increases (Senekal, 1988: 267) as they take responsibility for their food choices, purchasing and preparation. This is the time when young adults begin to cement their lifelong eating habits (Beerman, 1991: 343; Edwards & Meiselman, 2003: 21; Papadaki, Hondros, Scott & Kapsokafalou, 2007: 169; Gores, 2008: 5; Fitzgerald, Heary, Nixon & Kelly, 2010: 289). The generally unhealthy food choices and dietary behaviour of young adults are worldwide concerns (Khan & Lipke, 1982: 583; Senekal, 1988: 267; Maunder, Matji & Hlatshwayo-Molea, 2002: 57). Students' consideration for the importance of nutrition may diminish when making food choices as the ease of convenience is considered (Betts, Amos, Keim, Peters & Stewart, 1997: 74). Unsurprisingly lack of time is often reported by them as a major barrier to preparing nutritious meals (Larson, Perry, Story & Neumark-Sztainer, 2006: 2003), prompting students to 'buy' time through the purchase of convenience foods which are sold ready-to-eat or require minimal preparation. The increase in snacking between meals also decreases time spent on cooking as students reach for portable pre-packaged snacks instead of eating meals (Piernas & Popkin, 2010: 325; Hamrick, Andrews, Guthrie, Hopkins & McClelland, 2011: 1).

Many studies have explored the association between nutrition knowledge and healthy dietary practices among children (Stitt, 1996: 30; Steyn, Lambert, Parker, Mchiza & De Villiers, 2009: 145), adolescents (Anding, Suminsky & Boss, 2001: 167; Abood, Black & Birnbaum, 2004: 135; Franko, Cousineau, Trant, Green, Rancourt, Thompson, Ainscough, Mintz & Ciccazzo, 2008: 369; Venter & Winterbach, 2010: 75) and young adults (i.e. students) (Khan & Lipke, 1982: 583; Lin, Guthrie & Frazao, 1998: 10; Harnack, Block & Lane, 1997: 307; Haberman & Luffey, 1998: 189; Parmenter, Waller & Wardle, 2000: 163; Matvienko, Lewis & Schafer, 2001: 95; Ntuli, 2001: iv; Pirouznia, 2001: 62; Peltzer, 2004: 24; Von Ah, Ebert, Ngamivitroj, Park & Kang, 2004: 463; Whati, Senekal, Steyn, Nel, Lombard & Norris, 2005: 2; Peters, Higgins-Opitz, McLean & Van Wyk, 2006: 15; Kolodinsky, Harvey-Berino, Berlin, Johnson & Reynolds, 2007: 1409). Although there is strong evidence to suggest that nutrition knowledge may improve the nutritional value of an individual's dietary practices (Steyn, 2010: 63), Byrd-Bredbenner (2004: 158) indicated that limited food preparation knowledge (pertaining to choice, purchasing, storage, preparation and cooking) may prevent individuals from incorporating these food-related aspects in improving the healthiness of their diets. In South Africa (SA) there is a lack of published literature relating to the knowledge that young adults, represented by university students, have regarding food intake and patterns to support healthy eating practices (Senekal, 1988: 2; Du Toit, 2004: 3; Steyn, 2010: 62).

1.2 Background to the research problem

According to Lowry, Kann, Collins and Kolbe (1996: 793) young adults frequently have unhealthy dietary practices and usually do not follow healthy eating patterns. By adopting unhealthy diets, specifically those resembling the Westernised diet that features overconsumption of energy-dense food and low micronutrient intakes, together with an unhealthy lifestyle, the emergence of a range of chronic diseases of lifestyle (CDL) such as obesity, hyperlipidaemia, hypertension and diabetes mellitus is likely to follow at a later stage in life (Maunder *et al.*, 2002: 57; Klemmer, 2002: 97; Ayranci, Erenoglu & Son, 2010: 772; Peltzer & Pengpid, 2012: 3575). However, these risks may be lessened if healthy dietary and lifestyle practices are followed during the earlier 20 years of life (Haberman & Luffey, 1998: 189; Hizza & Gerrior, 2002: 3; Klemmer, 2002: 97; Racette, Deusinger, Strube, Highstein & Deusinger, 2005: 245).

Numerous studies have found that young adults do not consume the recommended daily intake of fruit and vegetables along with dietary fibre (Keim, Stewart & Voichick, 1997: 80; Love & Sayed, 2001: 24; Story, Neumark-Sztainer & French, 2002: 540; Peltzer, 2004: 25; Doyle-Francis, 2008: 242; Strong, Parks, Anderson, Winnett & Davy, 2008: 1708; Ayranci *et al.*, 2010: 775). In addition the typical food choices of young adults consist of high-fat products (Pirouznia, 2001: 62; Ayranci *et al.*, 2010: 775; Venter & Winterbach, 2010: 254). Research has shown that young adults frequently

follow diets of poor nutritional quality. Possible factors that contribute to this are low meal frequency, not eating breakfast, consuming sweetened beverages, skipping meals, failing to eat the recommended servings from all food groups or eating away from home (Khan & Lipke, 1982: 584; DeBate, Topping & Sargent, 2001: 819; Zizza, Siega-Riz & Popkin, 2001: 303; Story *et al.*, 2002: S40; Kubota & Freedman, 2009: A86; Steyn, 2010: 63). In support of these findings, the majority of food eaten by adolescent learners in the Western Cape, SA, is considered to be of poor nutritional value, i.e. low nutrient density. This relates to both food items brought to school from home and food items purchased on the school premises or dietary intake in general (Temple, Steyn, Myburgh & Nel, 2006: 252; Sauls, De Villiers, Fourie, Steyn, Draper & Lambert, 2008: 132).

Furthermore, young adults attending tertiary institutions are more vulnerable to weight gain than the general population (Senekal, 1988: 208; Lowry, Galuska, Fulton, Wechsler, Kann & Collins, 2000: 18; Butler, Black, Blue & Gretecheck, 2004: 24; Greene, Schembre, White, Hoerr, Lohse, Shoff, Horacek, Riebe, Patterson, Phillips, Kattelmann & Blissmer, 2011: 394). Almost a quarter of first-year students (n=186) at a university in the western region of the United States of America (USA), gained a substantial amount of weight during their first semester at university (Strong *et al.*, 2008: 1708). At Stellenbosch University (SU), Western Cape, SA, weight gain experienced during the first three months at university, even though not substantial in some instances, was pointed out to possibly be the starting point of the vicious cycle of lifelong weight gain and dieting (Senekal, 1988: 162).

These research studies provide support for the implementation of education or other strategies aimed at helping young adults entering tertiary education to achieve and/or maintain a healthy body weight (Senekal, 1988: 266; Wengreen & Moncur, 2009: 32). According to Worsley (2002: S579) and Stitt (1996: 27) greater attention should be given to the development of childrens' and adults' food and nutrition knowledge frameworks. The lack of knowledge and confidence that many consumers have regarding healthy food choices may very well be a barrier to healthy eating (Buttriss, 1997: 1987S; Berg, 2002: 194; Wrieden, Anderson, Longbottom, Valentine, Stead, Caraher, Lang, Gray & Dowler, 2007: 203). Wardle, Parmenter & Waller (2000: 269) found that nutrition knowledge regarding the consumption of fat, fruit and vegetables had a positive association with healthier eating practices in general. From an international perspective, in countries like Iceland, where food skills are taught as core or compulsory modules in the curriculum of almost all schools, the health of these inhabitants is superior to that of the populations of most other countries in the developed world. In these countries food skills and Home Economics are high-status subjects in the national curriculum from the age of six years (Stitt, 1996: 28), with the emphasis on the preparation, serving and eating of family meals (Stitt, 1996: 29).

The most common barrier to food preparation provided by university students, aged 18 to 23 years, is a lack of time (Larson *et al.*, 2006: 2001), while never being taught (i.e. knowledge barrier) and/or having no interest in learning how to prepare meals (i.e. attitude barrier) are also generally reasons provided by them for their lack of food preparation skills (Soliah *et al.*, 2006: 729). Unfortunately, the overall food preparation knowledge of young adults seems to be low, yet the majority overestimates their knowledge. Limited food knowledge may prevent individuals from fully implementing general food preparation recommendations designed to improve the healthiness of food (Byrd-Bredbenner, 2004: 154). Cooking experiences can help young people learn about ingredients, how to prepare food and make healthy food choices (Levy & Auld, 2004: 197; Thonney & Bisogni, 2006: 321). In other words, cooking experiences through involvement in meal preparation has the potential to positively affect diet quality (Smith, McNaughton, Gall, Blizzard, Dwyer & Venn, 2010: 1363; Leal, Oliveira & Rodrigues, 2011: 283). Interventions among young adults should teach skills for preparing quick and healthy meals (Larson *et al.*, 2006: 2001) as an increase in cooking skills leads to an increase in home-prepared meals, the selection of healthier foods and cooking self-efficacy and confidence levels (Condrasky, Parisi, Kirby, Machaud, Graham, Wall-Bassett & Clifford, 2009: 152). Young adults who reported frequent food preparation, reported less frequent fast-food consumption and were more likely to meet dietary intake recommendations for fat and fruit and vegetables (Soliah *et al.*, 2006: 729).

Based on the above and the limited research on food knowledge, research is required to establish the food-based knowledge students have in terms of food choice, purchasing, storage, preparation and cooking methods of particularly fruit and vegetables and fats and oils as these food items are the major concerns in the dietary intake of young adults. Due to the importance of food knowledge in supporting healthy eating, this study consequently aimed to develop a valid and reliable assessment tool in the form of a knowledge test that can be used to determine the food knowledge of young adults in their first year of tertiary education at a higher education institution.

1.3 Research question

Would the construction of knowledge questions on food choice, purchasing, storage and cooking methods pertaining to fruit, vegetables, fats and oils - which on pre-testing meet the criteria of item analysis - provide a valid and reliable knowledge measure to assess the food knowledge of first-year students at a university of technology (UOT) in the Western Cape, SA?

1.4 Research objectives

1.4.1 Main objective

To develop a valid and reliable self-administered questionnaire in the format of a test to determine the knowledge of first-year students on food choice, purchasing, storage, preparation and cooking methods pertaining to fruit and vegetables and fats and oils as dietary constituents.

1.4.2 Subsidiary objectives

To construct questions for inclusion in the questionnaire that meet the rules for test item construction and the criteria for test item analysis to determine knowledge on food choice, purchasing, storage, preparation and cooking methods of the aforementioned dietary constituents.

To establish the validity and reliability of the developed questionnaire comprising the questions that met the rules for item construction and the criteria for test item analysis in determining knowledge on food choice, purchasing, storage, preparation and cooking methods of the aforementioned dietary constituents.

To determine the standard/norm scores of the final questionnaire, in the format of the test, to differentiate between the food knowledge levels of participant groups.

To develop two valid and reliable self-administered questionnaires to represent each of the two content domains, i.e. fruit and vegetables and fats and oils, in the format of tests to determine the knowledge of first-year students on purchasing, storage, preparation and cooking methods of fruit and vegetables and fats and oils as two separate constructs on obtaining a sufficient number of questions within each content domain that met the criteria for test item analysis.

CHAPTER 2

LITERATURE REVIEW

The dietary practices of students is a matter of concern as it affects not only their present health and well-being, but dietary practices established during early adulthood can continue into later life (Haberman & Luffey, 1998: 189). Over the last decade, many international and national studies investigated the impact of nutrition knowledge on the dietary intake and the dietary practices of young adults (Wardle, Bellisle, Reschke, Steptoe, Davou, Lappalainen & Fredrikson, 1997: 443; Klemmer, 2002: 97; Kolodinsky *et al.*, 2007: 1409; Oosthuizen, Oldewage-Theron & Napier, 2011: 141; Van't Riet, Sijtsema, Dagevos & De Bruijn, 2011: 593). However, very little information is available on the food knowledge of these individuals. Not much is known about their knowledge of the choice, storage, preparation and cooking of food items. Knowledge of these aspects, amongst other factors, has been found to have an impact on the dietary practices of students (Contento, 1995: 287; Chenhall, 2010: 3).

In this chapter literature on the two focus areas of the research, namely food knowledge and cooking skills and the development of a knowledge test, is provided. In 2.1, the first focus area, food knowledge and cooking skills, is defined and the importance of food knowledge and cooking skills in addition to factors influencing food knowledge and cooking skills amongst young adults discussed. In 2.2, as the second focus area, the process to develop a valid and reliable knowledge test is presented.

2.1 Food knowledge and cooking skills

There is widespread concern over the decline of cooking skills, particularly among young people. Cooking skills are often viewed as no longer necessary in a high-tech world (Caraher, Baker & Burns, 2004: 255). Food knowledge and cooking skills are associated with dietary practices and behaviour (Contento, 1995: 287). This is of particular importance in the case of young adults, as represented by university students, as their dietary behaviour is a matter for serious concern (Fitzgerald *et al.*, 2010: 29).

2.1.1 Describing food knowledge and cooking skills and the essential elements

The concept cooking skills is rarely defined and is seen by many as a set of practical and/or technical tasks (Short, 2003: 13). Cooking skills include numerous aspects related to mechanical (preparing meals, chopping, mixing, cooking and following recipes), perceptual (using the senses), conceptual (creative use of leftovers and adjusting recipes), academic (knowledge about food, nutrition, labelling, food safety and ingredient substitution) and planning (organising meals and budgetary

constraints) skills. It is a complex topic and should not be oversimplified (Short, 2003: 15). It is broader than simply competence in executing certain tasks (Stead, Caraher & Anderson, 2004: 274).

The current trend is to include not only nutritional science, but also food preparation skills, physical exercise, gardening and farming as all these aspects relate to the provision of food in food education. Kimura (2011: 466) defines food education as the “teaching of a broad range of food knowledge and skills to help individuals make healthy food choices”. Food knowledge and skills are further defined as “purchasing, preparing and cooking food ingredients using available resources to produce a meal that is appropriate to the age and nutritional needs of the individuals consuming it”. While knowledge is defined as “personal awareness and understanding” (Fordyce-Voorham, 2011: 118), the term skill refers to proficiency that is acquired or developed through training and/or experience (Oxford Student’s Dictionary, 2011: 650).

Flowers and Swan (2011: 240) considered three different offered theories, as outlined below, in order to understand the complexity of food knowledge and skills, the first being that of Sutton (2001: 159), an anthropologist, who described cooking as a process that includes different forms of knowledge, i.e. cognition and memory. Cooking is therefore not merely remembering a set of rules, but it also involves images, tastes, smells, experiences and techniques. Secondly, Short (2006, cited in Flowers & Swan, 2011: 240), a sociologist, referred to cooking as “a mix of the fresh, the raw and the pre-prepared, the new and the traditional, the technological and the manual”. According to Short’s (2006, cited in Flowers & Swan, 2011: 240) theory home cooking does not operate along dichotomies of “real and traditional skills versus artificial, technologically reliant and unskilled”. Lastly, Vileisis (2008: 8), a historian, pointed out that the sight, smell, taste and touch of ingredients which are used to provide knowledge about food, were taken over by food science as food production became industrialised in the 19th century. These three different suppositions to food knowledge and skills provide evidence that the description and research of the topic is relatively complex.

The essential aspects of food knowledge that should form part of skills-based programmes in secondary schools, aimed at developing food preparation skills of adolescents, are difficult to identify. The reason for this is that food knowledge and skills are complex and multifaceted, as indicated above. In a study by Fordyce-Voorham (2011: 116) the input of experts and other interested parties, including home economics teachers, chefs, nutritionists, dieticians, community educators, homemakers and young adults living independently, were obtained to identify which essential aspects should be included. These ‘experts’ were asked to provide information in the

following categories, namely knowledge, information, skills and resources related to food. Table 2.1 provides a summary of the results of this study.

Table 2.1: Identified essential aspects of food knowledge, information and skills that should be included in a skills-based food programme in secondary schools (Fordyce-Voorham, 2011: 116)

Category	Aspects required
(i) Knowledge	<p>(a) Consumer knowledge, i.e. identification of quality fresh food in season and uses of different food types;</p> <p>(b) cooking methods, i.e. selection and application of the appropriate cooking method to achieve the best product outcome and using alternative cooking methods to improve the nutritional value of a meal;</p> <p>(c) equipment knowledge, i.e. having equipment and knowing how to use it in the preparation and cooking of food;</p> <p>(d) hygiene and safety knowledge;</p> <p>(e) meal knowledge, i.e. planning ahead, consulting recipe sources and incorporating the food groups; and</p> <p>(f) nutritional health knowledge, i.e. choosing food to include a wide variety of types and nutrients and fulfilling an individual's daily nutritional needs and using nutrition knowledge as an effective tool to make food shopping less confusing.</p>
(ii) Information	<p>(g) Food literacy, i.e. understanding food choice and culinary practices and considering it in consulting food labels; and</p> <p>(h) terminology information, i.e. a shared understanding of how to confidently follow recipe instructions and produce successful meals and/or food products.</p>
(iii) Skills	<p>(i) Consumer skills, i.e. planning, shopping and preparation skills young adults are empowered with to make their own meals from fresh produce and flavouring ingredients instead of relying on fast foods and/or expensive convenience foods;</p> <p>(j) skills acquisition, i.e. the process of cognitive learning that is equally important as learning the essential cooking skills;</p> <p>(k) meal skills, i.e. incorporating all stages of food preparation and cooking from the moment a meal ingredient is purchased, to it being prepared and cooked ready for consumption, choosing food preparation techniques like peeling, slicing, dicing and chopping and applying it safely and correctly and planning the meal process in order to coordinate the cooking process; and</p> <p>(l) hygiene and safety skills, i.e. basic hygiene practices and the storage of kitchen equipment and fresh produce.</p>

Based on the three categories mentioned in Table 2.1, it is evident that, in order to develop and/or improve food knowledge and skills of individuals, both the theoretical and the practical aspects need to be considered.

2.1.2 State of contemporary food and cooking knowledge and skills

Academics and food specialists in different countries have been discussing the state of contemporary home cooking skills (Short, 2003: 13). They have increasingly become concerned

about the state of home cooking skills (Baderoon, 2002: 4). Short (2003: 13) emphasised that knowledge regarding home cooking skills is scarce despite the fact that food preparation practices have changed dramatically in the past 50 years (Soliah *et al.*, 2006: 729). Technology has become more common in the home (Caraher *et al.*, 2004: 256). This could have brought about a decrease in cooking skills. Soliah *et al.* (2006: 729) are of the opinion that if more were known about the average person's cooking skills, then perhaps more practical food-related information could be delivered by health care professionals or health educators in support of health promotion and disease prevention.

The availability of convenience food and modern technologies are only two possible factors influencing peoples' ability to cook (Short, 2003: 13). With so many convenience foods available, there is a growing concern that globally nations of "cooking illiterates are being nurtured" (Brown, 2011: 6). The considerable growth in recent years of pre-prepared, packaged and convenience foods on the market which require fewer and/or different skills, may have led to a decline in cooking skills (Short, 2003: 13; Van der Horst *et al.*, 2011: 239). The growth in convenience foods has changed the nature of the food purchased and prepared and the relationship of the individual with food preparation (Caraher *et al.*, 2004: 256). Through the use of ready-prepared ingredients, cooking seems to become routinised and deskilled and the choice to cook with raw ingredients may be removed. Furthermore the availability of convenience foods has led to the lack of opportunity for children to acquire cooking skills from parents and caretakers (Gofton, 1992: 31). In many instances in the USA the family dinner has become the exception rather than the rule (Lichtenstein & Ludwig, 2010: 1857).

2.1.3 Importance of food knowledge and cooking skills

Food- and culinary professionals have indicated the importance of food and culinary knowledge for all individuals involved in food preparation in the home (Canter, Moorachian & Boyce, 2007: 314). Skills associated with the choice, purchase and preparation of food are part of the activities that comprise daily living. A lack of food skills may have serious implications on an individual's nutritional status if food availability, provision and choice become compromised (Porter, Capra & Watson, 2000: 51).

Dietary professionals, such as dieticians, should strengthen their practice with food and culinary knowledge. If the availability, provision and choice of food become compromised, the lack of food preparation skills could further expose individuals to a poor nutritional status. Dieticians should therefore strive to improve their knowledge of food and food preparation in all its dimensions, from

production, biotechnology, food safety, product development, packaging, storage, preparation and service (Canter *et al.*, 2007: 318).

2.1.4 Impact of food knowledge and cooking skills on dietary behaviour

The possible decline of food preparation skills could have a negative effect on the ability to follow dietary guidelines (Leather, 1996 cited in Short, 2003: 14). Limited food preparation skills may prevent individuals from applying the necessary skills to improve the healthfulness of their diets (Byrd-Bredbenner, 2004: 18).

Kimura (2011: 479) uses the term “food literacy” to refer to an individual’s understanding of food choices, culinary practices and dietary behaviour. An individual’s lack of food literacy could result in poor food choices, less desirable culinary practices and unwanted dietary behaviour. Individuals often do not have nutrition-related food knowledge, cooking skills or an understanding of the impact that these inappropriate food practices and behaviours may have on their health.

For instance, Soliah *et al.* (2006: 729) concluded from a study amongst female university students in the USA that the frequency of eating out increased as their food preparation skills decreased. Unfortunately convenience foods and foods such as fast foods eaten away from home are generally high in saturated fat and low in dietary fibre and calcium. In addition, convenience foods are often also high in energy and sugar and lack the inclusion of vegetables which supply essential vitamins and minerals as well as phytochemicals (Lin *et al.*, 1998: 2). A study conducted by Van der Horst *et al.* (2011: 240) in Switzerland examined the association between various factors, which included cooking skills, beliefs about the nutritional value and taste of pre-prepared meals and overweight, and convenience food consumption. In general the results obtained from the 1 017 participants of the study indicated men possess fewer food preparation skills and were more positive about pre-prepared meals compared to women. Lacking food preparation skills may therefore be a strong predictor of convenience food consumption and an increased risk for developing diseases of lifestyle (Van der Horst *et al.*, 2011: 243).

Knowledge of food intake is just as important as knowledge of nutrient intake as it promotes understanding of the dietary practices of population groups. Unfortunately there seems to be a lack of food intake data in SA. The results of the majority of dietary assessment research studies that collected food intake data from the various population groups in SA are expressed in terms of nutrient intake, i.e. energy and nutrient values. The intakes of specific foods are generally not included in these results. However, a clear picture of the actual food intake of the population is required in order to implement national food and nutrition policies such as for school-feeding

schemes. It is also necessary in the planning of nutrition interventions, for example human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS) programmes. Very little food intake data for adult South Africans is available since the publication of the first Food Based Dietary Guidelines (FBDG) in 2001. Due to economic factors such as food insecurity and general poor food choices, the consumption of certain foods typically linked to the Westernised diet may have increased, whereas the intake of nutrient-dense foods may have decreased in the interim (Van Heerden & Schönfeldt, 2011: 10).

Significant changes, such as changes in the dietary behaviour and physical activity, have taken place in the lifestyle of many South Africans during the last decade (Stupar, Eide, Bourne, Hendricks, Iversen & Wandel, 2012: 199). This is contributing to their risk for developing non-communicable (chronic) diseases (Steyn, Bradshaw, Norman, Joubert, Schneider & Steyn, 2006: 5). Stupar *et al.* (2012: 199) refer to it as “the Nutrition Transition”. In the last three decades the incidence of chronic disease has led to an increase in morbidity and mortality. This is particularly the case for ischemic heart disease, hypertension, stroke, diabetes and cancers. In a 2006 report by Steyn *et al.* (2006: 5) the major risk factors for an increase in these chronic illnesses included the Westernised diet, physical inactivity and tobacco use.

In SA the burden of disease has been described as a ‘quadruple burden’. This includes conditions associated with underdevelopment, emerging chronic diseases related to unhealthy lifestyles, HIV/AIDS and injuries (Steyn *et al.*, 2006: 6). Globally, the unhealthy lifestyles associated with chronic illnesses are the same, representing a dietary intake high in energy-dense foods that are low in micronutrients and dietary fibre, and high in saturated fat, trans-fatty acids, sugars and salt (Steyn *et al.*, 2006: 6; WHO, 2003). Steyn *et al.* (2006: 6) recommend that a review of the changes in diet, considering factors such as poverty and underdevelopment and the health transition in SA, should be taken into account in the development of a national health and wellness strategy. Such a strategy requires a strong dietary policy component if it is to be effective in future. Such policy should take cognisance of food-related aspects, including not only food intake but also the food knowledge and cooking skills of South Africans.

2.1.5 Food knowledge and food preparation of young adults

According to Byrd-Bredbenner (2004: 158), the majority of young adults who participated in a study in New Jersey, USA, overestimated their food preparation knowledge. Many health professionals also promote the theoretical concepts of lifestyle modifications, but find it difficult to provide practical dietary application advice (Parker, Steyn, Levitt & Lombard, 2010: 1).

In a study conducted by Kubota and Freedman (2009: A8), 343 students living in apartment style accommodation at a large multi-ethnic public university in California, USA, completed an online survey which assessed the eating habits and food preparation skills and knowledge of students. The results of the study indicated that 97% of the participants prepared some meals for themselves. Most (70%) of the participants reported limited access to various ingredients, thus limiting their food and meal choices. For this reason convenience foods or mixes were most often prepared. The same participants also took part in a four-week basic and practical cooking skills development programme taught by a professional chef. Pre- and post-assessment surveys showed that self-efficacy increased significantly in six to seven of the food preparation categories. The authors concluded that cooking skills development programmes can be used to increase the confidence of young adults regarding cooking or food preparation (Kubota & Freedman, 2009: A8). A study by Levy and Auld (2004: 200) considered whether self-reported positive attitudes differed between groups of students who attended cooking demonstrations compared to a group of students who attended hands-on cooking classes. Over 90% of the overall participants indicated that they knew how to cook and grocery shop. Participants had reported positive attitudes regarding cooking, food shopping and healthy eating practices. However, feelings regarding the perceived difficulty of preparing healthy foods seemed neutral. The results showed significant changes in attitude for all groups, particularly with regard to their enjoyment of cooking and a higher level of confidence in applying various cooking techniques (Levy & Auld, 2004: 201).

To improve dietary intake, interventions aimed at young adults should include knowledge and skills for the preparation of quick and healthy or nutritious meals. A study by Larson *et al.* (2006: 2001) corroborates this statement. In the study by Larson *et al.* (2006: 2001) the association between food preparation practices, cooking skills and resources for food preparation by young adults and diet quality was described. Food preparation tasks were not performed by the majority of the participants. Common barriers found to impair food preparation included a lack of food preparation knowledge, a lack of time or being too tired. The lack of food preparation knowledge could be effectively addressed through intervention.

2.1.6 Eating practices and dietary behaviour of young adults

Young adults frequently do not follow healthy eating patterns (Lowry *et al.*, 1996: 793). Ayranci *et al.* (2010: 775) describe a typical student diet as being high in fat and low in fruit and vegetable intake. By adopting an unhealthy diet, specifically resembling the Westernised diet, together with an unhealthy lifestyle such as physical inactivity and smoking, the likelihood of hyperlipidaemia, hypertension, diabetes and other chronic diseases of lifestyle at a later stage in life is high. University food kiosks provide a multitude of affordable and convenient fast-food variants to

students. The buying power of young adults for fast foods should not be underestimated since this consumer sector has a passion for eating out. Acceptable portion sizes, affordability and a variety of foods on offer are generally what satisfy the typical student consumer (Azanza, 2001: 515).

The Tufts Longitudinal Health Study (TLHS) investigated the association and interaction of various aspects of healthy living of undergraduate students at the Tufts University in Massachusetts. The concept of healthy eating included both physical and emotional health as well as the health-related behaviours of the students. The study was designed to follow incoming classes through their years at university over a period of seven years (Klemmer, 2002: 97). Data from the TLHS indicated that students who exercised regularly were more likely to meet the United States Department of Agriculture's (USDA's) recommended daily fruit and vegetable intake. Females were more likely to meet the recommended milk and milk product intake (Klemmer, 2002: 98). The poor quality diet was reflected in the low percentage of students that met the five-a-day fruit and vegetable consumption guideline. Detailed nutrient intake analysis indicated that 85% of participants did not consume the minimum recommended amount of dietary fibre, 65% exceeded the recommended intakes of total fat with 70% of participants also exceeding the saturated fat intake recommendation (Klemmer, 2002: 99).

At Bournemouth University Edwards and Meiselman (2003: 21) measured the changes that occurred in students' dietary habits from leaving home in September, the start of the academic year, until May in the following year. Three groups (n = 97, n = 123 and n = 157) of first-year students were surveyed over three consecutive years using a food frequency questionnaire (FFQ). Students completed the FFQ in September, January and May. The results indicated that from the time the students entered the university in September, their reported energy intake declined, and by January could have fallen by as much as 13.5% for males and 15.8% for females. Reported intakes of protein, fat and carbohydrates declined significantly while intakes of alcohol in males increased in each of the three periods. Interestingly, the decrease in energy intake stabilised and little change was found between January and May. The decrease in energy intake between September and January was attributed to the reported decrease in overall food consumption. However, participants' body mass index (BMI) did not change significantly and this may have been a result of decreased energy expenditure in terms of physical activity levels (Edwards & Meiselman, 2003: 31).

The Food Guide Pyramid (FGP) was used to evaluate the self-reported consumption of foods of 630 American college students, based on a 24-hour food recall. Sixty-four percent of the participants had a BMI which could be interpreted as optimal (DeBate *et al.*, 2001: 819). Comparisons between the recommended food group servings, mean number of servings consumed per study participant,

and percentage of study participants meeting the serving recommendations are indicated in Table 2.2.

Table 2.2: Self-reported consumption of foods by American college students in relation to the Food Guide Pyramid recommendations (DeBate *et al.*, 2001: 825)

Food group	Recommended servings from the Food Guide Pyramid	Mean number of servings consumed by participants	Participants consuming recommended servings (%)
Fruit	2-4	1.1	31.2
Vegetables	3-5	1.6	1.3
Milk, yoghurt, cheese	2-3 (Pregnancy = 3)	1.9	53.1
Meat, poultry, fish, dry beans, eggs, nuts	2-3	2.1	65.5
Bread, rice, pasta, cereal	6-11	2.6	6.9
Fats, oils, sweets	Sparingly	2.3	n/a

Haberman and Luffey (1998: 189) found a similar pattern in a study conducted in 1998 where students reported consuming less than the minimum recommended number of servings. In this 1998 study 81.7% consumed less than the recommended servings for fruit and vegetables, 44.3% for milk and milk products, 35.5% for meat, fish and beans and 80.3% for grains (Haberman & Luffey, 1998: 190).

Du Toit (2004: 167) used the South African FBDG (Vorster, Love & Browne, 2001: S3) and the Daily Food Group Guide (Whitney, Cataldo & Rolfes, 2002: 36) to assess the dietary intake of 60 randomly selected black female students living in Cape Technikon residences (before the Cape Technikon became the Cape Peninsula University of Technology [CPUT]) in Cape Town, SA. More than half of the participants (n = 36) indicated that they usually ate the same, or similar, foods daily during the term while living in the residence. Only 28.3% of participants consumed food items from all five of the food groups listed in the Daily Food Group Guide on a daily basis. The top ten food and drink items consumed by the participants included sugar, boiled/mashed/fried potatoes, chicken, breakfast cereal, white bread, coffee, full-cream milk, fruit juice (concentrate), margarine and 'cool drinks' including squash and sodas (Du Toit, 2004: 169). French, Lin and Guthrie (2003: 1326) examined the dietary intake data from three national surveys conducted in the USA and found that the prevalence of soft drink consumption among the youth increased by 48% from 1977 to 1998. In addition, the average intake of soft drinks more than doubled. Harnack, Stang and Story (1999: 436) concluded that the substitution of, for example, milk by carbonated drink and cool drinks is common among adolescents. A possible reason for the poor intake of milk by students in residence

accommodation may lie in the perishable nature of fresh milk (Du Toit, 2004: 185) and the fact that participants in some cases shared refrigerators, which meant that the stored item(s) were not only used by the buyer (Du Toit, 2004: 123).

The majority of food eaten by adolescent learners in SA is considered to be unhealthy. This relates to both food items brought to school from home and food items purchased at school. Research indicates that young adults frequently follow diets of poor nutritional quality, i.e. energy-dense intakes with poor micronutrient content. Although little published data on South African adolescents' food patterns is available, possible factors that may contribute to their poor dietary practices include not eating breakfast and the consumption of school tuck shop foods (Steyn, 2010: 62; Stupar *et al.*, 2012: 199). Adolescents have access to more pocket money and the freedom to purchase sweets and other snacks at school tuck shops as a result increases. Diminishing parental control and autonomy over food choices are important factors that may influence adolescents' dietary practices (Fitzgerald *et al.*, 2010: 289).

A study conducted by Temple *et al.* (2006: 253) in Cape Town, SA, investigated adolescents' eating habits at school, foods brought to school and foods purchased at school. The results indicated that 41% to 56% of participants brought their own food to school. However, in terms of the types of food that were brought to school, a ratio of 2:1 indicated that they brought white bread (25%), sweets and chocolates (25%), potato chips (24%), soft drinks with a high sugar content (16%), fried chips (12%) and confectionary foods (11%), which could be considered unhealthy, to school. Healthier food such as crackers (21%), fruit (17%), meat, processed meat, fish and eggs (13%), brown bread (11%), fruit juice (9%) and milk products (9%) were not as popular.

Feeley *et al.* (2009: 118) studied the fast-food consumption of urban black adolescents from Soweto, Johannesburg, SA. Black adolescents (n = 655) were interviewed to obtain information about their consumption of fast foods and the frequency of their visits to fast-food outlets. Over the assessment period of seven days the mean fast-food intake was 8.1 items per week for males and 7.2 items per week for females. The most popular item was the so-called 'quarter', bought from informal vendors and/or tuck shops. This food item made a significant contribution to the daily energy intake of the adolescent participants. A 'quarter' comprises a quarter-loaf of white bread, fried chips, processed cheese, processed meats or sausages, a fried egg and sauces (Feeley *et al.*, 2009: 119). Other popular fast-food items included chips, *vetkoek*, pies, sausage rolls, boerewors rolls, fried fish, hotdogs, pizzas, hamburgers and samoosas (Feeley *et al.*, 2009: 120).

In the Du Toit (2004: 190) study 55% of the participants indicated that they usually (48.3%) and sometimes (6.7%) consumed alcoholic drinks. However, the frequency of consumption was relatively low with 24.2% of the respondents consuming alcoholic drinks twice per week, 24.2% once a week and the rest (51.5%) indicating that they consumed alcoholic drinks less than once a week. The amounts consumed at a time, however, though were far in excess of the recommended intake, with participants indicating drinking four to six drinks at a time (Du Toit, 2004: 191). Alcohol abuse among students can lead to problems with academic achievement owing to lower class attendance and memory loss, violent behaviour and emotional problems (Munro, 2002: 3; Peltzer, 2003: 1097).

Research by Senekal (1988: 187) found that in general, first-year female students at SU, Western Cape, SA, practised self-reported good eating habits before they entered university. Breakfast, lunch and supper were enjoyed on a regular basis by most of the participants (n = approximately 400) who lived at home. Fruit, vegetables, meat and bread intake were relatively adequate. However, factors associated with student life, such as studies, tests, social problems and a lack of self-discipline, occasionally encouraged some of the participants to consume more food compared to when they lived at home. Frustration (i.e. annoyance, disappointment, dissatisfaction, irritation and resentment) and boredom seemed to influence dietary intake extensively (Senekal, 1988: 187). The research suggested that weight gain among first-year female students in residences at SU is a concern. First-year female students can therefore be classified as a risk group for weight gain and the development of obesity (Senekal, 1988: 100). DeBate *et al.* (2001: 831) emphasised that it would be beneficial for college health providers to take a social-ecological approach to the improvement of weight status among their students. This approach would suggest cooperation among university service providers such as food services, student health, student counselling, residence life and sports departments.

2.1.7 Factors influencing eating practices and dietary behaviour of young adults

Food choices, eating behaviours and the resulting nutritional health are influenced by numerous individual and collective determinants within complex, shifting, social, economic and physical environments worldwide (Chenhall, 2010: 5). In this literature review nine such factors are addressed.

2.1.7.1 Nutrition and food knowledge

A study by Wardle *et al.* (1997: 443) amongst a group of 16 000 European students indicated poor dietary intakes in terms of the frequency of consumption of red meat, fruit, addition of salt to food, trying to avoid consuming fat and cholesterol and trying to consume dietary fibre (Wardle *et al.*, 1997: 444). Although one of the reported factors that influence healthy dietary habits is nutrition

knowledge, it was not found to be a significant predictor of the dietary habits and practices of these students (Wardle *et al.*, 1997: 443). In a study by Pirouznia (2001: 62) adolescent participants from Ohio, USA, were asked to answer a Comprehensive Assessment of Nutrition Knowledge, Attitudes and Practices (CANKAP) questionnaire, which assessed nutrition knowledge and dietary behaviour. The results from Pirouznia's (2001: 65) study indicated that the correlation between nutrition knowledge and dietary behaviour was positive for the two older of the three participant groups. However, the general nutrition knowledge of adolescents in this study was low and the resultant recommendation was that further education in terms of functions and food sources of nutrients was needed. Research literature indicates that during adolescence, the energy and nutrient intakes needed to sustain physical changes vary widely, but that, in general, adolescents are not interested in nutrition or the benefits of good dietary practices in disease prevention (Pirouznia, 2001: 62).

Kolodinsky *et al.* (2007: 149) investigated the self-reported eating patterns of 200 university students, using an internet-based survey. The purpose of the study was to identify how closely the participants followed the Dietary Guidelines for Americans (2005) and to identify whether participants' eating habits were linked to their level of knowledge of the dietary guidelines. The study sample represented students enrolled in a university meal plan at residences. Food prepared away from home, including foods making up many university meal plans, have long been recognised to contain more energy, fat and added sugars with lower nutrient density (Guthrie, Lin & Frazao, 2002: 34). The results indicated that for fruit, milk and milk products, protein and whole grains increased knowledge were related to an increased likelihood of the dietary intake of the students meeting the dietary guidelines (Kolodinsky *et al.*, 2007: 149).

The risk for developing diseases such as heart disease, cancer, diabetes and osteoporosis could be lowered by having knowledge of nutrition and interest in healthy eating practices from a young age (Khan & Lipke, 1982: 583; Klemmer, 2002: 97; Von Ah *et al.*, 2004: 463; Malinauskas, Raedeke, Aeby, Smith & Dallas, 2006: 12; Gores, 2008: 9). Students not being aware of dietary guidelines such as reducing fat, sugar and salt intake and increasing fruit and dietary fibre intakes is a cause of concern in this regard (Parmenter *et al.*, 2000: 173). Individuals may not know which foods are the major contributors to fat intake, or are unable to identify food sources of dietary fibre (Parmenter, Waller & Wardle, 2000: 173). The lack of such knowledge is an obstacle to improving diets. One of the most important factors of health promotion is providing individuals with an ability to apply nutritional information, such as the dietary guidelines, into improved food choices (Buttriss, 1997: 1985S).

Little is known regarding the nutrition knowledge of South African learners. In a study by Venter and Winterbach (2010: 75) the knowledge of 17-year-old learners attending public schools in the northern suburbs of Cape Town, Western Cape, SA, regarding dietary fat was investigated. The learners scored poorly on the food sources of fatty acids and cholesterol and the relationship between fat and diseases of lifestyle (Venter & Winterbach, 2010: 80). The authors indicated that the subject Home Economics/Consumer Studies, which includes nutrition as part of the subject curriculum, could have a positive impact on learners' dietary behaviour. Unfortunately this subject is not compulsory for all learners. The subject Life Orientation, which is a compulsory subject in the current school curriculum, includes only a small component on nutrition (Venter & Winterbach, 2010: 82). In SA various studies indicate the nutritional intake of young adults, as represented by university students (Steyn, Senekal, Brits, Alberts, Mashego & Nel, 2000: 151; Vorster, Nell, Kumanyika & Tee, 2004: 44; Venter, 2006: 10). However, there is currently very little information available on the nutrition knowledge of South African university students and even less on their knowledge of food.

2.1.7.2 Food, cooking skills and nutrition education

In the USA, Home Economics was a compulsory subject in secondary schools through the 1960s, at least for girls (Lichtenstein & Ludwig, 2010: 1857). The underlying concept was that the future homemakers should be educated in the care and feeding of their families. It is believed that instruction in basic food preparation and meal planning skills need to be part of any long-term solution to improve the dietary quality of young adults (Steyn *et al.*, 2006: 5; Lichtenstein & Ludwig, 2010: 1857).

It is understood that very few dietary improvements have come about because individuals had decided to make changes for themselves. Factors that have influenced public health have rather been imposed by governments, economic climates and/or external events (Salmon, 1989: 34), which have also in some instances influenced the dietary practices of individuals. Food education is necessary to improve public health and to improve knowledge about the consequences of poor dietary choices which, for example, could lead to obesity. Societal demand for more knowledge and skills of food has been exacerbated by food activism globally (Kimura, 2011: 479).

Cooking is a life skill and unless children are taught cooking skills, the ability to eat and live healthily is difficult. To make informed choices about diet and health, young adults need to have a good understanding about food and nutrition (Stitt, 1996: 33). Stitt (1996: 33) therefore argues that all children should receive comprehensive food education while at school, beginning at the age of five years and continuing throughout their school career. Global interventions that teach the

preparation of quick and healthy meals are thus necessary to improve the dietary intake of young adults.

Many international studies suggest that nutrition education interventions may be an effective strategy to improve the nutrition knowledge of individuals with the aim to improve food choices (Matvienko *et al.*, 2001: 95). High school nutrition education is predominantly taught within a family and/or Home Economics/Consumer Studies class (Matvienko *et al.*, 2001: 99). Food experts working with young people emphasise that nutrition knowledge must be taught in a context of enjoying a variety of food and fulfilling individual students' daily activities as young adults are not necessarily interested in the short- and long-term dietary health outcomes. Producing quality food and showing how nutrient-dense food would contribute to 'looking good' and achieving optimum body shape and body weight are more productive (Fordyce-Voorham, 2011: 120). A study to determine the changes in knowledge, attitude and practice of healthy eating in children exposed to nutrition education over a six-week intervention period, indicated positive changes in the post-intervention mean scores of nutrition knowledge, attitudes and practice (Shariff, Buchari, Othman, Hashim, Ismail, Zubaidah, Kasim, Paim, Samah & Hussein, 2008: 119). A review undertaken by Steyn (2010: 62) on how nutrition knowledge influences the eating behaviour of adolescents, firmly supports the importance of nutrition education of children to promote healthy dietary practices and behaviours. Similarly, Saksvig, Gittelsohn, Harris, Hanely, Valente and Zinman (2005: 2395) provided evidence that increased exposure of seven- to 14-year-old Canadian learners to a culturally adapted one year school-based nutrition intervention programme is associated with an increase in knowledge about foods low in fat, overall health knowledge, dietary self-efficacy and meeting the dietary fibre intake recommendations.

A study by Seaman and Young (1996: 229) considered the nutrition knowledge of 80 adolescents to determine whether there was a difference between learners of both genders studying Home Economics and those who did not. Results from a short questionnaire (examining perceived and real nutrition knowledge and current healthy eating recommendations) and a seven-day food diary suggested that nutrition knowledge and food choice was better among those studying Home Economics. Participants studying Home Economics on average consumed less energy from fat and the energy derived from protein was slightly higher, whereas refined sugar intake was slightly lower.

It is expected that individuals attending university and enrolled for food science and nutrition courses would have improved food preparation skills. A study by Soliah *et al.* (2006: 729) focused on assessing the food preparation skills of young adult women (18 to 24 years) attending a medium-sized university in the southwestern region of the USA. In this study food preparation was

investigated from a specific skill level rather than from a general angle. The study was designed with three purposes in mind, namely to assess food preparation knowledge and practices of young women attending university and enrolled for food science and nutrition courses, to investigate the reason why they do not prepare certain foods and lastly to determine the frequency of dining in a restaurant, ordering take-away or home-delivered food. The results indicated that more than 90% of the participants knew how to prepare basic foods such as making the meat patties for hamburgers, mashed potatoes and scrambled eggs. However, less than a quarter knew how to make a quiche or a basic salad dressing. The two main reasons provided by the participants for being unable to prepare some basic foods and more complex dishes that required more than basic food skills, for example a meatloaf or a white sauce, were that they were never taught (i.e. knowledge barrier) and that they had no interest in learning (i.e. attitude barrier) (Soliah *et al.*, 2006: 729).

Japan has placed food education at the centre of its food policy in recent years. This is due to the realisation that there is an increase in heart disease, hypertension and diabetes among Japanese children. The government and health professionals have therefore placed emphasis on food and nutrition education (Kimura, 2011: 469). The place of food in the education system of any country should be assured (Stitt, 1996: 28). Unfortunately one of the major global challenges facing secondary and tertiary institutions is the outdated and poorly equipped facilities for teaching culinary skills (Canter *et al.*, 2007: 314; Yahia, Achkar, Abdallah & Rizk, 2008: 32). In Britain the teaching of food skills as part of the school curriculum seems to be in danger due to changes in their national curriculum. Education could be an effective vehicle for promoting food knowledge, changing attitudes, developing practical culinary skills, improving the acquisition of healthy eating habits and encouraging greater autonomy and responsibility for their own health status among young adults (Stitt, 1996: 27). Seeley, Wu and Caraher (2010: 10) reported on the impact of practical cooking initiatives in schools. The intervention initiative that was deemed the most effective by this review was a combination of theory-based food and environmental lessons, practical cooking sessions, parental involvement and provision of plant-based foods for school lunches.

In 2004 Peters *et al.* (2006: 15) conducted a study which involved first-year medical students (n=123) at the Nelson R Mandela School for Medicine in SA. The students spent the first six weeks of their academic year engaged in problem-based learning focusing on nutrition. The learning activity included active, personalised experiences such as analysing their own dietary intakes. The results indicated that 88.2% of the medical students had a greater awareness of their personal food intake two weeks after completing the learning activity, while 65.7% of the students reported an improvement in their general lifestyle (Peters *et al.*, 2006: 15f). Eighty-five percent of the students

also reported providing advice to family members and friends regarding diet and lifestyle-related issues (Peters *et al.*, 2006: 15g). The introduction of a nutrition intervention appeared to have impacted positively on the dietary awareness and lifestyles of the participants surveyed.

Oosthuizen *et al.* (2011: 141) conducted an investigation on the impact of the Nutrition Education Programme (NEP) on primary school learners, aged nine to 13 years, in an informal settlement in Gauteng, SA. The objectives of the NEP are to promote well-being and improve the nutrition knowledge amongst the group and to ascertain the nutrition knowledge retained after a period of nine months. Aspects included in the programme focused on the importance of physical activity, daily water consumption, colour associations with fruit and vegetables, the importance of breakfast and the role of fried foods, salt and oil. The Nutrition Education Tools (NET) included games and activity books as well as a nutrition knowledge questionnaire based on the South African FBDG, with illustrations where applicable. The programme was presented over nine hours, with seven hours for teaching (30 to 45 minutes at a time) and two hours of games (Oosthuizen *et al.*, 2011: 144). The results from this study showed that immediate improvement in nutrition knowledge from pre- to post-intervention was achieved and that a school-based setting is ideal in encouraging learning about nutrition amongst children. However, further studies though need to be carried out to determine the impact of the theory-based teaching on dietary practices. The authors emphasised that methods to encourage retention and revision of learnt work should be included in the programme. From this research it seems clear that nutrition education that could play a role in shaping food choices should be introduced at primary school level (Oosthuizen *et al.*, 2011: 141, 151). Although much work has been done to address the neglect within the South African education system, the right to basic and balanced nutrition has not yet been specified in South African legislation (Sloth-Nielsen, 2004:5; Vogel, 2008: 24).

Sauls *et al.* (2008: 132) investigated the nutrition and health-related practices at 100 randomly selected disadvantaged school districts in the Overberg and Metropole North in the Western Cape, SA. Only a small number of learners brought lunchboxes to school. The majority of learners bought items such as chips, carbonated beverages and sweets from the school tuck shop. Unhealthy diets (high in saturated fat and refined sugar) and physical inactivity were the top two health priorities found that needed attention across the areas. The school setting has the potential to influence learners' knowledge, attitudes and behaviours towards eating habits if managed effectively by educators and parents. As a result of the study by Sauls *et al.* (2008: 132), the HealthKick Programme was initiated in 2007 in the Western Cape, SA, with the following aims: improving the diet and physical activity of learners by means of teacher-based education, a parental responsibility and a healthy school environment promoting healthy eating and physical activity (Steyn *et al.*, 2009:

151). Key success factors, based on a comparison of 85 school-based interventions, appeared to be a nutrition-based curriculum offered at school by trained educators, a physical activity programme and parental participation (Steyn *et al.*, 2009: 145).

2.1.7.3 Gender as demographic characteristic

Even today cooking in the home seems to be relatively gender-based. Females are more involved in the purchasing and preparation of food as they are almost twice as likely to be responsible for these tasks (Larson *et al.*, 2006: 2004). Surveys suggest that women continue to take responsibility for food preparation in the household, even where the partner helps with the meal preparation (Dixey, 1996: 38). As a result of this responsibility women have been considered as being more progressive in their views about healthy diets (Dixey, 1996: 39). Women are said to be generally more aware of diet and health issues and to support dietary changes to a greater extent than men (Barker, Thompson & McClean, 1995: 654). Figueiredo, Jaime and Monteiro (2008: 1), for instance, found that in Sao Paulo, Brazil, fruit and vegetable intake in the adult population was higher among women. This is in correspondence with the findings of numerous studies that females consume more fruit and vegetables than males (Chourdakis, Tzellos, Papazisis, Toulis & Kouvelas, 2010: 724). Cooking skills for women must, however, not be seen as part of an attempt to recreate traditional gender roles, but rather that the empowerment of women in terms of nutrition knowledge is an essential goal of the global health promotion movement (Dixey, 1996: 39).

2.1.7.4 Convenience foods

Pre-prepared and convenience foods, also known as 'ready meals', have become a normal constituent within the eating patterns of families and children. In Canada the proportion of meals eaten away from home has almost doubled between 1978 and 1995 (Chenhall, 2010: 2). In SA one of the leading supermarket groups, serving the middle- and upper-income groups, has increased their offering of prepared foods with the focus on convenience (Shoprite Holdings, 2013).

Young adults want food that is convenient and available, quick and easy to prepare, foods that are practical for school lunches and foods that demand no clean-up (Fitzgerald *et al.*, 2010: 29). For students the importance of nutrition often disappears when convenience emerges as priority (Betts *et al.*, 1997: 74). A survey in England and Wales, using feedback from eight- and nine-year-old learners, confirmed the preference of fast foods at an early age. Visits to fast-food restaurants, even at this age, have become more frequent as opposed to the occasional and/or special event it used to be (Caraher *et al.*, 2004: 225).

2.1.7.5 Eating and/or living away from home

The years over which students attend university is considered a major period of change and a time of transition (Beerman, 1991: 343; Zizza *et al.*, 2001: 303; Klemmer, 2002: 97; Edwards & Meiselman, 2003: 21). First-year students become more self-reliant regarding food choices and preparation of meals as they generally move from home, where food is provided, to self-catering facilities (Wardle *et al.*, 1997: 448; Klemmer, 2002: 97). This period may be very stressful as young adults are faced with adapting to changes in academic workloads and their new-found freedom. These factors possibly increase barriers to maintaining or adopting a healthy lifestyle (Von Ah *et al.*, 2004: 463).

Young adults living independently need to gain knowledge of food and nutrition and food preparation skills as they plan, shop, prepare and cook their own food. They should therefore have the opportunity to acquire information, knowledge and skills for meal preparation (Fordyce-Voorham, 2011: 118). However, research indicates that increased independence seems to be related to less healthy eating patterns (Fitzgerald *et al.*, 2010: 295). Even though each generation does less cooking at home than the previous one, food choices still make a major contribution to health status (Soliah *et al.*, 2006: 729).

A study conducted by Papadaki *et al.* (2007: 169) in Greece found that students living at home did not show major changes in their eating habits when starting university. However, students living away from home, in residences or in own accommodation, decreased their weekly intake of fresh fruit, vegetables, oily fish, seafood, pulses and olive oil and increased their intake of sugar, alcohol and fast foods. American-based studies suggest that students enrolled in institutional meal plans at residences are potentially exposed to foods with high energy, fat and sugar content and low nutrient density (Kolodinsky *et al.*, 2007: 1409; Wengreen & Moncur, 2009: 32). When eating away from home, both food choice and nutritional value are affected as these meals are generally higher in fat and cholesterol (Serdula, Coates, Byers, Simoes, Mokdad & Subar, 1995: 236). Home-prepared meals, in general, are higher in several nutrients including dietary fibre, calcium, folate, iron and vitamins B6, B12, C and E as it is associated with increased fruit and vegetable intake, less fried foods and less soft drink consumption (Gillman 2000, cited in Soliah *et al.*, 2006: 729).

In Senekal's (1988: 217) study with first-year female students at SU, the results indicated that the higher weight gain group within the first year of study was more inclined to experience difficulty in adapting to the eating pattern in the residences than those who experienced no significant weight gain or slight weight gain. If the amount of food served at mealtimes was more than the participants were used to before and/or if more sweetened and fatty meals were served, it could have resulted

in an increase in energy intake. The amount and type of food served in the residences may have contributed to the weight gain after only three months of study (Senekal, 1988: 221).

2.1.7.6 Macro-environment

The dietary and individual risk behaviour of individuals influences their nutritional status, health, growth and development. However, the behaviour of individuals does not occur in a vacuum but within a cultural, economic, social and political context which can either exacerbate or promote health (WHO, 2003). The environment that people live in has been highlighted as possibly worsening or improving their health (Kruger, Puoane, Senekal & Van der Merwe, 2005: 497). In SA, almost a third of households live in traditional and informal dwellings, with only about a third of these housing structures having piped water (Steyn *et al.*, 2006: 11). For the majority of black populations there are two scenarios: On the one hand there is a large rural population, the majority of whom survive on an income of less than R1 000.00 per family per month. These families usually still follow their traditional way of living. On the other hand, there is a growing urban population, many of whom are faced with many new challenges and problems, such as living in an informal settlement with an extended family (Steyn, 2006: 33).

Urbanisation in the Third World has a direct impact on the nature of food supply as households no longer rely on home-grown produce. Urban communities have changed their lifestyles. Mothers are working outside and further away from home, earning higher monetary incomes with family members being exposed to marketing strategies by food companies. The result may be that urban communities (previously rural) are changing their diet towards that of affluent (Westernised) societies. The principal component of a country's diet tends to relate to the nation's level of affluence. As societies become more affluent, their most prominent dietary feature is a fall in the consumption of starchy foods and an increase in the consumption of animal foods which could also be associated with an increase in fat consumption (Garrow & James, 1993: 8).

Poverty is universally accepted as a fundamental cause of undernutrition, and it is a serious problem in SA (Love, Maunder, Green, Ross, Smale-Lovely & Charlton, 2001: 17). Inadequate income usually limits both the quantity and the variety of food consumed. While a low level of education is often associated with a lack of consumer skills in the general population, students lack consumer skills such as budgeting in order to optimally utilise available resources in making food choices. Food insecurity in SA has been associated with low socio-economic status as well as an increase in household size (Oldewage-Theron, Dicks, Selepe, Grobler, Van Rensburg, Hanekom & Vorster, 2000: 118). Even though higher socio-economic status does not necessarily translate to increased

expenditure and quality of dietary intake, it does provide greater availability of food (Sherperd, Paisley, Sparks, Anderson, Eley & Lean, 1996: 20).

The macro-environment in terms of influences impacting on food choices, for example the media, budgetary constraints and tuck shops and kiosks, need to be considered (Steyn, 2010: 62; Brown, 2011: 5; Kruger *et al.*, 2005: 497). Media resources like the internet, used by the majority of young adults, may be overwhelming when too many different recipes using unfamiliar terminology are offered (Fordyce-Voorham, 2011: 119).

Over the last four decades television has become part of the daily life of both urban and rural households. This has exposed children to the effect of advertising, which often portrays foods and drinks of poor nutritional value as part of a desirable lifestyle. Many of these advertisements encourage unhealthy eating practices such as snacking on unhealthy food items (Steyn, 2006: 33). The association between food marketing exposure and adolescents' food choices were investigated by Scully, Wakefield, Niven, Chapman, Crawford, Pratt, Baur, Flood and Morley (2012: 9). Participants in the study were between the ages of 12 and 17 years and were asked to complete an internet-based self-reported questionnaire. The findings indicated that adolescents are routinely exposed to food marketing messages and that the cumulative exposure of these messages may be linked to poor food choices and eating behaviour (Scully *et al.*, 2012: 3). Evidence exists to support the use of both general (for example the FGP) and tailored (i.e. based on the individual's current knowledge structure) messages to modify health-related knowledge, attitudes and behaviours (Brinberg, Axelson & Price, 2000: 36). Investigating motives behind food choices can help develop tailored messages and health promotion campaigns for specific market segments, such as young adults (Milosevic, Zezelj, Gorton & Barjolle, 2012: 205).

2.1.7.7 Level of post-school education

In a study by Georgiou, Betts, Hoerr, Keim, Peters, Stewart and Voichick (1997: 759) the health habits and food choices of young adults were compared. Three distinct groups, namely university students, graduates and non-students, were used. The study, which comprised 1 338 participants aged 18 to 24 years, indicated that non-students generally had a higher body weight compared to that of university students and graduates. According to the data gained through a FFQ university students and graduates consumed more grain foods, dietary fibre, fruit and vegetables, low-fat milk and milk products and meats than non-students (Georgiou *et al.*, 1997: 754). It was also reported that non-students were less likely to apply messages promoting weight control, smoking cessation and observance of the Dietary Guidelines for Americans (Georgiou *et al.*, 1997: 759).

Healthy eating habits are considered a priority in terms of the factors influencing food choices by people with tertiary education, whereas price is a more important consideration for individuals with only primary education. Although price, taste and habit are considered barriers to changing eating behaviours, these influences may be negated by knowledge (Parmenter *et al.*, 2000: 172).

2.1.7.8 Family influence

Mothers and caretakers are the primary role models and teachers of cooking and food preparation skills. This is found across all ages and socio-economic groups, followed by school-based education (Chenhall, 2010: 2). Family influence and household rules, such as restrictions on consuming unhealthy snack foods, have been found to relate to increased daily servings of fruit and vegetables (Zabinski, Daly, Norman, Rupp, Calfas, Sallis & Patrick, 2006: 814; Blissett, 2011: 830).

Food choices during childhood and adolescence are important for the development of lifelong dietary habits and may have long-term health implications (Coulson, Eiser & Eiser, 1998: 81). Parents and caretakers also may not realise the importance of nutrient-rich food for the purpose of brain development and learning. This may be due to choosing take-away or pre-prepared foods low in essential nutrients (Vogel, 2008: 25) or a lack of knowledge in implementing nutrition tools and healthy food and eating practices.

Eating as a family during adolescence may have a positive influence on the dietary choices of young adults (Larson, Neumark-Sztainer, Hannon & Story, 2007: 1502). These findings are supported by studies conducted by Fitzgerald *et al.* (2010: 293) and Fordyce-Voorham (2011: 118). Fitzgerald *et al.* (2010: 293) investigated the factors that influence the food choice of children and adolescents. Many participants identified autonomy, sport involvement and parents' work schedules as barriers to structured mealtimes.

It is important that children should be involved in family decision making related to meal and menu planning, food shopping, preparing and cooking family meals (Fordyce-Voorham, 2011: 118). Parents and caretakers may be resistant to food preparation tasks that involve children as it often takes longer and are messier. Subsequently many children, such as in the UK, may experience their first time cooking and trying of new foods at school. For this reason, schools need to expose young people to positive food tasting and cooking experiences (Fordyce-Voorham, 2011: 120).

2.1.7.9 Health views

Barker *et al.* (1995: 649) determined the attitudes of 592 adults, aged 16 to 64 years, towards fat and dietary intake in Ireland. Results from this study indicated that females are generally more

aware of diet and health issues and endorsed dietary changes to a greater degree than males. Females perceived fat as more health-threatening and dietary fibre as more health-promoting than did males (Barker *et al.*, 1995: 654). An attitude of cautiousness against fat in women was linked to a reduced intake of potato chips, butter and sausages, whereas a fibre-loving attitude was associated with an increased dietary fibre intake, generally through wholegrain bread and breakfast cereal consumption (Barker *et al.*, 1995: 649).

Young adults do not always portray an awareness of the genetic and environmental factors as well as lifestyle patterns conducive to the development of obesity and other chronic diseases (Senekal, Steyn & Nel, 2003: 114) that may develop later in life. The reason for this could be that young people do not perceive themselves as being vulnerable to disease at this age (Lawrence & Schank, 1993: 534). There is considerable evidence indicating that people who follow healthy dietary patterns are at a reduced risk of developing a range of chronic diseases of lifestyle. Diets rich in fruit and vegetables, wholegrain and dietary fibre are generally associated with lower risk (Robinson, 2002: 83). Evidence suggests that overweight children are facing an increased risk of chronic diseases later in their lives (Sizer & Whitney, 2011: 543).

2.1.8 Problems and concerns associated with eating practices and dietary behaviour of young adults

Globally, food purchasing and consumption data confirm that food choice and consumption patterns have undergone changes due to, among other reasons, an increase in convenience foods being purchased (Chenhall, 2010: 3). Various problems and concerns have been identified within the complex food environment which influence the eating practices and dietary behaviour of individuals. In the following part of the literature review four concerns are addressed.

2.1.8.1 Lack of food preparation skills

Learners rated food preparation skills in addition to effort as important factors when evaluating potential food consumption options (Holsten, Deatrick, Kumanyika, Pinto-Martin & Compher, 2012: 64). Examples mentioned by the participants in support included the following: sleeping instead of taking the same time to eat or prepare breakfast, eating at a fast-food restaurant because the food is served quickly and choosing foods that can be prepared quickly when cooking is required (Neumark-Sztainer, Story, Perry & Casey, 1999: 929). Participants in a study by Neumark-Sztainer *et al.* (1999: 929) indicated that even when time is available in the household, they would not choose to spend it on food preparation and would still rather consume food that is conveniently available. In previous generations most 'teaching' occurred through observation and participation, but as family meals are no longer the norm in many households these opportunities are no longer part of

daily living patterns (Chenhall, 2010: 10). The percentage of daily energy consumed from home food sources and time spent in food preparation decreased significantly for all socio-economic groups between 1965 to 1966 and 2007 to 2008. Between 2007 and 2008 foods prepared at home accounted for 65% to 72% of the daily energy intake, with 54% to 57% of participants preparing food at home (Smith *et al.*, 2013: 45). Related to this is the potential lack of transference of basic or 'from scratch' cooking and food preparation skills from parents and caretakers to children and adolescents. Self-perceived lack of food preparation skills and cooking has been identified as barriers to healthy food practices (Chenhall, 2010: 3).

A study focusing on food preparation behaviours, cooking skills, resources for preparing foods and associations with diet quality among a large group (n = 1 710) of young adults (18 to 23 years of age) was conducted in Minnesota, USA. Results from this study indicated that a minority of the participants pointed out that perceived inadequacy in the use of equipment/appliances for food preparation, for example knives for chopping, and inadequate food selection were barriers to the preparation of healthy meals. Lack of cooking skills, budgetary constraints and lack of available time for food preparation were reported as being the barriers to healthy eating. Most of the food preparation behaviours that were investigated in this study (i.e. buying fresh vegetables, writing a shopping list, preparing a green salad, making a dinner for themselves or for two or more people) were not performed by the majority of the young adults (Larson *et al.*, 2006: 2004).

Franciscy, McArthur and Holbert (2004: 29) surveyed male university students to assess their attitudes and behaviours regarding food preparation. The three most common food preparation methods reported were microwaving, toasting and grilling. The average length of time required to prepare breakfast was seven minutes, lunch 11 minutes and dinner in 26 minutes, generally utilising the above reported methods for the meal preparation. However, it should be noted that the majority of the male participants indicated wanting to learn more about food preparation.

Leal *et al.* (2011: 283) investigated the cooking habits and skills of 390 Portuguese adolescents and their dietary intake in relation to the Mediterranean diet and its adherence. Results from the study indicated that 57% of the participants reported that they had never cooked vegetables. Those who did not know how to cook, stated that the main reasons were that they had someone to cook for them regularly (47%) or had no interest in doing so (35%). As with many other studies, a positive outcome was that most of the participants wanted to learn how to improve their cooking skills. They wanted to improve these skills by learning from family members, peers or by taking culinary courses (Leal *et al.*, 2011: 284). Acquiring cooking skills may have a positive impact on supporting independent healthy food habits as indicated earlier (section 2.1.7.2).

Dombrowski (1990, cited in Porter, 2000: 53) developed a level descriptor termed the Functional Needs Assessment (FNA) that can be used to assess the level of food preparation skills of an individual. The five FNA levels are: i) Pre-basic, which implies that an individual can identify utensils used in food preparation, appliances and basic foods and are able to shop for basic food types; ii) Basic, which means the individual can identify the use of utensils, use basic kitchen appliances and is able to prepare a simple, uncooked meal; iii) Pre-intermediate, which refers to an individual who is able to use appropriate utensils and amounts of food, who can identify and demonstrate the use of kitchen utensils and who knows how to cook simple foods and clean up; iv) Intermediate, which implies that an individual can demonstrate the use of kitchen appliances, can store food properly and clean up; and v) Advanced, which refers to the individual who can compile and follow a shopping list, who is able to follow steps in food preparation and who is able to plan and prepare a well-balanced meal, representing the food groups. The FNA promotes skills development along with healthier eating. Considering the aforementioned FNA levels, where the consecutive levels build on knowledge and skills acquired on a previous level, pre-intermediate food skills are necessary for an individual to be able to provide basic cooked food whereas an advanced level is necessary to provide a well-balanced meal.

2.1.8.2 Meal skipping and snacking

Studies involving children and adolescents indicate that there has been an increase in the practice of snacking. However, little is known about changes in the snacking behaviour of young adults (Zizza *et al.*, 2001: 303). According to an analysis by the USDA covering two decades ending in 1995, snacking, in general, increased from less than once a day in 1987-1988 to 1.6 times a day in 1995 (Lin *et al.*, 1998: 2).

The USDA's nationally representative surveys from 1977-1978 to 1994-1996 studied snacking among individuals (n = 8 493) aged 19 to 29 years. Results from the snack food survey indicated that snacking prevalence increased from 77% to 84% between 1977-1978 and 1994-1996 among young adults in the USA. The nutritional contribution of snacks to total daily energy consumed per snacking occasion increased by 26% and the number of snacks per day increased by 14%. The increase in total energy and energy density derived from snacks may be directly linked to the obesity epidemic in the USA. The British Health and Lifestyle Survey also found similar trends. In Great Britain 61% to 65% of British young adults between the ages of 18 and 29 years consumed one or two snacks daily with 17% to 23% consuming more than two (Anderson, MacIntyre & West, 1993: 158). The main examples of food items contributing to the high energy intake from snacking include salty snack foods, desserts and alcoholic beverages (Zizza *et al.*, 2001: 306).

It is also necessary to consider the impact of sweetened and alcoholic beverages consumed by young adults (Zizza *et al.*, 2001: 303). High consumption of soft drinks and other sugary drinks are associated with a number of health problems, including overweight and obesity, type 2 diabetes, osteoporosis and dental caries (Rangan, Hector, Louie, Food & Gill, 2009: 3). In Australia, soft drinks are the most commonly consumed sugary beverage and have been singled out for specific attention as a target of obesity prevention programmes. Soft drinks are well-known, readily available and marketed extensively, especially to adolescents. They have no nutritional value other than sugar and fluid, and are identified in the Australian Guide to Healthy Eating as an 'extra' food – one that should be consumed only occasionally and in small amounts (Kellet, Smith & Schmerlaib, 1998: 14).

Research further suggests that females, in general, have healthier eating habits in terms of breakfast intake and meal frequency (Chourdakis *et al.*, 2010: 724). DeBate *et al.* (2001: 828) conducted a study amongst students in the USA and found that 90.2% of the participants always or often consumed dinner and 81% lunch. Forty-four percent indicated that they never or rarely ate breakfast and 36.6% that they always or often consumed breakfast. The consumption of a nutritious breakfast can play a vital role in an individual's health. Nutrients not included in breakfast are often not made up at lunch or dinner, but will rather be left out completely that day. Research suggests that younger children who do not eat breakfast are more likely to be overweight, snack on sweet and/or fatty food products, perform poorly in tasks requiring concentration, have shorter attention spans and achieve lower test scores. The association between poor food intake and academic progress has been a highly regarded factor in the USA where the government funds several school-based breakfast programmes (Sizer & Whitney, 2011: 545). Skipping meals may contribute to the lack of fruit and vegetable intake seen in university students' diets (Science Daily, 2011).

Research studies suggest that an increase in family meal frequency and increased involvement in planning and preparation of meals during adolescence may lead to the consumption of breakfast in addition to higher intakes of fruit, vegetables and nutrients as well as lower intakes of soft drinks during adulthood (Larson *et al.*, 2007: 1502). Children typically want to sleep as late as possible without being late for school on a weekday. This time pressure, combined with a taste preference for sweet foods, a low desire to prepare foods and a lack of parental presence may lead to children selecting pre-packaged, higher-energy foods, for example breakfast pastries, or to skip breakfast altogether. Furthermore adolescents often arrive home from school feeling hungry and lack the desire to prepare foods because of competing activities like homework or socialising with friends. Since parents are not always around due to work responsibilities, these adolescents may select

higher-energy snacks when available, such as biscuits and chips. Parents should be encouraged to make healthy snacks available, while children and students need to be encouraged to choose healthy snacks, such as low-fat yoghurts and fresh fruit (Holsten *et al.*, 2012: 72).

The majority (66.7%) of the participants in the study conducted by Du Toit (2004: 197) at the former Cape Technikon, Western Cape, SA, reported consuming snacks in the morning between breakfast and lunch times. Fifty percent of the participants reported usually consuming snacks and 16.7% of them indicated that they sometimes consumed snacks. About 23% of the participants who reported consuming snacks reported consuming them every day and 42.5% reported consuming snacks three to four days a week. Furthermore, almost half of the participants reported that they consumed snacks in the afternoon between lunch and supper times. Forty percent reported consuming snacks in the evening after supper and before going to bed (Du Toit, 2004: 198). The consumption of snacks can have a positive or negative effect on the nutritional status of the participants, depending on the choice of snack items (Du Toit, 2004: 200). Food items consumed most frequently by students as snacks included popcorn, crackers, crisps, carbonated beverages, chocolates, biscuits and sweets (Huang, Song, Schemmel & Hoër, 1994: 1143; Du Toit, 2004: 200). These examples represent high-energy food items with low nutrient density. Furthermore, the intake of snacks on a weekend day also tends to be more frequent compared to a week day (Du Toit, 2004: 206). Moreover, only 10% of the participants indicated consuming all three meals daily on five to six days per week, whereas 38.8% indicated skipping at least one of the three meals daily on five to six days per week. Lunch was the meal skipped most often with only 29.2% consuming it on a daily basis. Breakfast was consumed more often with 39.6% of the participants consuming it on a daily basis. It may be that the failure to meet the number of food group servings as recommended by the Daily Food Group Guide was due to the large percentage of participants who skipped meals (Du Toit, 2004: 233).

In a study conducted by Senekal (1988: 169) at SU, Western Cape, SA, eating between meals contributed approximately one third of the total energy intake of first year-female students. The high energy intake derived from foods eaten between meals could indicate that these students are already prone to snacking between meals when they arrive at the tertiary education institution (Senekal, 1988: 169). Sixty-nine percent of the first-year female students from Senekal's (1988: 170) study indicated that they often ate between meals. This habit could be stimulated by the increased availability of food, increased socialisation, adaptation problems and less parental control over activities as often experienced during the first months at university. After a period of three months the results of this study indicated that a slightly higher increase in energy consumed between meals occurred in the highest weight gain group, possibly because of an increased consumption of food

items such as rusks, coffee and tea (with added milk and sugar), sweets, chocolates, cake and take-away foods (Senekal, 1988: 176).

2.1.8.3 Weight management

International studies show that overweight and obesity are becoming one of the biggest health threats facing the world's population (Rosado, Arellano, Montemayor, Garcia & Mdel, 2008: 28). On the other hand underweight is also becoming a public health threat in developing and underdeveloped countries such as Turkey (Unnithan & Syamakumari, 2008: 2). The prevalence of underweight in South African adults is far lower than the prevalence of overweight and obesity in both genders (Steyn *et al.*, 2006: 21). The alarming obesity statistics may be due to the shift in nutritional and lifestyle habits. An increased popularity in fast-food and soft drink consumption, a more sedentary lifestyle which includes increased television watching and computer use have all become common trends adopted by children in developed and developing countries worldwide (Unnithan & Syamakumari, 2008: 2). In SA overweight and obesity are linked to an excessive dietary intake and that more than half of the population are sedentary at work and during their leisure time (Kruger *et al.*, 2005: 491; Steyn *et al.*, 2006: 5).

In terms of underweight, it is young adult women aged 18 to 30 years who comprise the largest percentage of this body weight class. When thinness takes on heightened importance, individuals begin to view the normal, healthy body as too fat, i.e. their body image becomes distorted (Sizer & Whitney, 2011: 363). The media convey messages that to be happy, beautiful and desirable, the individual must first be thin and in the search for identity adolescent girls are particularly vulnerable to such messages (Sizer & Whitney, 2011: 364).

In the study by Du Toit (2004: 218), the majority (80%) of the participants described their body weight status as optimal, although only 68.5% of the 54 respondents who were weighed and measured had an optimal BMI. Only one participant considered herself as underweight, although five participants were underweight. Seven described themselves as overweight, while 12 of the participants were overweight or obese. These results are in contrast with findings of studies conducted in the USA where almost 70% of female students thought of themselves as slightly overweight, even though only 39% could be classified as such based on their reported weights and skinfold measurements (Miller, Coffman & Linke, 1980: 564). In SA few overweight black women view themselves as overweight and some may associate thinness with illness (Kruger *et al.*, 2005: 491). It may be explained by the fact that black women are not under the same cultural pressure as white women to value thinness. These obesity-tolerant attitudes could protect black female

adolescents and young women from developing eating disorders (Senekal, Steyn, Mashego & Nel, 2001: 45).

Worldwide women are traditionally seen as the caregivers and providers of food who buy, prepares and serve food either in the home or at work (Dixey, 1996: 36). Few healthy eating or nutrition education projects, however, acknowledge the complexity of women's relationship with food. Furthermore there are limited programmes aimed at exploring the wider issues of preventing problems with food, for example eating disorders (Dixey, 1996: 37). Compulsive eating, self-starvation, bingeing and purging, using laxatives, skipping breakfast or monitoring one's intake are strategies individuals often use to deal with their weight and body shape/image. Malinauskas *et al.* (2006: 11) suggest that health educators could and should promote education and intervention strategies for young people that encourage appropriate and safe weight control practices during adolescence and the early adult years (Malinauskas *et al.*, 2006: 11; Austin, Kim, Wiecha, Troped, Feldman & Peterson, 2007: 865). In a study by Cilliers, Senekal and Kunneke (2007: 240) it was noted that normal-weight students as well as students who are already underweight often aim to lose weight. It is important that weight loss goals are realistic and that acceptable weight loss methods be used to prevent weight cycling and possible further weight loss (Cilliers *et al.*, 2007: 240). When designing weight management interventions for young adults, gender specificity may not be as important as considering that the barrier for one student may be an enabler for another. Individually focused interventions must be designed and implemented (Greaney, Less, White, Dayton, Riebe, Blissmer, Shoff, Walsh & Greene, 2009: 286) and should be based on health education, dietary behaviour changes, community participation and proper monitoring and evaluation (Kruger *et al.*, 2005: 497).

Weight gain and an increase in overweight and obesity amongst university students raise serious health concerns, such as for cardiovascular disease and diabetes (Greene *et al.*, 2011: 394). Young adults attending universities are more vulnerable to weight gain than the general population, especially during their first year at university, often due to increased independence with regard to food choice, which could be related to food items purchased and the method of food preparation (Wardle *et al.*, 1997: 448; Klemmer, 2002: 97; Strong *et al.*, 2008: 1708).

Wengreen and Moncur (2009: 32) investigated changes in weight, dietary intake and physical activity amongst first-year university students in the western region of the USA. In this study participants were asked to complete a questionnaire that included information about the aforementioned factors during the last six months of secondary school and again during their first semester at university. The authors concluded that almost 25% of the student participants gained a significant

amount of weight during their first semester at university. Those participants who gained more than five percent in body weight reported less physical activity during their time at university compared to at school. These researchers therefore support the implementation of education strategies to help young adults with their food choices and lifestyle habits during this time (Wengreen & Moncur, 2009: 32).

Senekal *et al.* (2003: 109) investigated factors associated with the self-reported weight status of economically active adults from four major ethnic groups in SA. A large proportion of the respondents (n = 554) were overweight and obese, particularly black women and women of mixed race. The mean BMIs of the women were also significantly higher than those of males for the same ethnic groups. In contrast, the BMIs for women were more balanced between the genders for the Asian and white ethnic groups (Senekal & Steyn, 2003: 111). Factors associated with weight status were employment status, smoking, meal patterns, high-fat food consumption and alcohol intake (Senekal *et al.*, 2003: 112).

A study by Racette *et al.* (2005: 245) investigated the body weight, exercise and dietary patterns of 764 university students. Students were assessed during their first year and again during their last year of study to determine any changes in their body weight and dietary patterns. At the beginning of their first year at university, 29% of the participants reported not exercising, 70% ate fewer than five fruits and vegetables daily and more than 50% ate fried or high-fat fast foods at least three times during the previous week. By the end of their time at university, 70% of the 290 participants who were reassessed had gained an average of 3.6 kilogram (kg) in body weight. When considering student life, the convenience of having access to less healthy foods and the affordability of these food items acted as barriers to manage a healthy body weight (Greaney *et al.*, 2009: 281).

Senekal (1988: 15) conducted a study to identify the possible factors related to or contributing to the weight gain experienced by first-year female students in residences at SU as weight gain experienced during the first three months at university, even though not substantial in some instances, could be the beginning of a never-ending pattern of weight gain and dieting (Senekal, 1988: 162). Results from the study indicated that after three months at university, increased energy intake during meals could possibly be attributed to increased consumption of desserts, sweetened vegetables, oily food and bread (Senekal, 1988: 176). A study by Okeyo (2009: 97) among university students at the University of Fort Hare in Limpopo, SA, also indicated an overconsumption of sweets and sugar, fat and oils in addition to low intakes of milk and milk products and fruit and vegetables. The participants indicated a meal pattern of three meals per day with the most frequently skipped meal being breakfast. Foods consumed on a daily basis by the participants included margarine, oils, fats,

sugar, bread, cereal and salt. These dietary habits contributed to overweight as well as a future risk for CDL. In terms of the level of physical activity (as measured by participation in organised sport), Senekal (1988:50) indicated a decrease amongst first-year female students in the first three months of their first academic year. Because the weight gain experienced by first-year female students from SU seemed to occur largely over a short period of two to four months, it was postulated that a sudden decrease in physical activity could play an important causative role in the weight gain. A study by Ganasegeran, Al-Dubai, Qureshi, Al-Abed, Rizal and Aljunid (2012: 48) at a Malaysian university, among 132 students, indicated that the eating habit scores were particularly low among younger students (18 to 22 years) who engage in smoking, alcohol consumption and less physical activity. From the Senekal (1988: 216) study homesickness was positively associated with the weight gain as the results indicated that the participants in the higher weight gain group were more inclined to eat due to homesickness than those participants who experienced no significant weight gain.

2.1.8.4 Dietary consumption

The intake of fat, especially food items high in saturated fatty acids, is positively associated with cardiovascular disease, obesity and certain types of cancer. For the prevention of CDL South Africans are encouraged to lower their fat intake from animal sources and non-dairy creamers (Wolmarans & Oosthuizen, 2001: 548). Furthermore, insufficient fruit and vegetable intake is considered one of ten major factors behind the international burden of disease. Fruit and vegetables are important contributors to a healthy diet as they provide micronutrients, dietary fibre and other components with functional properties (Figueiredo *et al.*, 2008: 2). An insufficient fruit and vegetable intake and high fat intake are considered among the major dietary concerns of young adults (Kolodinsky *et al.*, 2007: 1409; Figueiredo *et al.*, 2008: 2).

(i) Fat consumption

Changes in the dietary pattern of South Africans have been attributed to urbanisation and acculturation. Urbanisation has resulted in a decrease in the consumption of dietary staples and an increase in the consumption of fat and sugar (Ntuli, 2001: iv). Anding *et al.* (2001: 167) found that even if university students in the USA followed diets that were nutritionally adequate, they exceeded consumption recommendations for fat, sodium and sugar. The typical food intakes of many young adults are reported to consist of high-fat products. Examples of such foods consumed include pizza, fried chips, popcorn and confectionary foods such as biscuits and cakes (Pirouznia, 2001: 62; Venter & Winterbach, 2010: 254). The USDA's Dietary Guidelines for Americans recommend that a diet with moderate energy provision, low in saturated fat and cholesterol and moderate in total fat should be chosen (Sizer & Whitey, 2011: 36). The South African FBDG recommend to "eat fats sparingly" and to "eat food and drinks containing sugar sparingly and not

between meals” (Vorster *et al.*, 2001: 53). It is suggested that all South Africans over the age of two years should receive no more than 30% of their total energy from fat. In addition an increase in the intake of omega 3 fatty acids and mono-unsaturated fatty acids and less trans-fatty acids should be promoted (Vorster *et al.*, 2004: 44).

In a study by Venter and Winterbach (2010: 78) 168 mid-adolescent learners between the ages of 17 and 19 years attending public schools in the Durbanville/Bellville area, Western Cape, SA, completed a dietary fat frequency questionnaire. Results revealed that 36% of the participants consumed a diet high in fat, 14% a diet fairly high in fat and 12% the typical Western diet characterised by high levels of saturated fat. The remaining participants (39%) indicated that they followed a diet that included low-fat choices or a diet with a desirably low fat content. Approximately half of the participants indicated that they consumed eggs (46%), fried chicken with skin (45%) and red meat (41%), while just more than a quarter (27%) indicated cold cuts, lunch meats, ham, salad dressings and mayonnaise consumption once or twice a week. Food items contributing most to the fat intake of the participants were margarine or butter, followed by full-cream milk and cheese, which were consumed five or more times per week (Venter & Winterbach, 2010: 78).

In the study conducted by Du Toit (2004: 186), more than half (53.3%) of the participants fried food items in oil or margarine when preparing food. The mean fat intake in this study was 62.7 grams (g) (providing for 25% of the total energy intake) with the saturated fat contribution being just below 10% and the mono- and poly-unsaturated fats accounting for 9.8% and 8.3% of the daily energy intake respectively (Du Toit, 2004: 205).

The dietary fat intake and the nutritional status of the South African population are evident in the prevalence of overweight and obesity in all ethnic groups in especially urban areas (Department of Health, 2000). Changes in dietary patterns are associated with the process of urbanisation and linked to a shift from a traditional eating pattern to a more Westernised diet. The traditional food of rural Blacks is generally low in fat and high in unrefined carbohydrate and dietary fibre. With the process of urbanisation, however, there is an increased consumption of foods containing fat, animal protein, salt and sugar as well as a lower consumption of fibre-containing foods (Segal & Walker, 1986: 185). In a study by Bourne, Langenhoven, Steyn, Jooste, Laubscher and Van der Vyver (1993: 241) to assess the nutrient intake in the urban African population in the Cape Peninsula, SA, total fat intake among the adult population contributed 27% of total energy intake, which is higher than what is traditionally consumed in rural areas.

Vorster, Nell and Kumanyika (2007: 44) posed the question whether in developing countries, such as SA, dietary recommendations to consumers should not be more explicit, specific and detailed regarding fat consumption. The authors concluded that both consumers as well as the food industry as a whole should be given more nutrition information and guidance. The food industry should be encouraged to produce healthier, but still affordable food items to widen consumer food choices (Vorster *et al.*, 2007: 89), particularly in relation to expanding the lower fat food choices.

(ii) Fruit and vegetable consumption

Evidence suggests that a diet high in fruit and vegetables is associated with reduced risk of cancers of the oesophagus, stomach and lungs (Love & Sayed, 2001: S4; Blissett, 2011: 826), obesity and related chronic diseases (Padrao, Laszczynska, Silva-Matos, Damascene & Lunet, 2012: 428). However, studies have shown that young adults do not consume the recommended amount of five portions (400 g) of fruit and vegetables daily (Love & Sayed, 2001: 24; Peltzer, 2004: 25; Doyle-Francis, 2008: 424). The five-a-day concept, recognised as a national priority in SA, stresses the importance of increasing fruit and vegetable consumption. It also emphasises that a variety and different forms of these plant foods such as raw, processed, boiled, frozen, dried or juiced should be consumed (Robinson, 2002: 83). The aim of this campaign is to raise awareness of general health (Doyle-Francis, 2008: 242). This initiative is further supported by the South African Department of Health and the South African FBDG (Vorster *et al.*, 2001: S31).

In the study by Neumark-Sztainer *et al.* (1999: 929) adolescent participants were asked what factors deter them to consume more fruit and vegetables, more milk and milk products and fewer high-fat foods. The responses provided indicated that healthy eating was low on their list of priorities, that healthy eating and the effect that it may have on health later in life will be dealt with at a later stage and that school, friends and family were deemed more important.

The 2008 England Health Survey indicated that in general women consumed more fruit and vegetables than men (Doyle-Francis, 2008: 245). According to a USA-based telephone dietary intake survey using a FFQ with 23 669 participating adults in 16 USA states, men also generally consumed fewer servings of fruit and vegetables per day (3.3 servings) than women (3.7 servings). Only 20% of the participants consumed the recommended five or more daily servings of fruit and vegetables (Serdula *et al.*, 1995: 236). However, in a study conducted at Oregon State University which surveyed the eating habits of 582 university students, a majority of which were first-year students, obtained contrasting results. The male students had about five servings of fruit and vegetables per week, slightly higher than that of the female students who self-reported eating about four servings of fruit and vegetables per week (Science Daily, 2011). From the 2008 England Health Survey by

Doyle-Francis (2008: 244) it was also observed that the consumption of fruit and vegetables increased during mid-adulthood up to the age of 64 years, after which it declined. Consumption was almost double at the ages of 55 to 64 years when compared to the younger adults, aged 16 to 24 years (Doyle-Francis, 2008: 244). The biggest concern identified in the 2008 England Health Survey, however, was that the consumption of these foods was lower than in the previous year. The data also indicated that consumption of fruit and vegetables among children tended to be lower compared to the previous year (Doyle-Francis, 2008: 245).

A sample of 16 084 school children aged 13 to 15 years from five Southeast Asian countries, namely India, Indonesia, Myanmar, Sri Lanka and Thailand, took part in a study to assess the prevalence of fruit and vegetable consumption among adolescents (Peltzer & Pengpid, 2012: 3575). Three quarters of the participants consumed less than the recommended five daily servings of fruit and/or vegetables. Twenty-eight percent of the participants reported consuming less than one fruit serving per day and 13.8% indicated consuming less than one vegetable serving per day. The mean number of fruits consumed per day was 1.3 servings and for vegetables 1.9 servings, both far below the consumption recommendation (Peltzer & Pengpid, 2012: 3579). The results of this study supports the notion that low, middle and high income countries seem to have low fruit and vegetable consumption levels among adolescents (Peltzer & Pengpid, 2012: 3581).

In the study conducted by Du Toit (2004: 171) on black female students living in university residences the most popular vegetable consumed by these students was potatoes. Potatoes were boiled by the participants and then served with margarine, or mashed with margarine and/or milk or sliced and then shallow fried in margarine or oil. Other popular vegetables prepared by the students included carrots, butternut squash, green beans, broccoli, spinach, mushrooms and frozen mixed vegetables. Students also indicated that they consumed raw tomatoes, green peppers and mixed green salad. In the fruit group, 40% of the participants indicated drinking fruit juice. However, 36% of these participants consumed fruit nectars, while only four percent indicated consuming pure fruit juices. The most popular fruits were apples, naartjies, bananas and raisins. Only 10% of the participants consumed four or more servings of vegetables per day. A further 10% of the participants consumed 3 to 3.5 servings, 28.3% 2 to 2.5 servings and 16.7% 1 to 1.5 servings. Five participants (8.3%) did not consume any vegetables. The intake of fruit was low with less than 10% (8.3%) of the participants consuming three or more servings of fruit daily. Less than 10% (8.3%) of the participants also consumed 2 to 2.5 servings and 33.3% 1 to 1.9 servings. Half (n = 30) of the participants did not consume any fruit. Possible reasons for the low intake of fruit and vegetables may lie in the perceived cost and work associated with the preparation of fresh produce (Du Toit, 2004: 179). Senekal (1988: 203) furthermore reported that fewer first-year female students at SU

after three months at the institution indicated that they consumed fruit and vegetables often. Regular fruit and vegetable intake upon arrival at university decreased from 93% to 81% and 93% to 88% respectively after a period of three months. More participants after three months also indicated that they only ate fruit and vegetables occasionally compared to their consumption upon arrival at the university (16% versus 5.4% and 9% versus 6% respectively).

(iii) Dietary fibre consumption

It is accepted that the consumption of dietary fibre positively influences health and contributes to preventing chronic disease, such as obesity, non-insulin diabetes mellitus, cardiovascular disease (Vorster & Nell, 2001: S17) and colon cancer (Adegoke, Fadupin & Ketiku, 2006: 157). Dietary fibre improves digestion and absorption of other nutrients in the small intestine and, together with undigested starch, improves gastrointestinal mobility, metabolism and health. The South African FBDG “make starchy foods the basis of most meals” encourages individuals to consume cereals and grains such as maize, wheat, sorghum, oats and rice and preferably in the unrefined form (Vorster & Nell, 2001: S18). The USDA’s Dietary Guidelines for Americans, recommend the intake of dietary fibre-rich foods such as wholegrains, fruits and vegetables (Sizer & Whitney, 2011: 36).

A study by Adegoke *et al.* (2006: 157) to assess the adequacy of dietary fibre intake of undergraduate students (n = 14) at Ibadan University, Nigeria, indicated that the participants’ dietary fibre intake was adequate. Cereal-based foods contributed the highest (58.2%) amount of fibre in the participants’ diets while fruits and vegetables contributed the least (9.7%). These findings confirm that dietary fibre consumption among populations in developing countries is higher than in the more developed countries. The higher dietary fibre intake of the participants could be due to cereals, roots and tubers being the main staple foods in Nigeria (Adegoke *et al.*, 2006: 161).

South African studies on dietary intake indicate that the black population is undergoing a transition from a traditional high dietary fibre, high carbohydrate intake to a more typically Westernised diet. The other ethnic groups (white, coloured and Indian) already follow this Westernised dietary pattern (Steyn *et al.*, 2006: 5). Results from Du Toit’s study (2004: 177) indicated that only 18.3% of the black female study participants often consumed brown bread and 13.3% of the participants often consumed high-fibre breakfast cereals. With regard to dry beans, peas and lentil consumption, 40% answered affirmatively to eating these dietary items regularly. An additional 11.7% indicated that they sometimes ate these food items. Although 51.7% of the participants indicated eating these foods, none of them indicated eating these foods on a daily basis and fewer than half (41.9%) of these participants reported eating them once or twice a week. The mean dietary fibre intake was 16.3 g, which is below the limit of 27 g of dietary fibre per day as recommended by the WHO (Sizer &

Whitney, 2003: 105). The low dietary fibre intake is partly due to the fact that fewer than half (44.9%) of the participants reported consuming any of the food items from the breads, cereal, rice and pasta group in a wholegrain form (Du Toit, 2004: 205).

Larson, Neumark-Sztainer, Story and Burgess-Champoux (2010: 237) suggest that nutrition interventions should address the availability of wholegrain foods in homes and restaurants. Young people should be given the opportunity to taste a variety of wholegrain foods in order to develop their taste preferences and self-efficacy to consume wholegrain products.

2.2 Knowledge assessment

Knowledge cannot be directly observed, but rather inferred from observing performance on an assessment tool (Hunt, 2003: 102). Most assessment tools for measuring a respondent's knowledge on a topic are aimed at composing test items that represent the topic and that is fair and unbiased (Hunt, 2003: 105). Nunnally (1972: 6) describes a test as a "standardised situation that provides an individual with a score". Standardisation refers to the fact that all participants understand the instructions, answer the same questions and a predetermined scoring system is uniformly applied. It is important to note that the intention of a test is not to measure the individual participant's general knowledge, but rather a specific attribute, for example the knowledge of the participant regarding a particular matter (Huysamen, 1988: 10; Pedhazur & Schmelkin, 1991: 16). An advantage of measurements over subjective judgements is that it allows the researcher to communicate results to others more easily (Nunnally, 1972: 10).

2.2.1 Knowledge test item selection and construction

The basic unit of a test (or when constructing a test) is the compiled item, the individual part of the test that is scored (Nunnally, 1972: 153). Test items often consist of both statements and questions as they provide more flexibility in the design of the items compared to when only statements or questions are used (Babbie & Mouton, 2010: 233). There are several guidelines that should be used when designing a test item to prevent useless and even misleading information being collected (Nunnally, 1972: 154; Babbie & Mouton, 2010: 233). To provide for the large number of test items which may not meet the criteria for optimal item selection, Huysamen (1988: 46) recommends that twice as many items be developed as are required for the final test so that the envisaged number of test items can be retained after the item analysis (a statistical analysis to retain optimal items which is addressed later in this chapter) for the final test.

2.2.1.1 Test item types

Test items can take on very different appearances such as true-false, multiple-choice and short-answer essay and used in different types of tests entailing identification, problem solving and other evaluative aspects (Nunnally, 1972: 153). When designing the test or knowledge questionnaire, the researcher can make use of open- or closed-ended test items. In the case of open-ended items, the respondent is asked to provide his/her own answer to the question (Babbie & Mouton, 2010: 233; Bordens & Abbott, 2011: 262). A drawback to the open-ended item is that participants may not understand exactly what is required and may inadvertently omit some answers and thus may fail to provide the needed information (Bordens & Abbott, 2011: 262).

When using closed-ended items, the respondent is asked to select an answer from a list provided by the researcher (Neuman, 2006: 287; Bordens & Abbott, 2011: 262). Closed-ended questions tend to be more popular among researchers due to the fact that it provides uniformity of responses and are easier to process and these items are often described as being more objective (Nunnally, 1972: 155; Burns, 2000: 575; Adler & Clark, 2003: 240; Neuman, 2006: 287; Babbie & Mouton, 2010: 233). However, when making use of closed-ended questions it should be structured properly. The response categories should be exhaustive, meaning that they should include all the possible responses that might be expected, and the answer categories must be mutually exclusive, meaning that the respondent should not feel compelled to select more than one answer (Babbie & Mouton, 2010: 234). Furthermore, it is possible to include more closed-ended items in a test as the average student requires less than one minute to answer each item (Nunnally, 1972: 156; Neuman, 2006: 287). Short-answer items are often difficult to design as it is extremely difficult to phrase the question or incomplete statement so that only one answer is correct (Gronlund, 1993: 79). However, both open-ended and objective tests with the latter incorporating closed-ended questions can be excellent methods of evaluation if they are carefully constructed (Nunnally, 1972: 159).

(i) True-false

The true-false test item is perhaps the most familiar type of close-ended test item. Its popularity may be due to the ease with which such items can be designed (Nunnally, 1972: 160) and the fact that they provide a simple and direct means of measuring essential outcomes of formal education (Ebel & Frisbie, 1991: 133). However, the true-false item has several serious flaws and is therefore not recommended for general use in knowledge tests (Nunnally, 1972: 160).

One of the biggest pitfalls of the true-false item is that it is easily influenced by guessing on the part of the respondent. Even if the respondent knows nothing about the subject matter being assessed, he/she could get approximately half of the items on a true-false test correct by guessing. The test is

thus not discriminating between the levels of student accomplishment as well as it should (Nunnally, 1972: 160; Ebel & Frisbie, 1991: 135). Another serious negative aspect is that researchers find it difficult to make statements that are either absolutely true or absolutely false. The researcher needs to supply considerable detail in the statements to ensure that respondents are not misled in this regard. This can lead to a long and detailed test item that might be difficult to interpret (Nunnally, 1972: 161).

Guidelines for when the researcher chooses to design true-false test items include: Each statement should be limited to a single idea; the use of specific determiners, such as 'never' and 'always', should be avoided; each statement should be unequivocally true or false; the use of negative statements should be avoided; and an approximately equal number of true and false items should be used. Respondents often read over the word 'not' and answer the question on that basis. Negative test items are often misunderstood and lead to unusable data. The use of these items should therefore be limited (Nunnally, 1972: 162; Ebel & Frisbie, 1991: 135; Babbie & Mouton, 2010: 237).

(ii) Fill in

This item can be described as the question where respondents are asked to supply the one term, name or date which completes a statement or answers a question (Nunnally, 1972: 163). This type of item is useful when knowledge of very factual information is to be tested. Nunnally (1972: 164) provides the following guidelines when constructing this type of item: Use only one or two blank spaces to avoid ambiguity; make sure that only one term will sensibly complete the statement or answer the question, again to avoid ambiguity; leave only important and factual terms blank; place the blank space near the end of the sentence so that the problem is given to the respondent first and he/she does not have to work backward to answer; and avoid grammatical cues to the correct answer.

(iii) Matching items

In the matching test item respondents are presented with two lists of names, facts or principles and asked to write in a blank space the letter corresponding to the option on the right which matches with the item on the left (Nunnally, 1972: 166; Ebel & Frisbie, 1991: 182). The advantage of matching test items is that a large volume of curriculum content can be presented in a short space (Nunnally, 1972: 167).

When using matching test items, the following factors should be considered: The list of options (on the right) must be at least 50% longer than the list of items (on the left) to avoid guessing on the part

of the respondent; the list (on the left) should contain a maximum of eight entries to be identified to avoid the respondent getting confused in scanning the two lists and making clerical errors; when a matching item consists of a word/phrase having many associations to be paired with a specific word/phrase, the more specific term should be placed in the column on the left; the content of both sides of a matching item should relate to the same central theme; and the test instructions should clearly state how matching is to be performed by the respondent (Nunnally, 1972: 167; Ebel & Frisbie, 1991: 184).

(iv) Multiple-choice

The multiple-choice test item is considered as the most useful item type by many educationalists (Ebel & Frisbie, 1991: 154; Gronlund, 1993: 40) and is widely recommended for use in objective testing (Nunnally, 1972: 172.) The respondent is required to choose one alternative response to a problem or question. Multiple-choice items either begin with an incomplete sentence or with a question, referred to as the problem. Researchers often prefer the incomplete sentence as it saves space and, if well-constructed, permits a smooth transition between the problem and the correct answer (Nunnally, 1972: 169; Gronlund, 1993: 41; Struwig & Stead, 2001: 92).

Multiple-choice test items consist of two parts, namely the stem to acquaint the respondent with the problem and the list of possible answers or alternatives. In the standard form of the possible answers, one of the alternatives is the correct or best answer and the others are the distracters (Thorndike & Hagen, 1977: 228; Ebel & Frisbie, 1991: 159; Gronlund, 1993: 40). Multiple-choice test items should have at least three alternatives (distracters) to be classified as a multiple-choice item. However, the typical pattern is to make use of four or five alternatives to reduce the probability of guessing by the respondents (Thorndike & Hagen, 1977: 228; Gronlund, 1993: 41). According to Nunnally (1972: 171) the odds of obtaining the correct answer from respondents by guessing alone with the use of a true-false test item are fifty-fifty. However, with four or five alternatives the odds in obtaining the correct answer by chance are one in four and one in five respectively. A respondent who selects the correct alternative to a well constructed multiple-choice test item by eliminating alternatives he/she knows are incorrect demonstrates achievement of relevant subject matter (Ebel & Frisbie, 1991: 177).

The versatility of multiple-choice items allows the testing of many aspects of learning, such as definitions, factual curriculum content, association, evaluation, reasoning, interpretation and skills (Nunnally, 1972: 170; Ebel & Frisbie, 1991: 154; Gronlund, 1993: 46). Multiple-choice items also hold advantages for the researcher in that it does not require that one alternative be absolutely correct, but rather that one of the alternatives be markedly better than the others. In addition

respondents are not influenced by guessing to the same extent compared to true-false test items; respondents are not subject to the same amount of ambiguity as fill-in items; and more complex aspects can be assessed compared to, for example, matching items (Nunnally, 1972: 171; Ebel & Frisbie, 1991: 154).

The general rules when developing multiple-choice items, based on the experience of researchers, are as follows for both the problem statement and the alternatives: The test content should relate to important aspects of the subject matter (Nunnally, 1972: 172); avoid unnecessary sources of difficulty in the statement of the problem (i.e. stem) or in the alternatives, i.e. the use of difficult words; use negatives sparingly in the stem and whenever it is used, it should be emphasised because the use of negatives often confuse respondents who are used to look for the correct answer rather than the incorrect one (Gronlund, 1993: 51); each item should be independent of every other item (Nunnally, 1972: 172); the problem should clearly point to the theme of the correct alternative answer, i.e. the item should not present a random collection of ideas/facts (Parmenter & Wardle, 2000: 273); incorrect alternatives should be plausibly related to the problem, for example in some items the incorrect alternatives are completely unrelated to the problem, which means that a respondent can easily answer correctly by ruling out the unrelated alternatives; correct alternatives should not be consistently different in appearance from incorrect alternatives, for example one alternative being discussed in more detail in relation to the others; alternatives should be randomly ordered for each item; avoid including material in the problem which is unrelated to the alternatives provided; do not employ alternatives which say 'none of the above', 'both a and d above', 'all of the above' (Nunnally, 1972: 178; Thorndike & Hagen, 1977: 223); avoid grammatical cues and sentence structure that give away the correct alternative; and alternatives within an item should not overlap or be synonymous with one another (Nunnally, 1972: 172).

(v) Essay-type

In essay test items respondents are expected to supply their own answers and in their own way (Nunnally, 1972: 181; Struwig & Stead, 2001: 92), which reflects freedom of response (Gronlund, 1993: 82). No choices or alternatives are offered (Struwig & Stead, 2001: 92). Among others, it assesses respondents' ability to deal with curriculum content at a high level of understanding, their ability to organize their thoughts and to express themselves in writing (Nunnally, 1972: 181). There are two types of essay questions, namely restricted-response items, where boundaries of the curriculum content to be considered are narrowly defined by the problem and the specific form of the answer is also commonly indicated, for example to 'list' or 'define' and extended-response items, where respondents are given almost unlimited freedom to determine the form and scope of their responses (Gronlund, 1993: 84).

Long-answer questions are often subjected to potential faults. Respondents often get lost in their own answers, tend to repeat themselves or are not sure when they have written enough about the questioned topic. It is often difficult to direct the respondent toward the information wanted for an essay answer. Another disadvantage of long-answer questions is that only a small number of items can be used in the test due to time constraints (Nunnally, 1972: 181; Ebel & Frisbie, 1991: 189). It is therefore better to use a relatively small number of long-answer questions compared to the larger number of short-answer questions that can be answered in the same time frame on the topic (Neuman, 2006: 287).

If long-answer questions are used by the researcher, it is important that there is enough detail in the question to accurately direct respondents toward the required response. The question should thus have clear and detailed specifications (Nunnally, 1972: 182). Furthermore, when long-answered questions are used, all respondents should answer the same question(s) and not be able to choose. If respondents choose their own questions, it is difficult to make comparisons among respondents (Nunnally, 1972: 184).

2.2.1.2 Clarity, ambiguity and bias of test items

The test should be clear and unambiguous. Test items should therefore be precise so that the respondent knows exactly what the researcher is asking (Parmenter & Wardle, 2000: 270; Neuman, 2006: 278; Babbie & Mouton, 2010: 234). Also, double-barrelled questions should be avoided. A general rule is that whenever the word 'and' appears in a question or statement, the researcher should check whether the question is not possibly double-barrelled (Babbie & Mouton, 2010: 236). Furthermore, in a multilingual society like SA it is important that respondents are asked to answer questions in a language in which they feel comfortable (Babbie & Mouton, 2010: 238). Therefore jargon and technical terms should be avoided while the vocabulary and grammar used should be targeted at the respondents sampled (Neuman, 2006: 278). The reading difficulty and vocabulary level of the test items should be kept as simple as possible (Thorndike, Cunningham, Thorndike & Hagen, 1991: 214).

The meaning of an individual's response to a question depends in large part on its wording. Some items seem to encourage particular responses more than others do. Test items that encourage respondents to answer in a particular way are biased and should be avoided at all times (Babbie & Mouton, 2010: 237). A general rule is that if the test developer would feel embarrassed, inhumane, stupid, irresponsible or anything similar in selecting the response or answer, some thought should be given to whether others will be willing to give those answers (Babbie & Mouton, 2010: 238).

2.2.1.3 Relevance and length of test items

Just as respondents must be competent and willing to answer, questions asked should be relevant to most respondents (Babbie & Mouton, 2010: 236). Long and complicated test items should also be avoided (Babbie, 2007: 260). In the case of self-administered questionnaires the respondent should be able to read an item quickly, understand it and select an answer without difficulty. Respondents are often unwilling to first study an item in an attempt to understand the question being asked (Babbie & Mouton, 2010: 236).

Furthermore, alternatives provided should be clear and short so that it will not be misinterpreted under test conditions. If this is not the case, the results are not likely to be very useful (Babbie & Mouton, 2010:236).

2.2.1.4 Response category format

Effective formats for response categories may take the form of either boxes spaced adequately apart to be marked (ticked) or of a code number beside each alternative where the respondent marks (circles) the appropriate number/letter (Neuman, 2006: 295; Babbie & Mouton, 2010: 240). It could be assumed that items can be scored as either correct or incorrect, i.e. nil if it is answered incorrectly and one if it is answered correctly. Test items are therefore referred to as dichotomous items (Huysamen, 1988: 46; Struwig & Stead, 2001: 94) and the test must therefore be precoded (Struwig & Stead, 2001: 95).

2.2.2 Knowledge test construction

A test is just as good or as poor as the items of which it is composed. The properties of the test that should be considered are aspects such as its difficulty level, variance, internal consistency and criterion-related validity (Huysamen, 1988: 46). Planning the test is an important aspect of knowledge test construction. The researcher should be clear on the purpose of the test and what the test is intended to assess, for example the level of competencies/skills (Thorndike *et al.*, 1991: 192).

2.2.2.1 Knowledge test layout and length

The format of a knowledge test is just as important as the nature and wording of the questions asked. A questionnaire that has an improper layout can contribute to respondents excluding a question and confusion about the nature of the information required. Tests should therefore be brief, clear, neat, easy to follow and uncluttered (Parmenter & Wardle, 2000: 271; Neuman, 2006: 295; Babbie & Mouton, 2010: 239).

Self-administered questionnaires should begin with clear and basic instructions for completing it. For example, if the researcher wants a single answer, it should be made clear (Babbie & Mouton, 2010: 244). In the case of multiple-choice questions, the respondent may be asked to circle the appropriate number. If numbers/letters are to be circled, the researcher should provide clear instructions to the respondent to do so (Babbie & Mouton, 2010: 240).

There seem to be various considerations when deciding on the length of a test. Although restricting the test's length is difficult, the researcher should consider the respondents' fatigue (Struwig & Stead, 2001: 96). Tests with too many items may result in respondents becoming less interested in the test and this can reduce the internal consistency of the test (Struwig & Stead, 2001:133). Although there is no absolute proper length, responses may drop significantly for longer tests (Neuman, 2006: 292).

2.2.2.2 Test item ordering

The sequence in which test items are presented can also affect responses (Struwig & Stead, 2001: 98). The appearance of one question can affect answers given to later ones (Babbie & Mouton 2010: 234) and caution must therefore be taken that information given in one test item does not provide an answer to another (Thorndike & Hagen, 1977: 248). To overcome these effects, answer categories per question should be randomised (Nunnally, 1972: 175) to ensure that each alternative, namely a, b, c or d, is equally represented as the correct answer (Thorndike & Hagen, 1977: 241).

The desired ordering of items in a self-administered test is often to start with the most interesting set of items. Furthermore, the initial items should not be threatening or too difficult as the respondent may lose motivation to complete the questionnaire. If demographic data, such as age and gender, is required, it should be placed at the end of a questionnaire (Struwig & Stead, 2001: 98; Neuman, 2006: 293; Babbie & Mouton, 2010: 234).

2.2.3 Knowledge test pre-testing and evaluation

The surest protection against errors is to pre-test the questionnaire in full and/or in part. It is not essential that pre-test subjects comprise a representative sample, but the sample should be comparable to whom the test is intended for (Babbie & Mouton, 2010: 244). According to Wardle *et al.* (2000: 270) there are underlying consequences in the measuring of knowledge through the means of a test of unknown validity (and/or reliability) as it would be impossible to know whether the test is measuring what it claims to be measuring. Both properties contribute to establish the truthfulness, credibility or believability of findings and should be established (Neuman, 2006: 188).

2.2.3.1 Content and face validity evaluation

Lynn (1985: 254) recommends that a panel of at least three experts need to be considered for the purpose of evaluating the test items for content validity to obtain statistically justifiable results. However, five to ten experts has been recommended as useful to adequately judge the content domain of the test items (Wilson, 1989: 356; Burns & Grove, 1993: 328; Whati *et al.*, 2005: 79). In a study by Venter (2006: 4), where a valid and reliable nutrition-related test for higher educated young adults were developed, four higher education lecturers representing the food science and nutrition fields, and four fourth- year students knowledgeable about food and nutrition were utilised as part of the expert panel to judge the test content.

Face validity refers to the degree to which test items appear, on the basis of subjective evaluation by the scientific community, to serve its purpose in that the indicator really measures the construct (Struwig & Stead, 2001: 139; Neuman, 2006: 192). It can be determined by having any psychometrically untrained individual to determine whether the content appears to be appropriate to the stated outcome of the knowledge test. It is thus a desirable feature for the purpose of gaining the rapport of the participants (Huysamen, 1988: 42). The advantage of high face validity is that it gives the participants confidence in the perceived effectiveness of the test and thereby increases their motivation and accuracy in answering (Parmenter & Wardle, 2000: 274).

2.2.3.2 Item analysis

Pre-testing is also the process by which the initially large number of potential test items are screened and evaluated and the best items selected for the final knowledge test (Parmenter & Wardle, 2000: 272). Pre-testing involves having the test completed by a sample of persons who are similar to those for whom the measure is intended. The pre-testing sample should be as large as possible, but should be at least one more than the number of test items measured (Rust & Golombok, 1992: 52). Furthermore, pre-testing is important to highlight any difficulties that participants encounter with a test item (Parmenter & Wardle, 2000: 276). Item analysis should then be carried out on the completed test items in order to select the best ones for the final knowledge test (Parmenter & Wardle, 2000: 272).

Test item analysis is necessary to determine the preliminary food knowledge test items to be retained and to be discarded in the knowledge test construction. For the test item analysis of the preliminary test, more test items than required are drafted and included as it makes it possible to eliminate weak or inappropriate items (Nunnally, 1972: 156; Huysamen, 1983: 46). In general, it is recommended that at least twice the number of test items that is required should be constructed so that enough items remain after the item analysis (Parmenter & Wardle, 2000: 270). The test item

analysis parameters that are used in assessing the quality of individual test items include the item difficulty index (IDI), distribution of answers to alternatives, item-to-total correlation and the discrimination index (Nunnally, 1972: 186, 192, 193).

(i) Item difficulty index

The IDI refers to the percentage of the respondents who answer an item correctly (Nunnally, 1972: 186). Items that prove to be too easy or too difficult are excluded from the final knowledge test. Extremely easy or extremely difficult items add little information as it only differentiates a few participants from the others. The ideal item is one with a 50% easiness rating because such an item provides the maximum number of discriminations. A good rule to follow is to retain no items that are either above 0.80 or below 0.20. For a multiple-choice test with three alternatives items in the easiness range of 0.45 and 0.90 can be selected (Nunnally, 1972: 189). A study by Venter (2006: 14) used a range of 0.35 and 0.85 as advised by Nunnally (1972: 189). All test items found to be too easy (i.e. answered correctly by more than 85% of the respondents) or too difficult (i.e. answered correctly by less than 35% of the respondents) were excluded from the knowledge test (Venter, 2006: 14). Parmenter and Wardle (2000: 272) suggest that the index should fall between the values of 20% (i.e. item too easy if lower) and 80% (i.e. item too difficult if higher).

(ii) Distribution of answers to alternatives

The distribution of answers to alternatives refers to the proportion of respondents who choose a particular answer to a question or statement (i.e. stem). It determines the distracting ability of the alternatives (Venter, 2006: 14). Nunnally (1972: 190) uses a five percent standard, i.e. replacing or discarding alternatives (a, b or c) which were not chosen as the test item answer by at least five percent of the respondents.

(iii) Item-to-total correlation

The item-to-total correlation is used to determine the internal consistency of a test (Nunnally, 1972: 193). It refers to the probability of a respondent to choose the correct alternative and the respondent's final test score. In other words, it refers to the ability of each individual test item to discriminate between respondents with different levels of knowledge (Parmenter & Wardle, 1999: 300). Venter (2006: 14) used the Pearson's correlation to calculate the item-to-total correlations. Parmenter and Wardle (2000: 272) suggest 0.20 as the minimum correlation.

(iv) Discrimination index

Nunnally (1972: 192) explains the discrimination index as an "index used to determine the extent to which each item measures the same aspect as the total test in which it was included". The top and

bottom 25% of respondents in terms of test scores need to be identified. The percentage of respondents in the top and bottom groups choosing the correct answer is determined after which the percentage of the bottom group is subtracted from the percentage of the top group. A 20% difference is required per test item to ensure discrimination between the top or good performers and the bottom or poor performers. Venter (2006: 14) used the top and bottom 27%, as suggested by Thorndike *et al.* (1991: 249).

2.2.4 Validity of a knowledge test

Validity is described as the degree to which an instrument measures what it is intended to measure (Nunnally, 1972: 22; Huysamen, 1983:35; Thorndike *et al.*, 1991: 123; Oppenheim, 1992: 160; Gronlund, 1993: 175; Neuman, 2006: 188; Babbie & Mouton, 2010: 122). It is perhaps more accurate to refer to the validity of a test for a particular application than to speak of the validity of a test in general because a test may be highly valid for one use and highly invalid for another (Huysamen, 1983: 35; Thorndike *et al.*, 1991: 123). All the precautions taken during the test development process, in the test administration and in the reporting and interpretation of the obtained scores are intended to improve the validity of the test (Ebel & Frisbie, 1991: 100).

As there are different definitions of validity, there are also distinctions among different types of validity evidence (Ebel & Frisbie, 1991: 102; Pedhazur & Schmelkin, 1991: 30). A widely accepted classification related to validation of an assessment measure is: i) content, ii) criterion, and iii) construct validity (Thorndike *et al.*, 1991: 124; Babbie & Mouton, 2010: 123). In short, 'content' refers to some domain of content, 'criterion' refers to outcome and 'construct' refers to some trait or attribute (Pedhazur & Schmelkin, 1991: 31). Validity therefore depends on more than just the quality of the test. The responsibility of the test developer is to be as clear as possible about what is being measured and to produce a test that measures this as accurately as possible (Ebel & Frisbie, 1991: 106). A measure's scores are valid in terms of a particular sample, context and time (Struwig & Stead, 2001: 138).

2.2.4.1 Content-related evidence of validity

Also referred to as rational or logical validity (Thorndike *et al.*, 1991: 124), content validity refers to how much a measure covers the range of meanings included within the concept (Ebel & Frisbie, 1991: 102; Neuman, 2006: 193; Babbie & Mouton, 2010: 123). The content validity of a test may, in other words, be defined as "the extent to which the task it contains is representative of the total universe of instructional objectives of the course" (Huysamen, 1983: 41).

Tests usually contain only a sample of all possible items that could be used to measure knowledge in the content area of interest. The score interpretations are based on the hypothetical universe of items and not just the sample used in the test. In general, it is assumed that respondents who answer correctly on 75% of the items of a test, would likely answer 75% of the items in the content universe correctly (Ebel & Frisbie, 1991: 103).

Although the term content validity is used widely, referring to the analysis of the test in terms of content, one should not think of content too narrowly because it also involves the process as an outcome. In other words, content is what the respondent works with; process is what the respondent does with the content. Content-related validity refers to an assessment of whether a test contains appropriate content and requires the appropriate processes to be applied to that content (Thorndike *et al.*, 1991: 124).

Content validity is determined by careful analysis by professional and expert judgement provided by experts in the field of study (Huysamen, 1983: 42; Gronlund, 1993: 163; Struwig & Stead, 2001: 139). For content validity Lynn (1985: 254) recommends that a panel of at least three experts need to be considered for the purpose of evaluating test items. However, at least five to ten experts in total has been recommended as useful to adequately judge the content domain of knowledge test items (Wilson, 1989: 356; Burns & Grove, 1993: 328). This expert panel evaluation of the test content and included items to represent the test content is generally undertaken as part of the knowledge test pre-testing (see 2.2.3).

2.2.4.2 Criterion-related evidence of validity

Sometimes called predictive validity, criterion-related validity is based on some external criterion (Neuman, 2006: 193; Babbie & Mouton, 2010: 123). A criterion measure is an accepted standard against which some test is compared to validate the use of the test as a predictor (Ebel & Frisbie, 1991: 106; Thorndike *et al.* 1991: 126). It focuses on prediction, the overriding concern being the degree of successful prediction of a criterion, regardless of whether or not it is possible to explain the process or processes leading to the phenomenon that is being predicted (Pedhazur & Schmelkin, 1991: 32). It is concerned with relationships, usually represented by correlation coefficients, between the test scores and the scores on some criterion measure of relevant abilities (Ebel & Frisbie, 1991: 102).

Two kinds of criterion-related validity can be distinguished, namely predictive and concurrent validity. Predictive validity refers to the accuracy with which a test predicts or forecasts some future behaviour or status of respondents, whereas concurrent validity considers the accuracy with which

the test identifies some current behaviour or status of individuals. The most common method of investigating the criterion-related validity of a test is to determine the correlation between test data and criterion data. The correlation coefficient thus obtained is known as the validity coefficient and the higher such a correlation, the better the criterion-related validity of a test (Huysamen, 1983: 36; Ebel & Frisbie, 1991: 106).

There are four qualities desired in a criterion measure, namely (i) relevance, (ii) freedom from bias, (iii) reliability, and (iv) availability. For relevance it is necessary to rely on the best available professional judgement to determine whether the content of a test accurately represents the objectives of the test. When referring to freedom from bias it means that the measure should be one on which each respondent has the same opportunity to make a good score or, more specifically, one on which each equally capable person obtains the same score. The third factor, reliability, is merely that a measure of success on the task must be reproducible. In choosing a criterion measure researchers always encounter practical problems of convenience and availability. Any choice of a criterion measure must take these practical limitations into account (Thorndike *et al.*, 1991: 130).

2.2.4.3 Construct validity

Construct validity is based on the logical relationship among variables (Babbie & Mouton, 2010: 12) and is determined by statistical analysis (Alreck & Settle, 1985: 407). It refers to the extent to which the test indeed measures the theoretical construct it purports to measure (Huysamen, 1983: 43). In other words, construct validity is concerned with the overall meaning of the scores, what the collection of responses to the individual items means (Ebel & Frisbie, 1991: 102). There is, however, no unique research design and statistical technique for determining this kind of validity (Huysamen, 1983: 45).

Techniques associated with construct validity are exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). EFA is used to determine which variables are correlated with or independent of each other. Variables generally include test items, but may also comprise a group of tests. Those variables that are strongly correlated with each other form a factor. A test may comprise one or more factors that reflect the underlying structure of the data matrix (Struwig & Stead, 2001: 142; Costello & Osborne, 2005: 1). CFA is used to determine whether theoretically grounded models fit the data. CFA confirms or disconfirms the predicted latent variables (or factors). The factors obtained through factor analytic studies should be in agreement with the assumed underlying characteristics of the construct for there to be evidence of construct validity (Struwig & Stead, 2001: 142). Steyn (2011: 516) used CFA in a South African study looking at the strategic role of public relations.

Construct validity are also determined by the Mann-Whitney statistic (Parmenter & Wardle, 1999: 301), a non-parametric test which determines if a difference exists between two groups, however the groups are defined (MacFarland, 1998). Two sample groups are selected which differ in level of knowledge in that the one sample group represents the knowledgeable sample group while the other sample group represents the less-knowledgeable sample group (Parmenter & Wardle, 1999: 301). As an example, Whati *et al.* (2005: 6) used secondary school learners in Grade 12 who studied the subject Home Economics/Consumer Studies, which historically and at the time of the study included an extensive nutrition component, to be the knowledgeable sample group. Learners who did not choose Home Economics/Consumer Studies, represented the less-knowledgeable sample group in the development of a reliable and valid nutrition knowledge questionnaire for urban South African adolescents (Whati *et al.*, 2005: 1).

2.2.5 Reliability of a knowledge test

Oppenheim (1992: 150) describes reliability as consistency and the need to be sure that the assessment tool will behave in a manner which is consistent in itself, irrespective of when it is administered and in which form it is used (Huysamen, 1983: 25; Ebel & Frisbie, 1991: 224; Neuman, 2006: 188; Babbie & Mouton, 2010: 119). Reliability may be influenced by many factors, such as the group tested, the test content, length of the test, item characteristics and testing conditions (Ebel & Frisbie, 1991: 81, 88). Reliability, therefore, is necessary to determine validity, but it is not enough to ensure validity (Ebel & Frisbie, 1991: 101; Struwig & Stead, 2001: 130). One way to increase test reliability is to increase the number of test items. Therefore the more items, the better, since the test is only a sample of what the student knows (Nunnally, 1972: 156). Social researchers have developed a number of techniques for determining test reliability, for example the test-retest method, internal analysis or other established measures (Ebel & Frisbie, 1991: 82; Babbie & Mouton, 2010: 121).

2.2.5.1 Techniques for determining reliability

(i) Test-retest reliability

It is often appropriate to apply the same measurement more than once. If the researcher does not expect the information to change, then he/she should expect the same response both times and over a period of time. If answers vary, the measurement method may be unreliable or unstable (Nunnally, 1972: 80, 108; Ebel & Frisbie, 1991: 81; Struwig & Stead, 2001: 131; Babbie & Mouton, 2010: 121). The test must, therefore, be administered at least twice for the investigation of its reliability. If administered twice, the correlation between the two sets of scores, known as the reliability coefficient, provides an index of the reliability of the test (Huysamen, 1983: 27; Ebel &

Frisbie, 1991: 81). This method is particularly useful in situations where the trait being measured is expected to be stable over time (Ebel & Frisbie, 1991: 81).

Ebel and Frisbie (1991: 81) highlight some objections to this method, such as that respondents' answers to the second test are not independent of their answers to the first. Therefore, the time interval should not be too short as the respondents may remember the questions, known as reactivity (Struwig & Stead, 2001: 131). If the period is too long, the respondents may mature or gain knowledge, thus affecting their responses to the test items (Ebel & Frisbie, 1991: 82; Struwig & Stead, 2001: 131). Time intervals varying from two weeks to one year are often employed, although any time interval may be used if it can be justified (Struwig & Stead, 2001: 132).

(ii) Equivalent forms/Parallel forms

Equivalent forms reliability reduces the problem of the respondents' reactivity to responses from the first testing (Struwig & Stead, 2001: 132). This method refers to two or more forms of a test being produced in such a way that it seems likely that the scores on these alternate forms will be equivalent and if each respondent in a sample group is given two forms of the test, the correlation between scores on the two forms provides an estimate score of reliability (Ebel & Frisbie, 1991: 82; Struwig & Stead, 2001: 132). The disadvantage to this technique is that it is difficult to construct two measures that are greatly alike (Struwig & Stead, 2001: 132).

(iii) Internal analysis

(a) Split halves

In this method only a single test administration is involved on the basis of the respondents' consistency of performance on the items within the test (Huysamen, 1983: 27; Struwig & Stead, 2001: 132). This approach entails the splitting of a test into two reasonably equivalent halves. These two independent subtests are then used to obtain two separate scores required for the reliability estimation. One method of splitting a test and then to obtain the scores has been to score the even-numbered items and the odd-numbered items independently. Then the correlation between the scores on the even- and odd-numbered items is determined. The disadvantage to this approach is that the scores on which the reliability of the test is determined are from half-length tests. Therefore, to obtain the reliability based on the full-length test it is necessary to correct the half-test correlation to the full-length correlation. This is done with the Spearman-Brown formula that is used to predict the new reliability expected from increasing the length of a test of known reliability (Nunnally, 1972: 111; Ebel & Frisbie, 1991: 83; Struwig & Stead, 2001: 132). History, maturation and reactivity do not interfere with this method of reliability as testing occurs once (Struwig & Stead, 2001: 132).

(b) Internal consistency

Internal consistency is a technique that calculates the extent to which the test items all reflect the same attribute. Internal consistency comprises the average correlation among the items and the length of the test. It is, therefore, based on one form of the test and requires the respondents to complete the test on one occasion (Struwig & Stead, 2001: 132).

- **Kuder-Richardson**

The Kuder-Richardson (K-R) formulas are used to determine the reliability of a single administration of a single assessment tool when tests are scored dichotomously (Struwig & Stead, 2001: 133). In other words, one point for each correct answer and no points for an incorrect answer (Ebel & Frisbie, 1991: 84) and it is derived under the assumption that all the test items are equally difficult (Huysamen, 1983: 31). The K-R20 is the average correlation achieved by computing all possible split-half correlations for a test. The K-R20 can, therefore, be thought of as the average of all possible splits. The computation of the K-R20 requires information about the difficulty of each item in the test (Ebel & Frisbie, 1991: 84). The statistic measures the inter-item consistency by looking at two error measurements, namely the adequacy of content sampling and the heterogeneity of the domain being sampled (Kaplan & Saccuzzo, 2001). The K-R20 is the most widely accepted method for estimating reliability (Ebel & Frisbie, 1991: 83). The K-R21 only requires information on the number of test items, the mean/average score and the standard deviation (Gronlund, 1993: 171). If test items do not vary widely in difficulty, computing the test mean is reasonable, but when items vary in difficulty, as they almost always do, the K-R20 is considered, which requires information about the difficulty (proportion of correct answers) of each item (Ebel & Frisbie, 1991: 84)

- **Coefficient alpha**

The coefficient alpha provides a reliability estimate for a measure composed of items scored with values other than zero and one, for example essay test items and attitude scales (Ebel & Frisbie, 1991: 84). However, it can also be used for dichotomous items and if this is the case, it is algebraically equivalent to the K-R20 formula (Huysamen, 1983: 31).

2.2.5.2 Interpreting reliability coefficients

There are no absolute standards to serve as criteria for determining whether a given reliability coefficient is high enough. Some relative standards have evolved over time for evaluating reliability under each of several circumstances (Ebel & Frisbie, 1991: 85). The standards for minimally acceptable values for test score reliability need to be established in the context of score use. It is widely agreed by educational experts that the reliability coefficient should be at least 0.85 if the

scores will be used to assess individual participants and if the scores are the only available and useful information (Ebel & Frisbie, 1991: 86; Struwig & Stead, 2001: 133). If the assessment is about the scores of a group of individual respondents, the generally accepted minimum standard is 0.65 (Ebel & Frisbie, 1991: 86). Correlations range from 1.00 through zero to -1.00. A correlation of 1.00 means a perfect positive relationship, in other words respondents are rank-ordered in exactly the same way on both tests. Correlations between zero and 1.00 indicate varying degrees of correspondence and the higher the value, the higher the correspondence. A correlation of zero means that there is only a chance relationship between the two tests. A zero correlation means that the first test supplies no information at all as to how well respondents will do in the second test. A negative correlation means that there is an inverse relationship between the two tests. Respondents who rank high on the first test tend to rank low on the second test and *vice versa* for respondents who rank low on the first test (Nunnally, 1972: 83).

2.3 Summary

When considering the literature presented in this chapter, it is evident that the decline of food knowledge and cooking skills among young people is a concern. Food knowledge and cooking skills are associated with eating practices and dietary behaviour. A lack of food skills may consequently have adverse health implications for individuals. Possible reasons for the decline of contemporary cooking skills include the considerable growth of ready-prepared, packaged and convenience foods that require different, fewer or no food preparation skills. This, in turn, changed the nature of the food purchased and prepared by young adults with an inability to follow dietary guidelines to improve the healthfulness of their diets. Interestingly, according to Byrd-Bredbenner (2004: 158) the majority of young adults overestimate their food preparation knowledge. Therefore, to improve dietary intake, interventions among young adults should teach them knowledge and skills for preparing quick and healthy meals.

A typical student diet is in general associated with low fruit and vegetable intake and high fat consumption. Factors influencing the eating practices and dietary behaviour of young adults include, amongst others: i) nutrition and food knowledge; ii) food and cooking skills education taught as a life skill at home and/or school; iii) eating and living away from home, which is considered a major lifestyle change for young adults which requires sudden knowledge of food choice and preparation; iv) the macro-environment which impacts on food choice in relation to nutrition; v) level of post-school education linked to a sense of priority towards healthy eating; and vi) family influence as childhood and adolescent dietary behaviour is important for the development of lifelong healthy eating habits. Furthermore, problems and concerns associated with the eating practices and dietary behaviour of young adults include the lack of food preparation skills, meal

skipping and snacking, the oblivion and maintenance of optimal body weight from this time and dietary consumption not considering increasing fruit and vegetable intake and reducing fat intake.

The consumption of certain foods typically linked to the Westernised diet has increased. Together with lifestyle changes of many South Africans during the last decade the risk for developing non-communicable (chronic) diseases of lifestyle, such as hypertension and diabetes, has increased significantly. In SA there seems to be a lack of food intake data in addition to data of food knowledge. Knowledge of food intake is just as important as knowledge of nutrient intake. However, the majority of dietary assessment studies that collect food intake data are predominantly only expressed in terms of nutrient intake. A clear picture of the actual food intake of a population/study group is required in order to implement food and nutrition policies such as school-feeding schemes. However, for such strategies to be effective, the state of food knowledge and cooking skills among South Africans should also be considered.

Developing a valid and reliable knowledge test to determine the knowledge of individuals on a specific topic or content domain is a lengthy process. When developing a well designed test, consideration is firstly given to the test item selection and construction. The researcher can choose from a variety of test item types, which include true-false, fill in, matching, multiple-choice and essay-type items, after carefully considering the advantages and disadvantage of each item type and taking into consideration the objectives of the research study. Other aspects that need to be considered when developing any test item are clarity, ambiguity, bias, relevance and length in order to obtain useable data from the participants in a self-administered test situation. When constructing the knowledge test itself, the layout, length and order of test items are of particular importance.

There are underlying consequences in the measuring of knowledge through the means of a test of unknown validity and reliability (Wardle *et al.*, 2000: 270). Therefore validity and reliability evaluations should be undertaken. Content and face validity forms part of the pre-testing and evaluation of a test to ensure that the test is appropriate and gains the rapport of the participants. Through item analysis the large number of potential test items are screened and evaluated, after which the best items, based on the IDI, the distribution of answers to alternatives, the item-to-total correlation and the discrimination index, are retained to form the final knowledge test.

Different techniques for determining the validity and reliability of the final test exist and the ones used are determined by the outcomes of the research study. Validity refers to the degree to which a test measures what it intended to measure (Nunnally, 1972: 22), whereas reliability refers to the

consistency and the need to be sure that the test will behave in a manner which is consistent in itself, irrespective of when it is administered and in which form it is used (Huysamen, 1983: 25).

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 Permission to conduct the study

Ethical approval was granted by the CPUT Faculty of Applied Sciences Research Ethics Committee (Addendum A) after clearance of the research proposal by the Faculty Research Committee. Written permission to obtain the study samples were granted by the heads of departments (HODs) of Agricultural and Food Sciences (Faculty of Applied Sciences), Cape Town Hotel School (Business Faculty) and Public Relations Management (Informatics and Design Faculty). All the students who represented the study samples attended scheduled classes and participated voluntarily and anonymously after being informed about the study and invited to participate. All the participants signed the participant information leaflet and consent form as agreement to their participation (Addendum B).

3.2 Type of study and the study design

Quantitative research incorporating the steps involved in the development of a knowledge test was utilised in this study. Quantitative research obtains data in a form that can be measured, assessed and interpreted (Holloway & Wheeler, 1995: 224; Neuman, 2006: 14; Muijs, 2011: 1). It can therefore be described as a form of conclusive research (Struwig & Stead, 2001: 4), which is fundamental for the development of a knowledge test, meeting the criteria of being a valid and reliable assessment tool as was envisaged for this study.

The measurement of constructs in quantitative research is usually undertaken with the use of a questionnaire and/or some form of structured observation (Struwig & Stead, 2001: 4). To determine the food knowledge of young adults, as represented by university students, a structured and self-administered food knowledge questionnaire was developed which on its finalisation, would take on the format of a test. An outline of the phases and steps included in the development of the food knowledge test is provided in Figure 3.1.

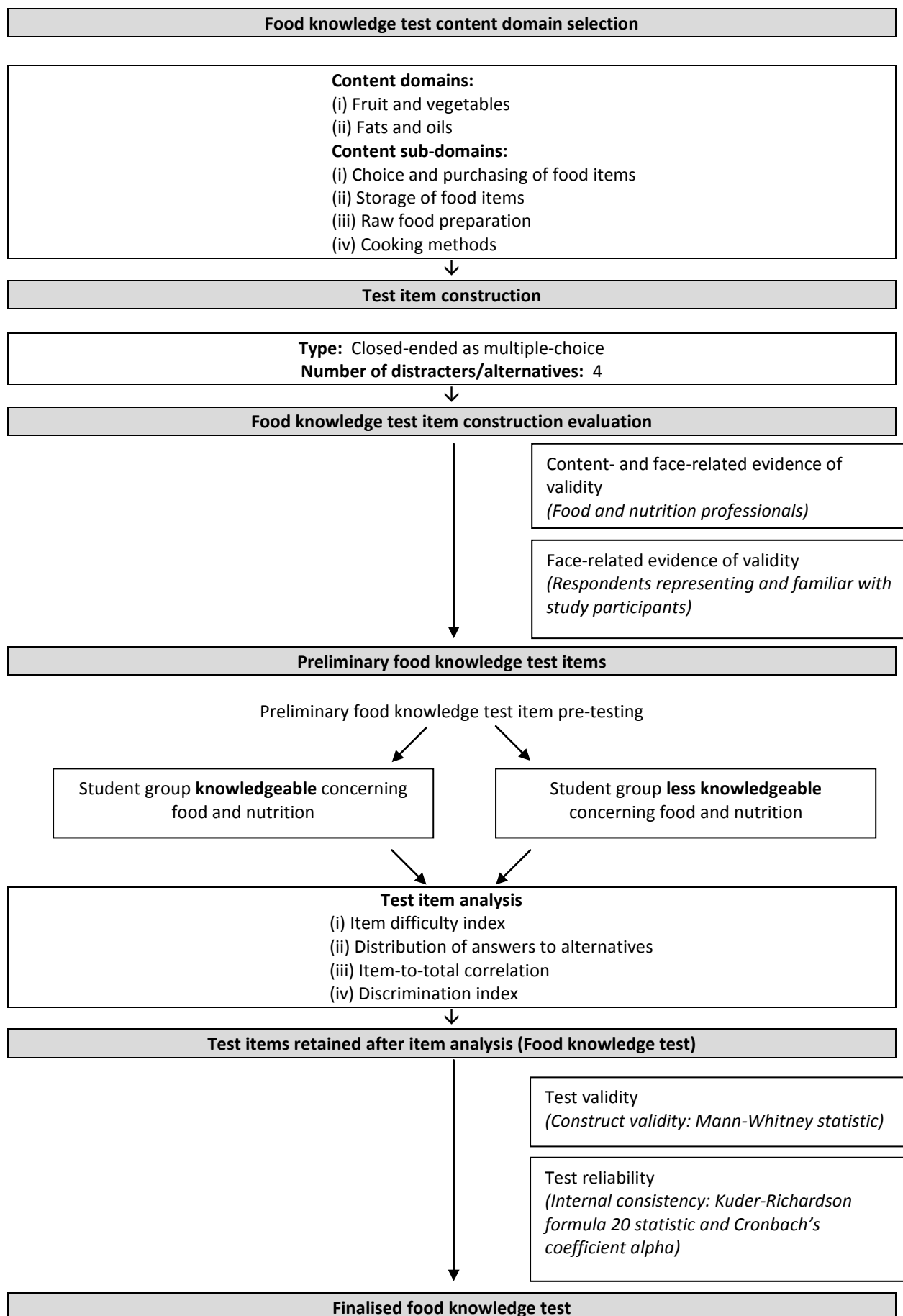


Figure 3.1: Outline of the phases and steps included in the development of the food knowledge test

3.3 Food knowledge test development

3.3.1 Content domain and sub-domain selection

The food content domains covered in the knowledge test were fruit and vegetables and fats and oils. An insufficient fruit and vegetable intake and high fat intake are major dietary concerns associated with young adults (Kolodinsky *et al.*, 2007: 1409). For young adults the Daily Food Guide recommends that five to nine servings of fruit and vegetables should be consumed daily with a minimum of three servings from the fruit and four servings from the vegetable group (Whitney *et al.*, 2002: 42). In addition, the South African FBDG state that all healthy persons aged two years and older should “eat plenty of vegetables and fruits every day” (Vorster *et al.*, 2001: S3). While the additional group in the Daily Food Guide, titled ‘Fats, oils and sweets’, have no daily serving suggestions (Whitney *et al.*, 2002: 37), the South African FBDG suggest “eat fats sparingly” (Wolmarans & Oosthuizen, 2001: S48). To consider South African support, the Du Toit (2004: 178) study, at the former Cape Technikon, found that only 20% of the black female study participants consumed relatively adequate vegetable intake of three or more servings of vegetables daily. The intake of fruit was as low. Only 16.6% of the participants consumed two or more servings daily, which is relatively adequate fruit intake. Half (50.1%) of the participants did not consume any fruit and 8.3% of the participants did not consume any vegetables on a daily basis. The Du Toit (2004: 186) study also found that more than half (53.3%) of the participants used frying in oil or margarine as a cooking method when preparing food and more than half (58.7%) reported snacking regularly on foods such as sweets, chocolates, potato crisps, cakes, tarts, biscuits, muffins and ice cream. These South African results, as well as the evidence from the literature review regarding the poor dietary practices among students worldwide, served as the motivation for the choice of fruit and vegetables and fats and oils as the content domains in this study.

Huysamen (1983: 41) and Borders and Abbott (2011: 267) suggested that a test be divided into its constituent subdivisions. Therefore, items referring to fruit and vegetables were grouped together and the items referring to fats and oils grouped together. These subdivisions were particularly important during the test item development as a wide range of items representing each of the sub-domains within each of these two content domains had to be drafted for adequate retention in each of the evaluations (i.e. face and content validity evaluation discussed in section 3.3.4 and pre-testing following thereafter).

The selection of the sub-domains was based on factors that influence the nutritional value of food consumed raw and cooked (Bennion & Scheule, 2000: 303). The sub-domains consisted of: i) choice and purchasing of food items; ii) storage of food items; iii) raw food preparation; and iv) cooking methods. The items covering the same content outcome were grouped together to form a sub-

domain (Thorndike & Hagen, 1977: 239). These sub-domains were considered during the test item development to ensure representation of all the relevant aspects of food knowledge within each content domain, i.e. fruit and vegetables and fats and oils. It was not deemed necessary to have test items from each of the aforementioned sub-domains to be represented or represented equally in the final food knowledge test.

3.3.2 Item construction

Items are the building blocks for tests and unless the individual items are good, the total test cannot possibly be good (Nunnally, 1972: 1950). Consideration was therefore given to various aspects related to the test item construction such as item type selection, clarity, ambiguity, length and relevancy.

3.3.2.1 Selection of item type

Multiple-choice items were chosen as the test item type, eliminating the use of true/false items to reduce the problem of guessing by participants (Nunnally, 1972: 171). The use of open-ended items where participants produce their own answers/responses, for example essay questions, short-answer and completion items (Thorndike & Hagen, 1977: 210; Babbie & Mouton, 2010: 122) were not considered for selection. These types of items require a longer time to complete and process (Nunnally, 1972: 159). In addition, the spelling ability of the participants could introduce subjectivity (Gronlund, 1993: 80) and uniformity amongst responses would not be provided.

The closed-ended multiple-choice items developed required that the participants indicate the correct answer to a question/statement by circling the correct answer (i.e. alternative). The stem of the test items were presented as both questions and incomplete statements (Thorndike & Hagen, 1977: 228). Closed items offer reliability because of the uniformity of measurement (Burns, 2000: 575; Adler & Clark, 2003: 240) and the processing of the data becomes easier as responses can be transferred directly into a computer format (Babbie, 2007: 256). Both comprehension and application type items, which both provide the basic means of understanding (Thorndike *et al.*, 1991: 227; Gronlund, 1993: 45), were included as test items.

Although the typical pattern is to make use of four or five alternatives/distracters when developing multiple-choice test items, Thorndike and Hagen (1977: 228) suggest that a test item must have at least three alternatives to be classified as a multiple-choice item. According to Nunnally (1972: 171) the odds of obtaining the correct answer from participants by chance alone with the use of true/false items, are fifty-fifty. However, with three to five alternatives, the odds in obtaining the correct answer by chance, are one in three, four or five respectively.

The choice of alternatives is very important as they permit control of item difficulty. Alternatives such as 'none of the above', 'all of the above' and other such alternatives are not recommended (Nunnally, 1972: 178; Thorndike & Hagen, 1977: 223; Cohen, Manion & Morrison, 2007: 427) and were therefore not included as answer options for the purpose of this study. The use of negatively formulated items was considered relevant, but done sparingly and where negative wording was used it was, emphasised (printed in bold and underlined) to call the participant's attention to it (Babbie & Mouton, 2010: 237; Cohen *et al.*, 2007: 427).

3.3.2.2 Item clarity, ambiguity, length and relevancy

The following criteria were applied in the wording of each test item whenever possible: Items were drafted concisely as too many words may obscure the meaning of a test item, while the stems included as much of the item as possible, with no irrelevancies (Cohen *et al.*, 2007: 427). Items did not contain ambiguous and vague wording (Cohen *et al.*, 2007: 427) and were not double-barreled (Neuman, 2006: 278). The level of vocabulary was considered suited to the educational level and background of the participants while jargon, slang and abbreviations were avoided (Neuman, 2006: 282). All the test items referred to specific matters and had specific answers, while leading questions were avoided (Oppenheim, 1992: 128; Babbie, 1992: 148; Huysamen, 1994: 130; Struwig & Stead, 2001: 90; Neuman, 2006: 279; Cohen *et al.*, 2007: 427). The alternatives provided were exhaustive. They included all the possible responses that might have been expected by the participants, and were mutually exclusive so that the participants would not have felt compelled to select more than one alternative (Babbie, 2007: 256).

In terms of the item length and relevancy, short items are indicated as being the best to use. This rule was applied wherever possible to avoid a lack of precision and misinterpretation by participants under test conditions (Babbie, 2007: 260; Babbie & Mouton, 2010: 237). Test items were relevant to the majority of the participants. When attitudes/behaviours are requested on a topic that few participants have thought about or are generally concerned about, the results are unlikely to be useful (Babbie, 2007: 259). Therefore, each test item was checked by an expert panel (section 3.3.4) to determine if it was related to the research problem being studied (Babbie & Mouton, 2010: 124). The expert panel selected has a good understanding of the level of food knowledge expected of first-year students entering higher education and on studying a food-orientated course.

3.3.3 Knowledge test construction and completion

Using self-administered research instruments to collect data is less expensive than using a personal/telephonic interview, and participants may feel more at ease if they can answer questions

anonymously (Bernard, 2013: 222). However, when using a self-administered research instrument, the appearance and layout are very important instrument features (Struwig & Stead, 2001: 89; Bordens & Abbott, 2011: 267). An organised assessment tool is much easier and more enjoyable for the participants to complete, factors that may increase the completion rate (Bordens & Abbott, 2011:2 67).

For this study, care was taken to spread out the test items over sufficient pages to provide an uncluttered appearance (Cohen *et al.*, 2007: 427). A test that is improperly laid out can lead to participants missing questions, confusion regarding the nature of the desired data and ultimately may even lead to the test having to be discarded.

An introductory paragraph was included to explain the purpose of the study (Cohen *et al.*, 2007: 429). To make sure that the test did not intimidate the participants it was not referred to as a test, but rather a questionnaire, as advised by Parmenter and Wardle (2000: 271). Clear and concise instructions on how to answer the test items (Thorndike *et al.*, 1991: 240; Bless & Higson-Smith, 1995: 107; Babbie & Mouton, 2010: 243) were included. The response format of circling the appropriate alternative (a, b or c) (Babbie, 2007: 262; Babbie & Mouton, 2010: 240) (as section A) was used. The test incorporated precoded answers to aid the data processing of the responses. The answers were scored dichotomously (0 or 1) by the researcher.

It is recommended that twice the number of test items required in the final knowledge test be compiled in the preliminary test to ensure that enough test items are retained, after the process of item analysis (Huysamen, 1983: 46). According to Gronlund (1993: 37), drafting more test items than required means that weak or inappropriate test items identified during the evaluation (section 3.3.4) and pre-testing (section 3.3.5) may be discarded. For this study, between three and five times the number of envisaged items was drafted, for the first and second constructed preliminary food knowledge tests respectively. This allowed for fair representation of the sub-domains under study and for an envisaged 20 to 25 test items to be retained after the item analysis determination. This would also provide for the final food knowledge test not being too long and time-consuming to complete. Gronlund (1993: 38) indicated that interpretations based on fewer than ten items may be considered highly tentative. The reliability of scores also tends to be lower when the test is short (Gronlund, 1993: 176).

A few demographic questions (marked section B) were included, but were placed at the end of the knowledge test, as advised by Parmenter and Wardle (2000: 271), as some participants dislike answering these questions, seeing them as intrusive and not interesting (Bordens & Abbott, 2011:

267). Besides age and gender as demographic questions, a few biographic questions were also asked that included questions regarding the participant's perceived food knowledge, interest in aspects related to foods and food consumption in comparison to that of peers. These latter questions were included as additional support for differentiating the two sample groups based on their acquired food knowledge.

The food knowledge test (deemed as questionnaire) was handed out and completed by the participants in an institutional setting, i.e. lecture periods with permission of the lecturers involved. While this setting increased the response rate (Babbie, 1990: 187), the possibility existed that questions might be left unanswered which could lower the amount of useable data (Singleton, Straits & Straits, 1993: 265). However, on completion each test was reviewed quickly for omissions and these students were notified thereof for full completion.

3.3.4 Test item content and face validity evaluation

The content-related evidence of validity of test items should be evaluated on logical grounds by experts involved in the related field(s) (Huysamen, 1983: 42). Lynn (1985: 254) recommends that a panel of at least three experts needs to be considered for the evaluation, while Burns and Grove (1993: 328) recommends at least five to ten experts in total to adequately judge the content domain of the knowledge test items. For this study the expert panel was selected within the academic fields of food science and nutrition. The panel content and face validity evaluations are referred to as the pre-phases. Three pre-phases were conducted with two expert panel members lecturing in the academic fields of food science and nutrition. Where both panellists focused on face validity, one panellist in particular commented on whether the items were acceptable in terms of content validity as this member is familiar with the food knowledge expected of first-year students on entering higher education and on studying a food-orientated course. For the further and final pre-phase content and face validity evaluation the expert panel consisted of an additional four members lecturing and/or working in the academic fields of food science and nutrition. Test items were reviewed in terms of accuracy, appropriateness, relevance (Babbie, 1975: 109; Whati *et al.*, 2005: 4), response suitability, response exclusivity (Babbie, 1975: 107), item clarity and format (Nunnally, 1972: 29; Huysamen, 1983: 40). No items were taken from existing and/or standardised questionnaires. Even the test items obtained were adapted or new items generated for them. In this study the evaluation of the preliminary test items was repeated and, where necessary new test items were developed to replace rejected items, until enough test items were retained to provide for a valid and reliable food knowledge test consisting of 20 to 25 test items as envisaged by the researcher.

Face validity refers to whether the test item appears to measure what the test purports to measure (McBurney, 1994: 123; Struwig & Stead, 2001: 139; Neuman, 2006: 192; Bordens & Abbott, 2011: 133). For the face validity evaluation the same expert panel, who are familiar with the knowledge of the study group, was used. In addition, 36 second-year students within the programme Consumer Science: Food and Nutrition at CPUT were selected to form the student panel for the purpose of evaluating the test items for face validity. This student panel, having food and food science and nutrition as subjects, could respond to what was known/unknown to them at university entrance and the knowledge and understanding of their counterparts studying outside the fields of food and nutrition and they represented the study group as being students themselves. Reasonableness of the test items from the participants' point of view (Thorndike & Hagen, 1977: 126) was evaluated, i.e. if terminology used was regarded as either too easy or too difficult (Huysamen, 1983: 41). After the content- and face-related validity evaluations, the items which were retained and revised/adapted formed the preliminary knowledge test. Two such tests resulted in this study, which is presented in the following chapter.

3.3.5 Pre-testing of preliminary knowledge test items and test item analysis

Item analysis was performed on all the preliminary food knowledge tests completed in the pre-testings. Item analysis entails the statistical analysis of the results of a test administration to identify which items can be retained in the final test and which items need to be revised or discarded (Nunnally, 1972: 186). The items meeting the criteria of item analysis formed the final knowledge test. In this study the final food knowledge test only resulted when an adequate number of test items were retained after the conducted item analysis.

3.3.5.1 Pre-testing samples

The participants consisted of two groups of senior students at CPUT to represent a knowledgeable and a less-knowledgeable sample group. The participants were divided into the two sample groups according to their programme of study and expected level of food knowledge. The sample groups for the pre-testing of the preliminary food knowledge tests as well as the sample sizes and the participants for each sample group are shown in Table 3.1. All the participants were second-, third- or fourth-year (i.e. senior) students from CPUT. It was expected that the knowledgeable sample groups would have a higher level of food knowledge as they study programmes with food science, nutrition and professional cookery as curriculum subjects and that the less-knowledgeable sample groups would have a low(er) level of food knowledge as their study programmes exclude these subjects. Study programmes having a dominance of female students were considered to represent the less-knowledgeable sample group due to the dominance of females among the food and

nutrition students. Variables such as gender and age would, therefore, be greatly similar for both sample groups completing the final preliminary knowledge test.

Table 3.1: Summary of sample groups used for pre-testing of the preliminary food knowledge tests

Pre-testing	Sample group	Sample size (n)	Participants
Pre-testing of preliminary food knowledge test (first)*	Knowledgeable	101	ND**: Consumer Science: Food and Nutrition
	Less-knowledgeable	112	BEd***: General Education and Training
Pre-testing of preliminary food knowledge test (first)*	Knowledgeable	<i>ND: Consumer Science: Food and Nutrition sample group retained (n = 101)</i>	
	Less-knowledgeable	68	ND: Environmental Management
Pre-testing of preliminary food knowledge test (second)*	Knowledgeable	119 Male: 33 (27.7%) Female: 86 (72.3%)	ND: Consumer Science: Food and Nutrition ND: Hospitality Management: Professional Cookery or Food and Beverage
	Less-knowledgeable	91 Male: 21 (23.1%) Female: 70 (76.9%)	ND: Environmental Management ND: Public Relations Management

* Refers to the two resultant preliminary food knowledge tests of this study

** ND National Diploma

*** Bachelor of Education

There is no clear-cut answer when it comes to the pre-testing sample size. The correct sample size depends on the purpose of the study and the nature of the population under scrutiny (Cohen *et al.*, 2007: 101). Huysamen (1988: 46) recommends that the knowledge test be administered to five times more participants than the number of test items. For efficient item analysis Nunnally (1972: 194) recommends that at least 40 and preferably 100 participants should be included in a study. In this study the maximum number of students available to include in the knowledgeable group was used as standard. However, Parmenter and Wardle (2000: 276) state that if an adequate sample proves difficult to obtain for the validity and reliability determination, it is better to use a smaller sample than none at all.

Due to the first preliminary test construction requiring further pre-testing administrations (see Table 3.1) during the development process (presented as part of the following chapter), some of the participants from the programme ND: Consumer Science: Food and Nutrition were used twice as the programmes at CPUT that include formal education in food and nutrition are limited. However, the period between the completions of the preliminary tests was between nine and 13 months. Steenhuis, Burg, Van Assema and Imbos (1996: 331) and Parmenter and Wardle (1999: 299) suggest a three and two week interval respectively for participants to have forgotten their original responses. Their answering of the test items would, therefore, reflect their food knowledge at that

time. From the less-knowledgeable sample groups, no student group completed the preliminary test more than once.

3.3.5.2 Item analysis

The data of the completed tests were entered into a Microsoft (MS) Excel spreadsheet and the item analysis conducted using IBM SPSS Statistic (version 21.0). SPSS statistics is a software package widely used for statistical analysis in social science (<http://en.wikipedia.org/wiki/SPSS> [4 July 2013]).

(i) Item difficulty index

The IDI indicates the percentage of participants who answer a test item correctly (Nunnally, 1972: 186; Thorndike *et al.*, 1991: 212, Cohen *et al.*, 2007: 422) and was calculated so that only those test items with suitable difficulty indices were included in the final test. A study by Venter (2006: 14) used a range of between 0.35 and 0.85 as advised by Nunnally (1972: 189), which was also applied in this study. All items found to be too difficult (items answered correctly by less than 35% of the participants) and all items found to be too easy (items answered correctly by more than 85% of the participants) were discarded.

The determined item difficulty/easiness were used to rank the items from easiest to the most difficult (Nunnally, 1972: 189) in the final knowledge test. Placing the easier items first will provide participants with an optimistic start (Nunnally, 1972: 188).

(ii) Distribution of answers to alternatives

The percentage of participants who marked each of the alternatives in the test (a, b or c) as their answer were computed to determine the distracting ability of the alternatives. A useful standard to apply, regardless of the number of alternatives, is to replace those alternatives which were not chosen by at least five percent of the participants, as those alternatives could not be regarded as good distracters (Nunnally, 1972: 190). In this study, as in the test development study of Venter (2006: 14), the particular alternatives were not replaced, but the test item as a whole discarded in such occurrences.

(iii) Item-to-total correlation

The item-to-total correlation is used to determine the internal consistency of the test (Nunnally, 1972: 193). The Pearson's correlation was used to calculate the item-to-total test correlation to determine whether the individual test items measure the same aspect as the test in general. Only those items meeting the item-to-total correlation of 0.20 and higher were retained, as suggested by

Parmenter and Wardle (2000: 272), and effectively used in the aforementioned Venter (2006: 14) study.

(iv) Discrimination index

The discrimination index is used to determine the extent to which each item measures the same aspect as the total test in which it was included (Cohen *et al.*, 2007: 423). For this test the top and the bottom 20% of the participants in terms of test scores were found. Then for each test item the percentage of participants in the top and bottom groups who answered the item correctly was determined. Finally, the percentage of the bottom group was subtracted from the percentage of the top group. The larger the difference, the better the item as it can discriminate the top participants from the bottom participants (Nunnally, 1972: 191). In this study, items which were poor discriminators were discarded, while only those items with a discrimination index of equal to or more than 20% were retained (Thorndike *et al.*, 1991: 250).

3.3.6 Validity and reliability determination

Only those test items meeting all the item analysis criteria were included in the final test (Gronlund, 1993: 34). The main criteria that an effective assessment and evaluation instrument needs to meet are those that incorporate appropriate levels of validity and reliability testing (Parmenter & Wardle, 1999: 298).

3.3.6.1 Food knowledge test validity

For this study there was no appropriate criterion measure available (Ebel & Frisbie, 1991: 107) to determine the criterion-related evidence of validity of the final knowledge test. Construct-related evidence of validity requires that the construct that are presumed to be reflected in the test scores actually do account for differences in the test performance (Gronlund, 1993: 166). This was achieved by comparing the scores of known sample groups to determine whether the scores differentiated between the groups, as was predicted on the grounds of the relevant construct (i.e. food knowledge). It was predicted that there would be a difference between the knowledgeable and less-knowledgeable sample groups. The use of sub-populations with expected differences in food knowledge in order to determine construct validity was also used by Parmenter and Wardle (1999: 301) and Steenhuis *et al.* (1996: 331). If the test scores between the sample groups were significantly different in the expected direction, it was accepted that the test measured what it was supposed to measure (Steenhuis *et al.*, 1996: 331).

The Mann-Whitney test was used to determine the construct-related evidence of validity of the final test, which is whether the test could distinguish between groups of participants having different

levels of knowledge. The Mann-Whitney test accepts/rejects the hypothesis that the two sample groups of participants had the same median degree of knowledge. If there is a difference between the sample groups, the ranks for the scores in one group should be consistently above the ranks from the other group, rather than being randomly distributed (Bordens & Abbott, 2011:456).

3.3.6.2 Food knowledge test reliability

For this study reliability was determined by administering the preliminary knowledge test once and computing the consistency of the responses within the test, i.e. an internal consistency method (Ebel & Frisbie, 1991: 81). The K-R20 statistic was used as it is a widely accepted method for estimating the internal consistency reliability of items scored dichotomously (Ebel & Frisbie, 1991: 83; Struwig & Stead, 2001: 203). The K-R20 statistic determines the average of all the split-half reliabilities that could be derived from splitting the test into two halves in every possible way. The resulting number will lie between zero and one; the higher the number, the greater the reliability of the test. A K-R20 statistic of 0.75 indicates a moderate level of reliability (Bordens & Abbott, 2011: 275).

Like the K-R20 statistic, the Cronbach's alpha coefficient is an internal consistency or reliability score between zero and one, with higher numbers indicating greater reliability (Bordens & Abbott, 2011: 275; Muijs, 2011: 217). The following guidelines are generally used as indication of the reliability: > 0.9 excellent/strong reliability; > 0.8 good reliability; > 0.7 acceptable reliability; > 0.6 questionable/marginal reliability; > 0.5 poor reliability; while < 0.5 low/unacceptable reliability (George & Mallery, 2003: 231; Cohen *et al.*, 2007: 506).

3.3.6.3 Participant sample correspondence and differentiation

When the dependent variable is a frequency count, the statistic of choice is the Pearson's chi-square (Bordens & Abbott, 2011: 453). For the interpretation of the demographic and biographic data, the chi-square statistic was used to determine any associations/differences between the sample groups' demographic and biographic data (section B of the questionnaire/test) as indication of sample group correspondence/differentiation and additional support to the curriculum content used as basis for determining the construct validity. A significant chi-square ($p < 0.001$) indicates that the two variables are significantly related or differ significantly (Bordens & Abbott, 2011: 453).

3.3.7 Norm scores on retained items

Norm scores are used to differentiate between participants' achievement levels, as used in the Venter (2006: 17) study. The mean and median scores of the final knowledge test (incorporating the items that met the item analysis criteria and found a valid and reliable measure) for the two student sample group administrations are calculated. The mean and median scores for the knowledgeable

group administration indicate an above average/good score, whereas the mean and median scores for the less-knowledgeable group administration indicate a below average/poor score. Tests which interpret each participant's relative standing among other participants or can compare individual participants' performance with that of other participants are norm referenced (Grondlund, 1993: 12).

CHAPTER 4

RESULTS

4.1 Introduction

The process followed to obtain a valid and reliable food knowledge test consisting of a sufficient number of test items is presented in this chapter along with the findings of this process. Throughout this chapter, reference is made to two preliminary food knowledge tests. Two preliminary food knowledge tests had to be constructed for this study to provide a valid and reliable food knowledge test consisting of a sufficient number of test items. The steps followed in the development of both the first- and second preliminary tests are similar and include: i) pre-phase evaluations by expert panellists of the test item content and face validity; ii) administration of the preliminary tests containing the items found acceptable by the panellists to sample groups and the item analysis thereof; and iii) the construct validity and reliability determinations of the resultant tests consisting of the retained test items meeting the item analysis criteria. The findings of each of these steps for both the preliminary tests form the study findings presented in this chapter.

The construction findings of the first preliminary food knowledge test developed are presented first in this chapter. The construction process consisted of three pre-phase content and face validity evaluations by two expert panellists, one pre-phase content and face validity evaluation by an additional four expert panellists and a second-year student sample group and two sample group administrations. Item analysis, construct validity and reliability testing were performed for both the sample group administrations in an attempt to retain a sufficient number of test items to result in a food knowledge test not considered highly tentative.

Thereafter the construction findings of the second preliminary food knowledge test developed are presented. For this test only one pre-phase content and face validity evaluation was conducted by an expert panellist as well as one further pre-phase evaluation by an additional eight expert panellists. The data from only one sample group administration of this preliminary test was used to perform the test item analysis and to determine the construct validity and reliability of the test items that remained on meeting the item analysis criteria. The second preliminary food knowledge test formed the basis for the final food knowledge test developed for the purpose of determining the food knowledge of first-year higher education students.

4.2 Pre-phase evaluations of the drafted test items of the working document forming the first preliminary food knowledge test

Before the preliminary items reached the expert panel of six panellists for evaluation, it passed three pre-phases of evaluation for both content and face validity by an expert panel of two higher

education lecturers at CPUT in the programme Consumer Science: Food and Nutrition. For the purpose of this study the preliminary sets of items that went through these three pre-phases are referred to as a working document. The steps in the development of the food knowledge test are presented in Figure 3.1 while Figure 4.1 depicts the placement of these pre-phases in the developmental process.

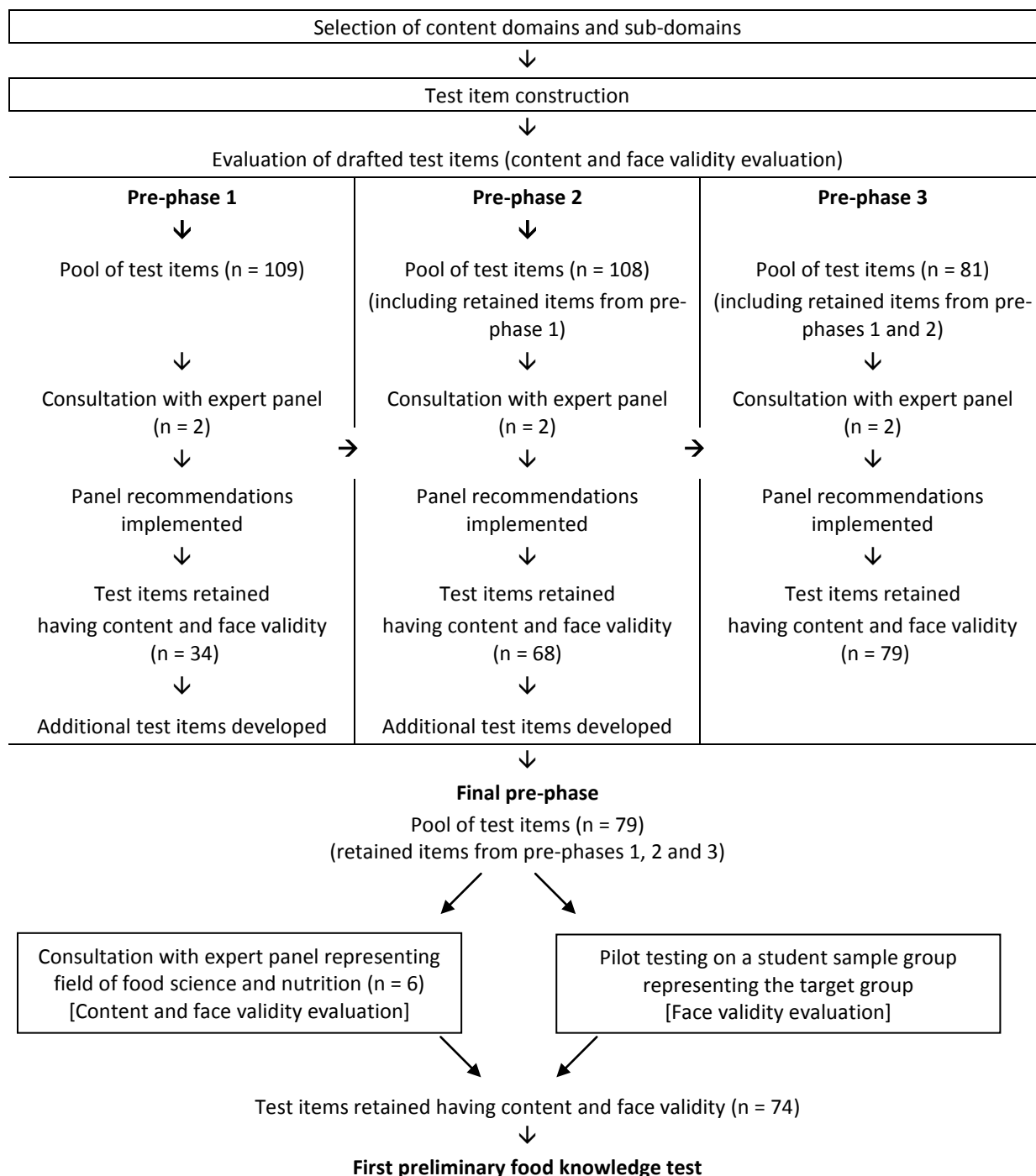


Figure 4.1: The different pre-phases in the development of the first preliminary food knowledge test

The working document evaluated by the aforementioned two panellists (i.e. pre-phases 1 to 3) are not included in this thesis as many of the test items were found inappropriate and considered

nutrition- rather than food-related by the panellists and as a result discarded as possible test items for the final test. This section provides an overview of the problems encountered with the working document test items (other than those considered too nutrition-related and inappropriate) as identified by the panellists, together with their comments, suggestions and recommendations for improvement of the test items. The comments indicated by the panellists as well as their suggestions and recommendations are summarised for each pre-phase of the working document. While Figure 4.1 presents an overview of the pre-phases followed, it additionally indicates the number of test items worked with in each of the pre-phases for clarity.

4.2.1. Panellist evaluation of pre-phase one working document

4.2.1.1 Content and face validity

In section A pertaining to the content domain fruit and vegetables, the panellists advised that the items be more specific when referring to fruit and vegetables in the stem of 12 test items, for example, referring to 'an apple' or 'a carrot' in the stem of a test item instead of either 'fruit' or 'vegetables' in general as some of the response alternatives provided for these questions were not relevant to all types of fruit or vegetables. The panellists also suggested terminology changes to improve the clarity of eight test items and to use the same terms throughout in all related questions to avoid confusion. In terms of terminology, word choices like 'palatability' and 'broth' were identified as possibly unknown to the target group and suggestions were provided to replace these terms where they occurred. The panellists also advised changing terms used to simplify four items, for example, replacing the word 'purchasing' with 'choosing' or 'buying'. Suggestions were also provided to change two test items to make them easier to grasp by the lay person. The panellists provided word changes to improve the understanding of these items. Simplification of test items became a focus point and meant that the stem and/or alternatives had to be adapted in order to retain these specific test items.

Some test items were found to be too advanced, for example, where a test item referred to adding acids to cut fruit and vegetables to avoid discolouration. This was not considered necessary to know as a general food practice by the target sample. A further five test items were also thought to be of no relevance to the target group or it was queried whether the food practice being referred to was of importance to the target group. All test items referring to freezing (n = 4) were discarded as the panellists stated that students do not buy in large quantities and may have refrigerators but limited freezer facilities. Eight test items were thought to be too specific culinary knowledge, or too scientific for the target sample, and also discarded.

In section B pertaining to the content domain fats and oils, the panellists commented that many test items were drafted on fats and oils as ingredients and as a result became too scientific. Questions on the fat content of foods, such as of meat and dairy products, were therefore considered for pre-phase two. As in section A, attention was given to simplification of the terminology to make the words used more relevant to the target sample and to replace words thought to be unfamiliar to them, for example, ‘rancid’ and ‘transparent’.

The panellists overall queried five specific test item alternatives, where the correctness of the responses to each was questioned. Where two test items in general indirectly obtained the same information, but were worded differently, one of the two items was discarded. Where items were stated negatively, the panellists recommended stating the stem as positive where possible. With regard to the general construction of the test items, the panellists suggested including the action word at the beginning of a question/statement in the stem and to shorten questions/statements.

4.2.1.2 Number of test items retained in pre-phase one

The first working document consisted of 109 knowledge test items. Section A: Fruit and vegetables consisted of 54 items numbered 1 to 54, and section B: Fats and oils contained 55 items numbered 1 to 55. The numbering was later changed to follow consecutively throughout both sections.

After incorporating the panellist feedback on the content and face validity evaluation of the first working document, 34 (63%) items were discarded as options from the fruit and vegetables section and a further 41 (74.5%) items discarded as options from the fats and oils section. This resulted in a pool of 34 retained items after the first round of evaluation (see Table 4.1). These retained items were greatly adapted according to the comments, suggestions and recommendations made by the panellists (summarised above) to be acceptable for inclusion into the next pre-phase.

Table 4.1: Number of test items within each content domain after the content and face validity evaluation* of pre-phase 1 of the first preliminary food knowledge test working document

Test content domains	Number of test items				
	Developed	Discarded		Retained	
		n	%	n	%
Section A: Fruit and vegetables	54	34	63.0	20	37.0
Section B: Fats and oils	55	41	74.5	14	25.5
	109	75	68.8	34	31.2

* Evaluation undertaken by two expert panellists

4.2.2 Panellist evaluation of pre-phase two working document

After the general content and face validity evaluation related to pre-phase one, the revision of the test items in the working document focused on specific aspects concerning the content and face

validity in pre-phase two. Specificity, clarity, simplification, consistency within test items, accuracy of alternatives and relevance to the target sample were the aspects now specifically addressed in the content validity evaluation. For the face validity evaluation, grammatical errors were identified and recommendations made to improve the construction of the test items.

4.2.2.1 Content validity

(i) Specificity of test items

The panellists advised being more specific with regard to the description of the preparation method, for example, to rather stipulate 'apple slices' or 'cut apples' instead of just 'apples' to avoid spoilage. They also indicated specifying the form of certain vegetables when referring to the cooking thereof, for example, to stipulate 'finely sliced carrots' (see item 11, Addendum C) or 'whole, unpeeled butternut' (see item 12, Addendum C). Suggestions were also made to be more specific regarding the stages of the preparation of a food item, for example, to add the words 'before boiling/cooking' where necessary.

Where cooking methods were questioned, the panellists advised the inclusion of certain terms to ensure specificity with regard to the reason for cooking or use of cooked fruit and/or vegetables, for example, 'cooking to retain colour and texture' and 'cooking apples for an apple pie'. Where certain cooking methods were described inadequately in terms of the optimal way to cook foods to retain nutrients, suggestions were made to improve these test items.

Further suggestions regarding specificity included omitting the general use of the word 'fruits' or 'vegetables' and rather referring to a specific fruit or vegetable in the stem of the test item. However, where a cooking method did not refer to only one specific fruit and/or vegetable, the general use of fruit and/or vegetables were retained. Where the test item referred to meat choices, it was suggested that the specific species be named, for example, chicken, beef or ostrich mince.

(ii) Clarity of test items

Although test items need to be clear and unambiguous (Thorndike & Hagen, 1977: 220), researchers often create long and complicated items. This tendency should be avoided (Babbie, 2007: 257). Babbie (2007: 257) suggested as a general rule that whenever the word 'and' appears in a test item question/statement (i.e. stem), the researcher should check whether a double-barrelled question is being asked or not. All test items considered double-barrelled were as a result discarded.

The panellists expressed concern about confusing or misleading terms, for example, the use of the words 'spoil' and 'discoloured' when used interchangeably, as these terms do not have the same

meaning. Items referring to specific parts of fruit or vegetables were also noted as being confusing as participants may not have the knowledge of parts of these food items in order to answer the item appropriately. A further test item that was considered confusing was the item that asked 'Why is fat added to baked products?' The panellists identified this item as being misleading as participants might interpret the question as adding fat to a product after it was baked.

(iii) Simplification of test items

According to Nunnally (1972: 176) it is wise to keep the terminology as simple as possible. Where an item was identified as being too long and complicated, suggestions were made to simplify the item by making the stem and/or alternatives shorter and more specific, eliminating unnecessary terms or adapting the way in which the alternatives were written. In addition various alternatives were removed and replaced with more appropriate response suggestions made by the panellists.

Thorndike and Hagen (1977: 231) states that as much of the item as possible should be included in the stem to keep the alternatives as short as possible. If the same words or phrases were repeated in all or most of the alternatives, the stem was rewritten to include the repetitive response content.

(iv) Alternatives

The most evident focus point of the content validity evaluation of the fats and oils section was the use of weak distracters; for example, where one alternative referred to the use of a 'saucepan' and one to 'baking'. The panellists identified such an occurrence as a weak distracter or in more literal terms, that the alternative is too obviously the incorrect answer for participants to select.

(v) Accuracy of test items

Where items were evaluated and found to have more than one correct answer alternative based on the test item interpretation, suggestions were made to rectify this by either adapting or replacing these alternatives, which lead to the test items being acceptable if reworded. Thorndike and Hagen (1977: 235) states that there should be only one correct or clearly best answer, while taking into consideration that the distracters must also be alternatives that attract participants that have no or partial knowledge on the topic.

When an item referred to selecting the correct alternative relating to the 'most energy' contained in food, the panellists commented that the FoodFinder 3 dietary analysis software program (South African Medical Research Council, 2002) or food composition tables be consulted to confirm the correct answer alternatives. It was further recommended to use the South African Medical Research Council food quantities manual, for instance to confirm '40 gram (g)' when using the description

'medium' in the stem of an item, for example referring to the addition of milk to coffee and/or tea in terms of energy value added (Langenhoven, Conradie, Wolmarans & Faber, 1991: 9). It was also recommended that nutrition information on the packaging of items be consulted, such as coffee creamers for the amount expected to be added to coffee and/or tea when formulating such items in order to make it relevant to participants (see item 138, Addendum D).

(vi) Unfamiliarity and relevance

Various words were adapted as they were thought to be unfamiliar in the South African context, for example 'broiling', a typical American term. The South African term used is 'searing'. Unfamiliar fruit and vegetable types used were also replaced with alternatives more familiar and applicable to the sample group. Some items were eliminated as they were thought to pertain to that of a chef's understanding of food terminology, or were not viewed as being food-based, but rather nutrition-based, for example, testing participants' knowledge of the fat or dietary fibre content of fruits.

Questions asked in a test should always be relevant to most participants (Babbie & Mouton, 2010: 236). Therefore test items that referred to a specific food process unrelated to students, for example wine making, shelf life or food deterioration, seasonality, age and ripeness of fruit and vegetables and value for money were discarded. In the fats and oils section the items discarded based on relevancy related to the temperature of oil, amount of fat absorbed by foods, spattering of oil and cooking sprays. Items related to the types of fats or fatty acids were also discarded as they were not considered appropriate as they were viewed nutrition- rather than food-related.

4.2.2.2 Face validity

(i) Format

Where negative items occurred, for example when referring to the factors that are not a sign of good food quality, the panellists suggested changing these to positively worded items by rephrasing the questions/statements. Thorndike and Hagen (1977: 232) recommend that negative items should be used sparingly. Babbie and Mouton (2010: 237) further adds that the use of negative items should be avoided as they may lead to misinterpretation. However, as in this study, a few items with the word 'not' in the stem may be justified (Thorndike & Hagen, 1977: 232). The panellists suggested that the negative word should be in bold and underlined for emphasis and notification by the participants and to reduce ambiguity, as advised by Nunnally (1972: 162).

(ii) Grammar

To support face-related evidence of validity, grammatical suggestions included substituting the words 'a little' with the words 'a small amount'. Suggestions were also made to be consistent with

the sentence structure throughout all alternatives to an item in terms of the number of parts of an alternative, for example ‘in the refrigerator’ (having one part) versus ‘in the cupboard in an airtight container’ (having two parts). Further notes for improving the sentence structure included the removal of a comma after the words ‘no’ and ‘yes’ and to replace the comma with a colon. Further basic grammatical corrections included not capitalising certain words.

(iii) Consistency

Consistency of alternatives (Huysamen, 1983: 42) as a consideration of face validity was also stressed by the panellists. The panellists suggested being consistent with pronouns and nouns, for example, using either ‘lettuce’ or ‘leaves’ throughout the alternatives to ensure the same response structure. In terms of the preparation methods stipulated within items, the panellists emphasised the importance of maintaining the same preparation method for the stem and the alternatives, for example, where one alternative referred to after and the remaining alternatives to during preparation.

4.2.2.3 Number of test items retained in pre-phase two

After the first pre-phase evaluation the remaining pool of 34 items was too low. As a result it was considered necessary to develop new test items for the second pre-phase evaluation. A total of 40 and 32 items were added to the fruit and vegetables and the fats and oils sections respectively, which resulted in a pool of 108 test items (60 in the fruit and vegetables, and 48 in the fats and oils content domains) for the working document.

Based on the evaluation feedback received, 21 (35%) items were discarded as options from the fruit and vegetables content domain and 19 (39.6%) items from the fats and oils content domain. A pool of 68 items was retained after this evaluation (see Table 4.2).

Table 4.2: Number of test items within each content domain after content and face validity evaluation* of pre-phase 2 of the first preliminary food knowledge test working document

Test content domains	Number of test items				
	Developed	Discarded		Retained	
		n	%	n	%
Section A: Fruit and vegetables	60	21	35.0	39	65.0
Section B: Fats and oils	48	19	39.6	29	60.4
	108	40	37.0	68	62.7

* Evaluation undertaken by two expert panellists

After this evaluation, it was again necessary to compile new test items for the working document before providing it to the final expert panel consisting of an additional four panellists for evaluation.

A total of 13 items (four to section A and nine to section B) were added that resulted in a pool of 81 test items.

4.2.3 Panellist evaluation of pre-phase three working document

4.2.3.1 Content validity

Fewer concerns by both panellists arose in both the fruit and vegetables and the fats and oils content domains for content (and face) validity when compared to the previous evaluation phase. However, many of the same concerns resurfaced even after changes were made regarding item specificity, clarity, accuracy and unfamiliarity and discrepancies regarding the distracters.

(i) Specificity of test items

As in the previous pre-phase, it was again recommended that certain test items be more specific. In this pre-phase, the concerns mainly pertained to cooking processes, for example, to include the words 'at the beginning of the cooking process' in order to avoid misinterpretation by the participants. Similarly, instead of only stating 'pre-cooking vegetables', suggestions were made to rather state 'pre-cooked and then added'. Further suggestions were made to specify when vegetables are to be added, for example, 'to the last 30 minutes of cooking after the meat is cooked'. An example from the fats and oils section includes where an item referred to the 'best' fat used for baking. It was adapted to include 'best for baking a layer cake, using the creaming method'.

(ii) Clarity of test items

The panellists again identified certain terms and items they thought were confusing, for example, 'do not add too little fat' as an alternative to a question on stir-frying. Suggestions were made to clarify the test item. From the fats and oils section certain alternatives pertaining to cooking methods were queried as they were thought to be incorrect or contained unnecessary words that would confuse the participants.

(iii) Accuracy of test items

Various alternatives were queried in terms of their correctness, for example, where a test item referred to the signs of good quality broccoli when purchasing. The alternative 'colour of broccoli is yellow-green' was indicated by the panellists as a sign of age and decay and not the quality of broccoli. Where an item questioned a specific type of fruit regarding its ripeness, one distracter namely 'green skins', was identified as incorrect as this response was dependent on the variety. The panellists suggested including a distracter referring to the size of the fruit instead. The panellists also pointed out certain items where the answer was too obviously correct, for example, the use of the term 'very lean meat' when asked about reducing the energy content of meat dishes.

(iv) Alternatives

The panellists found minor discrepancies between item alternatives and recommendations were made for adaptations in these instances, for example, where an item referred to the boiling of vegetables and factors that will increase the cooking time, one of the alternatives was 'cooking a small amount of vegetables at a time'. It was, however, pointed out by the panellists that this method will also increase the cooking time. In such items where two alternatives were found to be correct, suggestions were made to adapt these alternatives so that only one is correct.

An example of weak distracters included the listing of three oils compared to the correct answer being a solid fat. Where two distracters were almost similar, for example using both 'tub margarine' and 'margarine' within one test item as alternatives, suggestions were made for substitutions.

(v) Unfamiliarity

Where test item distracters referred to terms such as 'maturity' and 'physical appearance' of vegetables, the panellists queried whether students would be familiar with these terms. It was suggested to rather refer to 'the age of the vegetables' and to ensure that the study group was more familiar with the other alternatives/distracters in order to avoid one answer to be obviously correct.

In the fats and oils section, where items referred to temperatures, it was recommended that temperature references be changed or the items discarded as students would not have knowledge regarding this topic. Furthermore, terms such as 'stick margarine' and 'richest flavour' and items referring to price and availability of products were removed and replaced with more familiar and relevant items.

4.2.3.2 Face validity

In some instances where the panellists found the test items to be acceptable, suggestions were still made to change various alternatives to ensure that the items were more reader-friendly for the target sample. Suggestions were also made to improve the consistency in sentence structure throughout all alternatives in terms of the number of parts to a sentence. Instead of referring to 'using a pot', it was, for example, suggested to rather include 'use a small pot to cook' to ensure that all alternatives contained sentences with the same number of parts.

Other formatting issues included the bolding and underlining of certain terms that were to be emphasised within the stem of the item (Thorndike & Hagen, 1977: 232), as suggested in the previous round of evaluation. Again, recommendations were made regarding the consistency of the use of pronouns when included in response alternatives (Thorndike & Hagen, 1977: 218), for

example, to insert the word ‘them’ into all alternatives. In the previous pre-phase evaluation it was suggested to keep the structure of sentences consistent, for example, to replace the comma after the words ‘no’ and ‘yes’ with a colon. In this phase the panellists suggested inserting the comma back into the sentence, eliminating the need for the colon.

4.2.3.3 Number of test items retained in pre-phase three

Only one of the test items were discarded from the fruit and vegetables content domain. In the fats and oils content domain one item was discarded while one item was added. Overall, two items were discarded (see Table 4.3), that resulted in a preliminary food knowledge test consisting of 79 test items.

Table 4.3: Number of test items within each content domain after the content and face validity evaluation* of pre-phase 3 of the first preliminary food knowledge test working document

Test content domains	Number of test items		
	Developed	Discarded	Retained
Section A: Fruit and vegetables	41	1	40
Section B: Fats and oils	40	1	39
	81	2	79

* Evaluation undertaken by two expert panellists

4.3 Panellist evaluation of the final pre-phase working document

In the final pre-phase evaluation of the content and face validity, an expert panel was utilised which comprised of an additional four panellists consisting of three higher education lecturers at CPUT in the Faculty of Applied Sciences in the programme Consumer Science: Food and Nutrition and a qualified expert working in the field of food science and technology.

In this final pre-phase, panellists were no longer asked to comment on whether the items were food- or nutrition-based, but rather if they were found to be acceptable in terms of both their content and face validity for first-year students on entering higher education and becoming responsible for their own food provision in addition to studying a food-orientated course. Panellists were asked to provide suggestions for improvement or changes to make the test items more appropriate for the target sample. However, panellists provided comments even when test items were accepted as appropriate. For this pre-phase the content sub-domains were adapted by combining food purchasing and food choice as one sub-domain, as individually, each of these sub-domains were not large enough to form a sub-domain on their own and often the individual topics were found to overlap. Addendum C comprises the summary of the working document indicating the comments and suggestions made by these expert panellists (n = 6).

In the fruit and vegetables content domain, some concerns resurfaced from the first, second and third pre-phases of evaluation. Again, the main points of concern regarding the content validity pertained to item specificity, accuracy and term use unfamiliarity. Regarding the face validity evaluation, various sentence structure recommendations were provided for improvement to ensure consistency, emphasis on specific terms, shorter item length and item ordering to, among others, address the difficulty of the items.

4.3.1 Content validity

In this final pre-phase fewer concerns surfaced as the purpose of the initial three rounds was to phase out the majority of errors.

i) Specificity of test items

Panellists suggested specifying the type of vegetables when the stem of the item referred to 'vegetables' in general and to specify the state of vegetables, for example 'cooked', 'uncooked' or 'after cooking or peeling' to increase the specificity. Panellists also suggested that the purpose of preparing the fruit and/or vegetables should be indicated for clarification of the item, for example, 'cook to retain the colour, texture and nutrients' (see items 8 and 9, Addendum D). In the fats and oils section a further example includes the item asking 'why fat is added when baking a cake' (see item 54, Addendum D). It was suggested that it should be specified as 'added to the ingredients' to avoid misinterpretation by the participants.

ii) Accuracy of test items

Various alternatives were identified as being "obviously incorrect/correct" by the panellists (see items 2 and 35, Addendum C). However, these comments were ignored for the purpose of the final preliminary knowledge test. Test item alternatives being obviously incorrect or correct, as interpreted by the panellists, may not be as obvious to the study group who may not be familiar with what may be considered general food knowledge. One test item contained an alternative that was thought to be the "odd one out" (see item 7, Addendum C) and therefore discarded.

iii) Unfamiliarity

Some terms were suggested as not being familiar to the study group, for example, the word 'wilted' (see item 3, Addendum C) was not identified as being unfamiliar to the study group in pre-phases one to three. However, this term was maintained for inclusion in the final preliminary food knowledge test. No other term could be found that would be appropriate as a substitute without changing the meaning of the item. Similarly, panellists identified the word 'legumes' as not being familiar to students and suggested the use of 'beans' or 'lentils' (see item 13, Addendum C). A

further example of an uncommon term used from the fats and oils section includes the use of ‘coffee creamers’. This alternative was replaced with ‘condensed milk’ as alternative (see item 70, Addendum C). An item referring to the dietary fibre content of various dried fruits was eliminated from the final pool of test items, as more than one panellist identified it as being too difficult to answer because the item content may not be relevant to the knowledge of a first year student (see item 40, Addendum C).

4.3.2 Face validity

i) Format

Minor sentence structure issues arose in the final pre-phase. Panellists recommended starting alternatives with the verb included in the sentence as an action word for all alternatives (see items 1 and 7, Addendum C) for the purpose of consistency (Huysamen, 1983: 42) or changing verbs to be consistent with one another where they were different among the alternatives (see item 10, Addendum C). Recurring formatting errors included suggestions to improve options by emphasising specific adjectives within the alternatives (see item 31, Addendum C).

The panellists commented on adapting various items to be more reader-friendly, by either changing the sentence structure (see item 7, Addendum C), adding additional words (see items 18 and 37, Addendum C) or adapting word use to ‘everyday language’. The sentence structure of item alternatives were also adapted according to the panellist feedback received (see item 20, Addendum C).

Comments received in the final pre-phase that were not provided in the first three pre-phases of the evaluation included the ordering of the test items. The ordering of the test items was, however, only fully attended to in the final developed food knowledge test where the calculated item difficulty indexes were used to rank the items from the easiest to the most difficult. An item found to be too long (see item 16, Addendum C) was excluded from the final pool of test items. Grammatical errors identified by the panellists included the incorrect use of terms (see item 71, Addendum C). Suggestions to improve such items were made by the panellists and incorporated.

ii) Knowledge level

Where items received comments related to them being “too scientific” (see items 1 and 24, Addendum C), this comment was not considered for adapting the items concerned. Panellists’ comments on items being “too general knowledge” (see items 37, 38, 76 and 77, Addendum C) or “too easy” (see items 28, 33, 34, 35 and 37, Addendum C) were also not considered as item analysis would be applied to the test item administration to identify items being too difficult or too easy.

According to Nunnally (1972: 188) some rather easy items should be included to provide a participant a sense of accomplishment. Similarly, some difficult items should be included to illustrate to participants that they still have to gain knowledge regarding the topic and these items should serve as motivation (Nunnally, 1972: 188). The decision to retain or discard these abovementioned items were based on how many of the panellists commented on the issue and where a minimum (n = 1) commented, the comment was ignored.

In addition to the expert panellists, 36 second-year students from the programme Consumer Science: Food and Nutrition, who were knowledgeable through having at least two years of formal food science and nutrition education, were selected to make up the panel for the face validity evaluation. The student group were divided into nine groups of four students each. The pool of 79 test items was divided between the nine student groups to allow for more evaluation time per test item. The students were asked to comment on the acceptability of the test items for entry-level (i.e. first-year) students. In general, the students commented on the simplification and clarification of 13 test items as comments arose of these items being too scientific, too difficult or referring to processes and/or ingredients not familiar to the student target group. The recommendations made by the second-year student group for the 13 aforementioned questions were also addressed during the face validity evaluation by the expert panellists and therefore no further changes were necessary after the student evaluation.

4.3.3 Number of test items retained in final pre-phase working document

The evaluation of the final working document undertaken by the six expert panellists and the student sample group led to three items being discarded from the fruit and vegetables content domain and two items from the fats and oils content domain. This resulted in a preliminary food knowledge test consisting of 74 test items (see Table 4.4).

Table 4.4: Number of test items within each content domain after the content and face validity evaluation* of the final pre-phase working document

Test content domains	Number of test items		
	Developed	Discarded	Retained
Section A: Fruit and vegetables	40	3	37
Section B: Fats and oils	39	2	37
	79	5	74

* Evaluation undertaken by six expert panellists and a student sample group represented by 36 second-year students from the programme Consumer Science: Food and Nutrition

4.4 Item analysis of first preliminary food knowledge test administrations

The first preliminary food knowledge test was administered twice. Item analysis was performed on both administrations to determine which and how many items in each administration met the item analysis criteria to form the final knowledge test. Figure 4.2 summarises the two administrations with the number of test items retained from the item analysis performed for each administration. Items 15 and 48 were omitted from the preliminary test due to missed typing errors, resulting in a total of 72 useable test items.

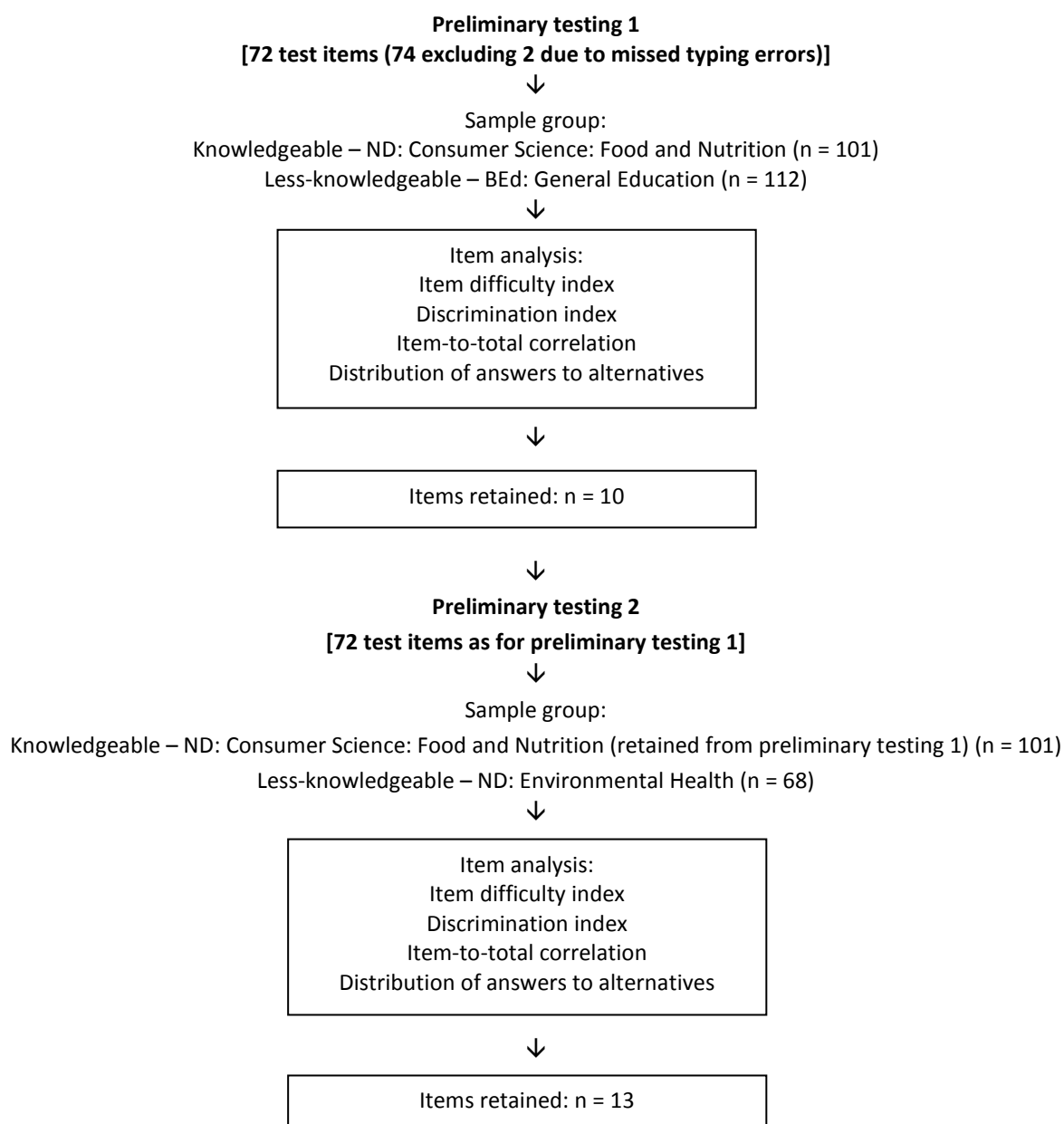


Figure 4.2: First preliminary food knowledge test administrations and number of test items retained from the item analysis

Item analysis involved the statistical analysis of the results obtained from the administrations of the preliminary food knowledge test to identify which test items could be retained, which needed further revision or needed to be discarded. Only the test items meeting the analysis criteria would

be retained for the validity and reliability determinations of the final food knowledge test. The results of the item analysis of the first preliminary food knowledge test administration are indicated in Table 4.5 and the results of the second administration in Table 4.6. Replacing the less-knowledgeable sample group during the second administration was done to align the knowledgeable and less-knowledgeable sample groups more effectively, based on their socio-economic status representation. A representative sample closely matches the characteristics of the population (Bordens & Abbott, 2011: 278). In this case, the sample group representing the less-knowledgeable sample constituted a biased sample (Bordens & Abbott, 2011: 278) as they were not representative of the student demographics at the institution.

Table 4.5: Item analysis of the first administration of the first preliminary food knowledge test

Question number*	Item difficulty index (IDI)**	Discrimination index***	Item-to-total correlation#	Distribution of answers to alternatives##			
				a	b	c	d
1	84.51	42.1	0.473	2.35	5.16	7.98	84.51
2	66.20	2.3	0.055	22.54	66.67	7.51	3.29
3	60.09	47.6	0.337	1.88	60.56	30.05	7.51
4	86.85	14.2	0.176	86.85	2.35	9.86	0.94
5	96.71	5.3	0.101	2.35	95.77	0.00	1.88
6	87.32	10.6	0.135	0.94	2.82	7.98	88.26
7	29.58	34.3	0.321	20.19	11.27	35.80	30.05
8	38.03	15.1	0.110	25.82	14.55	38.97	20.66
9	39.44	28.9	0.214	10.80	47.89	37.44	1.88
10	72.30	-3.0	0.009	0.47	72.30	3.76	23.47
11	81.22	21.2	0.184	77.46	6.57	7.04	8.92
12	73.71	37.0	0.316	4.23	73.71	6.10	15.96
13	63.85	51.0	0.381	64.32	28.64	5.63	1.41
14	81.22	28.1	0.313	9.39	3.76	6.10	80.75
16	60.56	21.6	0.184	7.51	6.57	24.88	61.03
17	49.30	14.8	0.085	27.23	13.15	49.30	10.33
18	77.00	24.8	0.247	11.27	76.53	3.29	8.92
19	52.58	35.6	0.310	7.51	52.11	32.86	7.51
20	46.48	26.9	0.202	4.69	27.70	45.07	22.54
21	65.26	9.3	0.105	25.35	65.26	4.23	5.16
22	77.93	19.6	0.220	77.46	17.84	0.94	3.76
23	88.26	12.4	0.177	2.35	0.00	8.92	88.73
24	89.20	22.8	0.288	88.73	1.41	2.35	7.51
25	82.16	16.0	0.153	1.88	82.16	3.29	12.65
26	79.81	33.4	0.332	7.98	3.29	79.81	8.92
27	85.45	22.9	0.269	2.35	5.16	6.57	85.92
28	81.22	26.4	0.214	81.22	0.94	7.51	10.33
29	82.63	19.4	0.244	13.15	82.16	0.94	3.76
30	65.73	35.4	0.275	65.73	20.19	13.62	0.47
31	94.84	14.0	0.203	2.35	2.35	94.37	0.94
32	59.62	26.7	0.209	59.62	4.69	10.33	25.35
33	60.09	39.0	0.317	14.08	4.69	20.19	61.03
34	79.34	38.7	0.371	4.69	5.16	10.80	79.34
35	78.40	38.7	0.365	78.40	11.74	5.63	4.23
36	74.18	35.3	0.352	74.18	0.94	21.13	3.76
37	82.16	36.9	0.386	5.63	6.10	82.16	6.10
38	74.65	35.2	0.339	75.12	8.45	1.88	14.55
39	90.14	7.1	0.078	1.41	6.57	90.14	1.88
40	89.67	19.3	0.272	5.16	89.67	3.76	1.41
41	95.31	8.8	0.208	3.76	0.47	94.84	0.94
42	82.16	7.2	0.094	4.69	82.63	9.39	3.29

Table 4.5 [continued]

Question number*	Item difficulty index (IDI)**	Discrimination index***	Item-to-total correlation#	Distribution of answers to alternatives##			
43	<i>59.15</i>	35.5	<i>0.311</i>	<i>11.74</i>	<i>59.15</i>	<i>15.49</i>	<i>13.62</i>
44	71.83	38.7	0.334	26.29	71.83	0.94	0.94
45	88.73	17.6	0.265	87.32	9.39	3.29	0.00
46	<i>55.87</i>	<i>66.8</i>	<i>0.541</i>	<i>14.55</i>	<i>55.40</i>	<i>16.90</i>	<i>13.15</i>
47	67.14	-11.6	0.056	4.69	67.14	2.35	25.82
49	46.95	27.0	0.264	0.94	6.10	47.42	45.54
50	57.75	52.9	0.429	2.82	57.75	3.76	35.68
51	27.23	30.7	0.237	26.76	4.23	49.30	19.72
52	79.81	17.8	0.192	79.81	1.88	9.39	8.92
53	76.53	16.2	0.138	4.69	77.00	5.16	13.15
54	86.85	21.2	0.313	87.32	11.74	0.47	0.47
55	79.81	35.2	0.396	80.28	12.21	3.29	4.23
56	73.71	16.2	0.141	1.41	73.71	23.94	0.94
57	34.27	16.8	0.175	33.80	34.27	6.10	25.82
58	77.00	47.4	0.450	11.27	77.00	9.39	2.35
59	85.92	2.0	0.076	3.29	1.41	9.39	85.92
60	<i>66.67</i>	<i>24.9</i>	<i>0.201</i>	<i>66.67</i>	<i>7.51</i>	8.92	<i>16.90</i>
61	34.27	34.1	0.265	0.94	60.09	34.27	4.69
62	<i>54.46</i>	<i>38.9</i>	<i>0.283</i>	<i>32.86</i>	<i>7.98</i>	<i>5.63</i>	<i>53.52</i>
63	<i>48.83</i>	<i>53.1</i>	<i>0.371</i>	<i>5.16</i>	<i>50.70</i>	<i>27.23</i>	<i>16.90</i>
64	45.07	35.8	0.283	28.17	2.82	24.41	44.60
65	92.24	5.3	0.053	0.47	95.77	0.94	2.82
66	33.80	4.5	0.014	61.50	33.80	2.35	2.35
67	<i>69.48</i>	<i>23.2</i>	<i>0.273</i>	<i>6.10</i>	<i>69.01</i>	<i>14.08</i>	<i>10.80</i>
68	75.59	23.0	0.259	11.74	11.27	75.59	1.41
69	70.42	56.2	0.471	21.13	0.47	70.42	7.98
70	69.48	31.8	0.267	15.96	69.48	1.88	12.62
71	<i>38.97</i>	<i>51.4</i>	<i>0.397</i>	<i>47.89</i>	<i>38.97</i>	<i>7.98</i>	<i>5.16</i>
72	92.49	0.2	0.005	92.49	4.69	1.88	0.94
73	23.94	22.2	0.249	33.33	18.78	23.47	24.41
74	<i>43.19</i>	<i>27.0</i>	<i>0.211</i>	<i>43.19</i>	<i>5.63</i>	<i>12.21</i>	<i>38.97</i>

Values in bold print: Item does not meet specific item analysis criteria

Values in italic print: Items retained

* Excluding items 15 and 48 leaving a pool of 72 items

** Item difficulty index: 0.35 – 0.85

*** Item discrimination index: ≥ 0.20

Item-to-total correlation: ≥ 0.20

Distributions of answers to alternatives: ≥ 5%

Table 4.6: Item analysis of the second administration of the first preliminary food knowledge test

Question number*	Item difficulty index (IDI)**	Discrimination index***	Item-to-total correlation#	Distribution of answers to alternatives##			
				a	b	c	d
1	<i>80.47</i>	<i>59.5</i>	<i>0.639</i>	5.92	6.51	7.10	<i>80.47</i>
2	67.46	15.0	0.140	20.12	66.27	9.47	4.14
3	<i>56.21</i>	<i>48.1</i>	<i>0.390</i>	5.92	<i>55.62</i>	<i>27.81</i>	<i>10.65</i>
4	82.25	21.6	0.212	82.25	3.55	12.43	1.78
5	98.22	2.4	0.211	2.96	97.04	0.00	0.00
6	88.76	12.1	0.198	2.37	2.37	6.51	88.76
7	34.91	36.8	0.306	22.49	12.43	29.59	35.50
8	33.14	18.0	0.133	30.18	14.20	33.14	22.49
9	31.36	39.1	0.277	17.75	47.34	31.36	3.55
10	56.80	36.4	0.270	3.55	56.80	10.65	28.99
11	80.47	19.3	0.193	79.29	3.55	4.14	13.02
12	75.74	35.9	0.356	2.37	75.74	7.10	14.79
13	65.68	55.0	0.426	66.86	26.04	5.33	1.78
14	78.11	38.2	0.429	11.24	4.14	6.51	78.11
16	63.31	31.6	0.222	10.65	4.73	20.71	63.91

Table 4.6 [continued]

Question number*	Item difficulty index (IDI)**	Discrimination index***	Item-to-total correlation#	Distribution of answers to alternatives##			
17	47.34	-5.9	0.007	23.67	15.98	47.34	13.02
18	66.27	52.6	<i>0.404</i>	<i>13.61</i>	<i>65.09</i>	9.47	<i>11.86</i>
19	61.54	29.0	0.246	4.14	60.95	25.44	9.47
20	43.20	31.8	0.183	1.78	22.49	41.42	34.32
21	54.44	10.4	0.098	34.32	55.03	2.96	7.69
22	86.98	5.1	0.069	86.39	12.43	0.00	1.18
23	76.33	43.0	0.411	6.51	0.59	15.98	76.92
24	80.47	50.1	0.482	79.88	0.00	5.92	14.20
25	78.70	24.1	0.191	2.37	78.70	5.92	13.02
26	89.94	21.4	0.277	6.51	1.18	89.94	2.37
27	83.43	38.2	0.444	2.37	5.33	8.88	83.43
28	82.84	23.9	0.199	84.02	0.00	9.47	6.51
29	66.27	50.1	0.466	24.85	65.68	4.14	5.33
30	49.70	64.7	0.506	49.11	32.54	16.57	1.78
31	82.25	74.6	<i>0.530</i>	5.33	7.10	82.25	5.33
32	47.93	48.2	<i>0.359</i>	47.93	6.51	11.24	34.32
33	59.17	31.5	0.186	21.30	5.33	13.61	59.76
34	78.70	54.8	0.536	2.96	5.33	12.43	79.29
35	63.31	81.0	0.703	63.31	21.89	12.43	2.37
36	67.46	52.7	0.447	67.46	1.78	24.85	5.92
37	80.47	47.6	<i>0.460</i>	7.10	5.33	80.47	7.10
38	76.33	45.3	0.377	76.33	6.51	1.78	15.38
39	85.21	33.4	0.372	2.37	8.88	85.21	3.55
40	73.96	71.5	0.643	15.38	73.96	4.73	5.92
41	81.66	50.0	0.483	16.57	1.78	80.47	1.18
42	83.43	9.8	0.152	5.92	84.02	6.51	3.55
43	71.60	14.7	0.164	9.47	71.60	13.02	5.92
44	78.70	64.3	0.622	17.75	78.70	2.37	1.18
45	84.62	38.2	0.487	83.43	8.88	4.73	2.96
46	65.09	47.8	<i>0.424</i>	8.88	65.68	13.02	12.43
47	67.46	-13.1	-0.009	8.88	67.46	3.55	20.12
49	50.89	36.7	0.318	2.96	10.65	50.89	35.50
50	62.72	66.8	0.502	3.55	61.54	5.33	29.59
51	30.18	34.4	0.242	29.59	5.33	50.30	14.79
52	73.96	19.4	0.214	73.96	8.28	7.69	10.06
53	72.19	14.9	0.127	4.73	72.78	6.51	15.98
54	79.29	40.6	0.400	79.88	15.98	1.18	2.96
55	79.88	47.6	0.473	79.88	10.06	5.33	4.73
56	71.60	28.9	0.236	0.59	71.60	26.04	1.78
57	35.50	13.2	0.108	32.54	35.50	7.69	24.26
58	75.74	52.5	0.570	11.83	75.15	10.65	2.37
59	82.25	24.2	0.310	8.88	2.96	5.92	82.25
60	56.21	52.8	<i>0.420</i>	56.21	8.88	16.57	18.34
61	31.95	34.4	0.250	0.59	62.72	31.95	4.73
62	47.34	57.6	<i>0.380</i>	28.40	10.65	13.61	47.34
63	55.03	38.8	<i>0.300</i>	5.33	55.62	23.67	15.38
64	39.05	29.5	0.230	38.46	4.73	18.34	38.46
65	89.35	26.3	0.320	0.59	88.76	2.96	7.69
66	24.85	36.9	0.220	66.27	24.85	4.73	4.14
67	70.41	33.8	<i>0.241</i>	6.51	70.41	13.02	10.06
68	72.19	38.3	0.319	14.20	12.43	71.60	1.78
69	80.47	35.8	0.343	10.06	1.78	80.47	7.69
70	62.13	69.3	0.535	14.79	62.13	4.73	18.34
71	35.50	57.9	<i>0.428</i>	44.97	35.50	13.61	5.92
72	81.07	28.9	0.317	81.07	7.69	6.51	4.73
73	27.81	22.8	0.159	35.50	24.85	13.02	26.63
74	42.01	43.6	<i>0.304</i>	42.01	12.43	8.28	37.28

Values in bold print: Item does not meet specific item analysis criteria

Values in italic print: Items retained

* Excluding items 15 and 48 leaving a pool of 72 items

- ** Item difficulty index: 0.35 – 0.85
- *** Item discrimination index: ≥ 0.20
- # Item-to-total correlation: ≥ 0.20
- ## Distributions of answers to alternatives: $\geq 5\%$

Ten of the 72 items (13.9%) were retained after the item analysis of the first administration of the preliminary food knowledge test while 13 of the 72 items (18.1%) were retained after the item analysis of the second administration. A summary of the items retained and discarded after the item analysis based on the IDI, item discrimination index, item-to-total correlation and distribution of answers to alternatives are indicated in Table 4.7.

Table 4.7: Items retained based on the item analysis of the first and second preliminary food knowledge test administrations

Item analysis	Items meeting item analysis criteria (retained)			
	First administration		Second administration	
	Number (n)	%	Number (n)	%
(i) Item difficulty index (IDI)	56	77.8	59	81.9
	[Discarded: Items too difficult: 6 Items too easy: 15]		[Discarded: Items too difficult: 7 Items too easy: 6]	
(ii) Item discrimination index	45	62.5	58	80.6
(iii) Item-to-total correlation	49	68.1	56	77.8
(iv) Distribution of answers to alternatives	17	23.6	22	30.6

4.5 Validity and reliability of the first preliminary food knowledge test

A total of 20 to 25 test items was envisioned to be retained for the final knowledge test after the item analysis determinations. Gronlund (1993: 38) suggests that knowledge interpretations based on fewer than ten items should be considered highly tentative.

Those items that met the item analysis criteria formed the final knowledge test. From the first administration of the preliminary test, only ten test items remained (items 19, 37, 43, 46, 60, 62, 63, 67, 71 and 74, Addendum E) while 13 test items remained after the second administration of the preliminary test (items 1, 3, 18, 31, 32, 37, 46, 60, 62, 63, 67, 71 and 74, Addendum E). After consultation with the expert panel, who was involved in the pre-testing and evaluation, and consideration of the suggestion by Gronlund (1993: 38), the finalised and remaining test items were not considered representative of a knowledge measure to determine first-year students' food knowledge and were therefore not accepted as a knowledge test for use, but rather included as drafted test items for inclusion in a further (i.e. second) developed food knowledge test (see section 4.6).

4.5.1 Validity

The final tests, consisting of ten and 13 test items after the first and second administrations of the preliminary knowledge tests respectively, were found to be valid as a significant difference ($p < 0.001$) in knowledge was found in the expected direction between the two student groups utilising the Mann-Whitney Test ($z = -7.64$ and -8.57 respectively). The mean total scores and score standard deviations along with the median scores for the two student groups are indicated in Table 4.8.

Table 4.8: Mean and median scores of the first preliminary food knowledge test administrations

Samples*	First administration scores		Second administration scores	
	Mean	Median	Mean	Median
Knowledgeable	6.84 ± 1.74***	7.0	8.42 ± 1.88	8.0
Less-knowledgeable	4.70 ± 1.75	5.0	4.97 ± 2.04	5.0

* See Table 3.1 and Figure 4.2

** Based on total a score of 10 and 13 for the first and second administrations respectively

*** Mean ± standard deviation

4.5.2 Reliability

To determine the reliability of the two compiled tests consisting of ten and 13 test items (after the first and second administrations of the first preliminary knowledge test) respectively, the Cronbach's alpha coefficient and the K-R20 statistic was utilised. The Cronbach's alpha coefficient for the first administration was 0.501 and for the second administration 0.671. It is indicated that a Cronbach's alpha above 0.7 is acceptable for research purposes (Muijs, 2011: 217) and therefore it can be said that the test delivered marginal reliability. The K-R20 statistic for the first and second administrations was 0.501 and 0.671 respectively and also lower than the 0.75 guideline for 'moderate' reliability (Bordens & Abbott, 2011: 275).

4.6 Pre-phase evaluations of the drafted test items of the working document forming the second preliminary food knowledge test

For this phase of the study the preliminary sets of compiled items that went through their pre-phases of evaluations are referred to as the second working document. The second working document that went through its first pre-phase of evaluation for content and face validity is not included in this thesis as only a few changes were suggested by the expert panellist involved. The second working document that went through the second pre-phase of evaluation is included as Addendum D and provides an overview of the problems that were encountered with the working document as identified by the panellists, together with their comments, suggestions and recommendations for improvement of the test items. Figure 4.3 represents a flow diagram depicting the different phases in the development of the second preliminary food knowledge test to form the final food knowledge test.

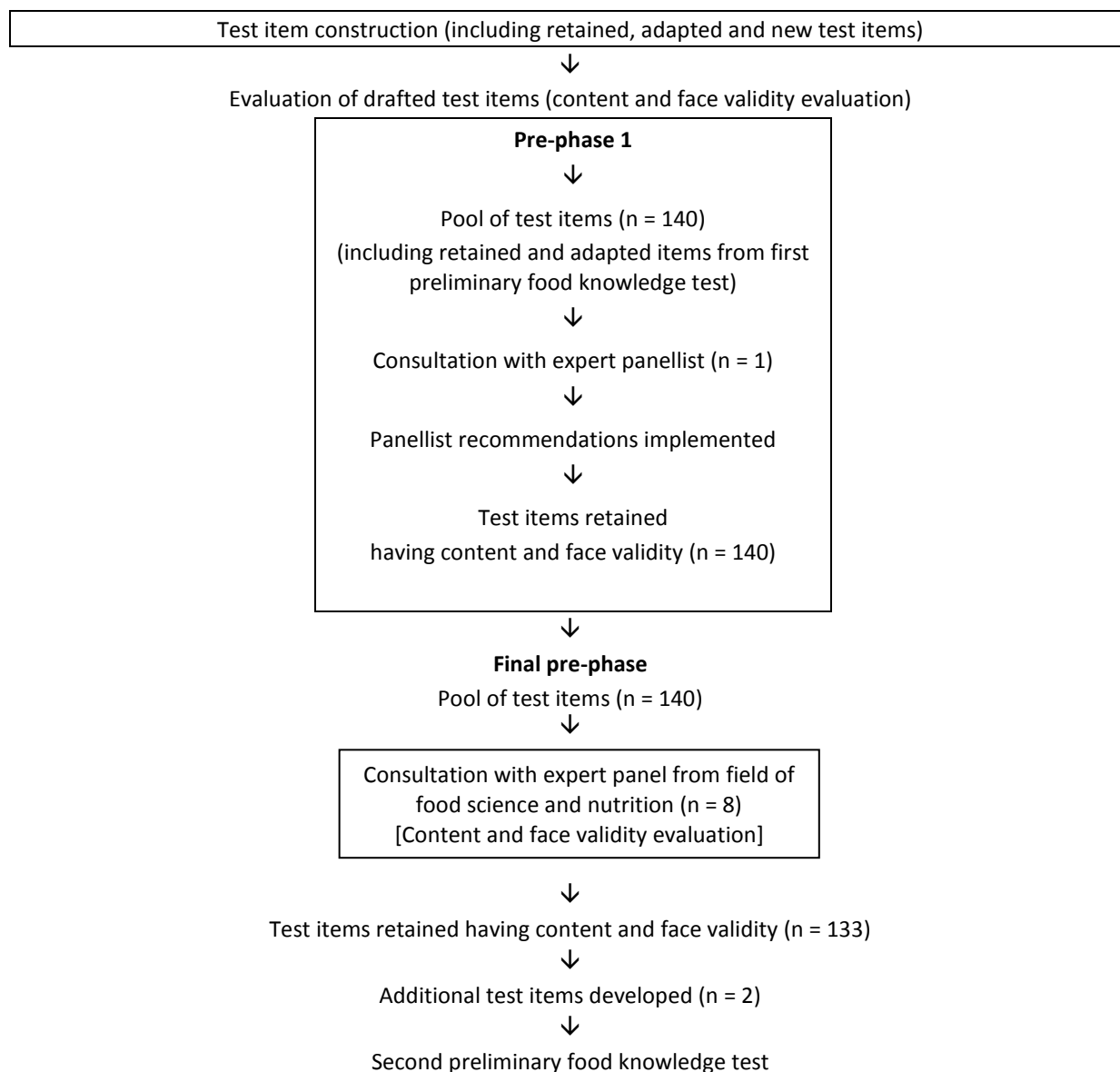


Figure 4.3: The different pre-phases in the development of the second preliminary food knowledge test

Forty-six of the 72 test items (69.9%) from the first preliminary food knowledge test were retained for the second working document to form the second preliminary food knowledge test. Ten of these items were adapted before inclusion in the second working document. All the test items retained for possible inclusion in the second preliminary knowledge test were changed from having four alternatives to three alternatives. To decide which one of the four alternatives to eliminate, the results of the item analysis (distribution of answers to alternatives) of the first preliminary food knowledge test were used to discard the alternative within each multiple-choice test item with the lowest response rate as indicated in Tables 4.5 and 4.6.

The 36 retained and unchanged test items were items 1, 3, 8, 9, 14, 17 - 20, 25, 27 - 29, 32, 35 - 39, 43, 44, 47, 48, 53, 57, 58, 60, 62 - 64, 66, 67 and 71 - 74 from the first preliminary knowledge test

(see Addendum E). The ten items that were adapted for inclusion in the second working document to form the second preliminary food knowledge test were items 12, 13, 15, 21, 31, 33, 46, 50, 52 and 68 (see Addendum E). The second working document consisted of 32.9% (n = 46) retained (kept as is and adapted) and 67.1% (n = 94) newly developed test items.

4.6.1 Panellist evaluation of pre-phase one working document

For the first pre-phase evaluation of the content and face validity the one expert panellist familiar with the food knowledge expected of first-year students was involved. In section A, pertaining to the fruit and vegetables content domain, and section B, pertaining to the fats and oils content domain, the expert panellist advised that alternatives be more varied in order to prevent one alternative from being too obviously correct or incorrect. An example would be item 2 that tested knowledge on food item identification, where two alternatives initially referred to 'small' and one to 'large' as part of an identification item. One of the alternatives that referred to 'small' was changed to 'medium' (see item 2, Addendum D). Where a test item presented food items as alternatives to choose from, suggestions were made to replace some of the alternatives with foods that were more familiar to first-year students. Other changes included suggestions on making alternatives shorter and more concise or changing the order of the alternatives in order to prevent consecutive test items having the same alternative (i.e. a, b or c) as the correct answer.

Grammar changes included making the stems of test items more uniform in terms of sentence structure, for example, placing the action word at the beginning of the statement/question followed by the application of knowledge in terms of food preparation and purchasing knowledge. Overall, the uniformity of test items was a focus point and the following guidelines were applied for inclusion in the second working document: Where the stem of a test item was presented by a question, the alternatives started with a capital letter (of a word or phrase) and ended with a full stop (phrase); where the stem of the answer consisted of an incomplete statement and where the alternatives completed the statement, the alternatives did not have a capital letter, but ended with a full stop; and where the stem of the item consisted of a statement and the alternatives provided the best option to support the content of the statement, the alternatives did not have a capital letter but, ended with a full stop (Gronlund, 1993: 43) (see Addendum D).

4.6.2 Number of test items in first pre-phase working document

During this pre-phase no test items were discarded, but rather adapted based on recommendations provided by the expert panellist. Table 4.9 provides a breakdown of items in the fruit and vegetables the and fats and oils content domains that made up the 140 drafted test items for the

pre-phase two working document evaluation of the content and face validity to form the second preliminary food knowledge test.

Table 4.9: Number of test items within each content domain after the content and face validity evaluation* of pre-phase 1 of the second preliminary food knowledge test working document

Test content domains	Number of test items		
	Developed	Discarded	Retained
Section A: Fruit and vegetables	88	0	88
Section B: Fats and oils	52	0	52
	140	0	140

* Evaluation undertaken by one expert panellist

4.6.3 Panellist evaluation of pre-phase two working document

Minor concerns were raised regarding the items included in both the fruit and vegetables and the fats and oils content domains by the expert panellists (n = 8) working in the fields of food science and nutrition. The panel consisted of senior lecturers and lecturers in the fields of food science and nutrition (n = 6), a dietician (n = 1) and a senior graduate student with industry experience (n = 1). The panellists focused on content and face validity and specifically aspects such as item clarity, simplicity, relevance, accuracy and specificity of test items (Addendum D).

4.6.3.1 Content validity

i) Clarity of test items

The panellists recommended removing unnecessary words/information from the stem of a test item that may lead to confusion, for example, removing the 'per 100 g' from a question enquiring about dried apricots (see item 31, Addendum D) as it would not influence the participants' answers if deleted. Suggestions were also made to remove all unnecessary words from alternatives in order to make them shorter and to the point (see item 96, Addendum D).

ii) Simplification, unfamiliarity and relevance of test items

Where alternatives were presented as a list of food items, for example a shopping list when wanting to make a specific dish (see item 88, Addendum D), panellists suggested that a maximum of three food items (rather than four items) should be listed to simplify the alternatives. A few concerns arose with regard to the use of subject terminology which may not be familiar to the student sample group. Examples include the use of words such as 'wilted' (see item 5, Addendum D) and 'swiss chard' (see item 48, Addendum D). Similarly, some panellists questioned the relevance of some items pertaining to food purchasing, storage and preparation to the sample group, for example, the ripening of bananas (see item 36, Addendum D), the use of bananas to ripen other fruits at home (see item 56, Addendum D) and the blanching of vegetables (see item 50, Addendum D).

Furthermore, item 104 (see Addendum D) referred to an air-fryer. The panellists commented that it was a relatively new development few students may be familiar with and that it should rather be replaced with a familiar preparation method such as 'oven-baked'. Where alternatives included food items that, in general, are not part of a student's dietary intake, suggestions were made to replace these food items with more commonly consumed and available ones, for example, replacing 'salmon' with 'sardines' which are more readily available and affordable for a student.

In some instances panellists commented on the difficulty level of items (see items 129 and 133, Addendum D) and recommended that some of these items should be discarded for the final test as it may test knowledge that is not relevant to the student sample group on a day-to-day basis. Item 133, referring to fat replacers, was retained as it may be applicable to participants following an energy-restricted diet in order to lose weight or maintain their body weight status. Items 130 and 132 (Addendum D) were identified as being irrelevant due to it assessing nutrition-based knowledge rather than food-based knowledge. However, where the nutrition information was linked to labelling and therefore food choice, the item was retained (see item 132, Addendum D).

iii) Accuracy of test items

In some instances panellists made suggestions to replace alternatives of test items as they felt that more than one alternative could be correct (see items 73 and 80, Addendum D), or to change specific words within alternatives (see item 86, Addendum D) to improve the test items and minimise confusion.

Where some alternatives stood out as being obviously correct or incorrect, suggestions were made to change alternatives to relate better to each other. Changing the sequence of alternatives within test items were also suggested by some panellists (see items 3, 6, 44, 60, 68, 70, 120 and 124, Addendum D) to improve the items and to ensure that not too many consecutive test items have alternatives a, b or c as the correct answer and be leading to the participants.

iv) Specificity of test items

The panellists recommended adding a specific dish when asking about the preparation of vegetables as specific recipes may differ (see item 52, Addendum D). In this regard the panellists pointed out that if the stem of the item is not specific, the response of the participants may be based on personal experience and interpretation.

4.6.3.2 Face validity

i) Grammar

A few grammatical errors were noted by the panellists. Better word choices were suggested by a panellist in two instances (see items 25 and 66, Addendum D) to improve the sentence construction and clarity as well as using words that were more familiar to the student sample group.

ii) General formatting

Most of the general formatting of the test items and the test as a whole were addressed during this pre-phase evaluation of the working document. Formatting changes included using italics when the name of a dish is used, for example, ‘moussaka’ and ‘guacamole’, for consistency and clarity. When the stems of items were written in the negative, the word indicating the negative statement, for example ‘not’, was printed bold and underlined for emphasis. The application of the general guidelines for writing test items and the use of punctuation (Gronlund, 1993: 43) were checked for consistency during the finalisation of the preliminary food knowledge test.

4.6.4 Number of test items in final pre-phase of the second working document

After the content and face validity evaluation by the expert panel, 133 test items were retained. Three items were discarded from the fruit and vegetables content domain and four items from the fats and oils content domain (see Table 4.10).

Table 4.10: Number of test items within each content domain after the content and face validity evaluation* of pre-phase 2 of the second preliminary knowledge test working document

Test content domains	Number of test items		
	Developed	Discarded	Retained
Section A: Fruit and vegetables	88	3	85
Section B: Fats and oils	52	4	48
	140	7	133

* Evaluation undertaken by eight expert panellists

After the evaluation of the second working document, a further two items were developed and added (see items 123 and 125, Addendum D), based on general advice from a panellist, resulting in a preliminary food knowledge test consisting of a 135 multiple-choice test items. The motivation for the increase in the number of test items were twofold: to allow for better reliability, as one way to increase test reliability is to increase the number of test items, since the test is only a sample of what the participant knows (Nunnally, 1972: 156; Gronlund, 1993: 179); and to allow for test items to be discarded in both content domains while retaining the envisaged 20 to 25 items for the final knowledge test after the item analysis determinations.

4.7 Item analysis of second preliminary food knowledge test administration

The second preliminary food knowledge test was administered only once. Item analysis was performed to determine which and how many items met the item analysis criteria to form the final food knowledge test. Only the test items meeting the analysis criteria would be retained for the validity and reliability determinations of the final food knowledge test. The results of the item analysis are indicated in Table 4.11.

Table 4.11: Item analysis of the administration of the second preliminary food knowledge test

Question number	Item difficulty index (IDI)*	Discrimination index**	Item-to-total correlation#	Distribution of answers to alternatives##		
				a	b	c
1	50.95	51.5	0.420	35.71	50.95	13.33
2	54.29	18.2	0.169	6.19	54.29	39.52
3	30.00	20.6	0.187	30.00	62.38	7.62
4	37.62	17.8	0.140	37.62	29.05	33.33
5	69.52	33.4	0.245	4.29	26.19	69.52
6	50.95	5.8	0.001	16.67	50.95	32.38
7	47.62	44.4	0.335	38.57	49.62	13.81
8	87.62	24.9	0.281	4.76	7.62	87.62
9	67.14	28.0	0.236	10.00	22.86	67.14
10	50.00	-24.2	0.166	43.33	50.00	6.67
11	61.90	-26.9	0.188	61.90	26.19	11.90
12	71.90	6.4	0.041	17.14	71.90	10.95
13	35.24	12.1	0.071	26.67	38.10	35.24
14	76.67	55.2	0.459	15.24	8.10	76.67
15	70.95	33.4	0.293	7.62	70.95	21.43
16	51.43	30.3	0.275	33.81	51.43	14.76
17	71.90	29.4	0.286	10.48	17.62	71.90
18	34.29	45.3	0.383	44.76	34.29	20.95
19	63.33	39.7	0.314	23.81	12.86	63.33
20	41.90	23.4	0.181	46.67	11.43	41.90
21	63.81	64.8	0.531	63.81	22.86	13.33
22	39.05	19.3	0.151	32.8	28.57	39.05
23	79.5	41.8	0.407	10.48	79.52	10.00
24	58.10	34.5	0.261	18.57	23.33	58.10
25	62.86	52.7	0.352	7.62	29.52	62.86
26	67.14	30.4	0.234	67.14	23.81	9.05
27	53.81	31.2	0.242	21.90	24.29	53.81
28	83.33	45.3	0.418	83.33	10.95	5.71
29	89.52	30.2	0.354	2.86	7.62	89.52
30	57.14	54.5	0.466	57.14	17.14	25.71
31	53.33	25.9	0.164	28.10	53.33	18.57
32	69.05	55.4	0.453	25.24	5.71	69.05
33	38.10	49.0	0.332	7.14	54.76	38.10
34	53.33	34.5	0.281	12.86	53.33	33.81
35	39.52	8.3	0.090	35.71	39.52	24.76
36	52.86	39.1	0.263	52.86	14.29	32.86
37	43.33	26.5	0.217	32.86	43.33	23.81
38	56.67	17.1	0.130	36.67	56.67	6.67
39	55.24	42.2	0.327	33.81	10.95	55.24
40	72.86	46.1	0.349	72.86	13.33	13.81
41	74.76	45.6	0.403	16.67	74.76	8.57
42	69.05	60.9	0.524	69.05	21.90	9.05
43	83.81	19.8	0.177	83.81	8.57	7.62
44	64.29	68.7	0.554	9.52	26.19	64.29
45	60.95	52.4	0.398	14.76	24.29	60.95
46	71.43	49.9	0.418	71.43	8.10	20.48
47	30.00	9.6	0.110	33.33	30.00	36.67

Table 4.11 [continued]

Question number*	Item difficulty index (IDI)**	Discrimination index***	Item-to-total correlation#	Distribution of answers to alternatives##		
48	53.81	70.8	0.570	22.38	23.81	53.81
49	71.90	38.5	0.354	11.43	71.90	16.67
50	43.81	33.9	0.302	22.86	33.33	43.81
51	60.48	39.9	0.334	9.52	60.48	30.00
52	58.10	36.7	0.266	58.10	27.62	14.29
53	45.24	-25.7	0.100	45.24	9.52	45.24
54	68.57	32.0	0.233	16.19	68.57	15.24
55	51.90	47.7	0.403	17.62	51.90	30.48
56	19.05	21.6	0.241	69.05	11.90	19.05
57	68.10	40.8	0.363	8.57	68.10	23.33
58	49.05	51.8	0.426	49.05	30.95	20.00
59	69.52	77.4	0.616	17.62	12.86	69.52
60	53.33	27.5	0.251	26.19	53.33	20.48
61	42.38	40.8	0.361	31.90	25.71	42.38
62	91.43	22.8	0.308	5.24	91.43	3.33
63	77.14	58.7	0.486	77.14	10.95	11.90
64	49.05	52.4	0.441	28.57	49.05	22.38
65	72.38	51.1	0.466	72.38	16.67	10.95
66	62.38	70.5	0.551	62.38	20.00	17.62
67	19.05	-9.3	0.000	35.24	45.71	19.05
68	77.14	62.4	0.536	77.14	12.86	10.00
69	62.86	39.9	0.284	23.33	13.81	62.86
70	57.62	35.3	0.286	17.62	57.62	24.76
71	64.29	57.6	0.450	64.29	23.81	11.90
72	11.90	13.0	0.130	11.90	61.43	26.67
73	42.38	17.8	0.156	12.86	42.38	44.76
74	61.90	51.2	0.418	11.90	61.90	26.19
75	59.52	54.5	0.418	59.52	15.24	25.24
76	82.86	39.9	0.442	8.57	82.86	8.57
77	42.38	37.2	0.310	42.38	26.19	31.43
78	32.86	30.8	0.259	16.19	50.95	32.86
79	48.57	51.0	0.389	48.57	26.19	25.24
80	58.10	31.1	0.264	13.81	28.10	58.10
81	41.43	37.5	0.264	20.95	41.43	37.62
82	52.86	67.2	0.515	21.43	25.71	52.86
83	63.81	53.3	0.480	26.19	63.81	10.00
84	71.43	67.9	0.589	71.43	18.57	10.00
85	48.10	56.8	0.479	48.10	41.90	10.00
86	75.71	53.5	0.456	10.95	13.33	75.71
87	15.71	7.6	0.060	45.71	38.57	15.71
88	48.57	37.5	0.309	29.05	22.38	48.57
89	65.24	60.9	0.487	65.24	22.38	12.38
90	78.10	49.2	0.450	5.24	78.10	16.67
91	54.29	13.2	0.120	34.29	54.29	11.43
92	78.10	56.8	0.495	78.10	12.38	9.52
93	75.24	43.9	0.399	75.24	16.19	8.57
94	34.76	-1.5	0.000	41.90	34.76	23.33
95	59.52	52.2	0.385	17.62	22.86	59.52
96	55.71	43.5	0.353	55.71	24.29	20.00
97	47.62	53.7	0.397	28.10	24.29	47.62
98	65.24	40.0	0.315	19.05	65.24	15.71
99	54.29	40.3	0.339	54.29	18.10	27.62
100	60.95	12.8	0.120	22.38	60.95	16.67
101	69.52	48.0	0.433	69.52	21.90	8.57
102	51.43	31.4	0.200	20.95	51.43	27.62
103	30.48	9.8	0.090	29.05	40.48	30.48
104	63.81	35.3	0.328	21.90	63.81	14.29
105	33.81	-6.9	0.000	33.81	31.90	34.29
106	79.05	32.7	0.286	7.62	79.05	13.33
107	54.76	45.3	0.394	21.90	23.33	54.76

Table 4.11 [continued]

Question number*	Item difficulty index (IDI)**	Discrimination index***	Item-to-total correlation#	Distribution of answers to alternatives##		
108	50.00	33.8	0.286	22.38	50.00	27.62
109	64.29	52.2	0.428	10.95	24.76	64.29
110	64.29	72.0	0.587	64.29	20.00	15.71
111	50.00	71.3	0.527	30.00	20.00	50.00
112	68.57	44.2	0.334	12.86	18.57	68.57
113	41.43	53.2	0.447	41.43	31.90	26.67
114	51.90	27.8	0.242	33.81	14.29	51.90
115	41.90	2.8	0.020	23.33	41.90	34.76
116	34.29	-10.3	0.000	36.67	34.29	29.05
117	72.38	62.6	0.529	72.38	13.81	13.81
118	13.81	-6.6	0.000	13.81	67.14	19.05
119	52.38	51.5	0.328	52.38	17.14	30.48
120	47.62	59.7	0.398	47.62	36.19	16.19
121	54.76	58.1	0.380	26.67	54.76	18.57
122	27.14	-4.2	0.000	38.57	34.29	27.14
123	69.05	71.9	0.612	69.05	17.62	13.33
124	36.19	22.2	0.214	13.81	50.00	36.19
125	54.29	16.6	0.170	51.29	16.19	29.52
126	40.95	21.9	0.157	20.00	40.95	39.05
127	28.10	-11.5	0.000	52.86	28.10	19.05
128	51.43	28.9	0.216	16.19	32.38	51.43
129	55.24	61.7	0.472	55.24	18.10	26.67
130	65.71	36.8	0.306	16.19	65.71	18.10
131	42.38	54.9	0.451	29.52	28.10	42.38
132	58.57	27.3	0.210	28.57	58.57	12.86
133	27.14	5.3	0.100	58.57	27.14	14.29
134	65.71	53.5	0.420	65.71	20.00	14.29
135	57.62	52.1	0.415	27.14	15.24	57.62

Values in bold print: Item does not meet specific item analysis criteria

Values in italic print: Items retained

* Item difficulty index: 0.35 – 0.85

** Item discrimination index: ≥ 0.20

Item-to-total correlation: ≥ 0.20

Distributions of answers to alternatives: ≥ 5%

Ninety-five of the 135 items (70.0%) were retained after the item analysis of the second preliminary food knowledge test. A summary of the items retained and discarded after the item analysis based on the IDI, item discrimination index, item-to-total correlation and distribution of answers to alternatives are presented in Table 4.12.

Table 4.12: Items retained based on the item analysis of the second preliminary food knowledge test

Item analysis	Items meeting item analysis criteria (retained)	
	Number (n)	%
(i) Item difficulty index (IDI)	116	88.0
	[Discarded: Items too difficult: 16 Items too easy: 3]	
(ii) Item discrimination index	108	82.0
(iii) Item-to-total correlation	102	77.0
(iv) Distribution of answers to alternatives	131	97.0

Representation of the sub-domains was considered in the final food knowledge test as this test would be administered in future. All sub-domains were represented in the final food knowledge test as a whole. The storage sub-domain was not represented in the fats and oils knowledge test. Table 4.13 indicates the representation of the sub-domains across the respective food knowledge tests.

Table 4.13: Representation of the sub-domains across the two content domains of the respective food knowledge tests

Sub-domains	Food knowledge tests					
	Food, comprising fruit and vegetables as well as fats and oils, as content domain (n = 74)		Fruit and vegetables as content domain (n = 49)		Fats and oils as content domain (n = 25)	
	n	%	n	%	n	%
Choice and purchasing	34	45.9	18	36.7	16	64.0
Storage	7	9.5	7	14.3	0	0.0
Preparation	13	17.6	10	20.4	3	12.0
Cooking	20	27.0	14	28.6	6	24.0

4.8 Validity and reliability of the second preliminary food knowledge test

The test items that met the item analysis criteria formed the final food knowledge test. The 95 items retained were 1, 7, 9, 14 - 17, 19, 21, 23 - 28, 30, 32 - 34, 36, 37, 39 - 42, 44 - 46, 48 - 52, 54, 55, 57 - 61, 63 - 66, 68 - 71, 74 - 77, 79 - 86, 88 - 90, 92, 93, 95 - 99, 101, 102, 104, 106 - 114, 117, 119 - 121, 123, 124, 128 - 132, 134 and 135 (see Table 4.11 and Addendum F).

4.8.1 Validity

The Mann-Whitney Test was used to determine the test construct validity and because more than the envisaged test items were retained, the construct validity was also determined for each item individually in addition to that of the final food knowledge test as a whole. Based on the individual item results, 21 test items were eliminated due to not statistically providing a difference ($p > 0.05$) in knowledge between the knowledgeable and the less-knowledgeable sample groups. The 21 items eliminated were items 16, 17, 27, 39, 41, 49, 54, 60, 69, 80, 88, 93, 98, 101, 102, 104, 107, 112, 114, 124 and 128 (see Addendum F), providing for a total of 74 test items for the final (valid) food knowledge test (49 in the fruit and vegetables and 25 in the fats and oils content domains respectively).

The validity of the final food knowledge test (included as Addendum G) as a whole, based on the Mann-Whitney Test ($z = 9.74$), was found to be acceptable as a significant difference ($p < 0.001$) in knowledge was found in the expected direction between the two sample groups. The validity of the two separate tests, i.e. fruit and vegetables and fats and oils as content domains, based on the

Mann-Whitney Test ($z = 9.75$ and $z = 8.73$ respectively) was also found to be acceptable with a significant difference ($p < 0.001$) in knowledge between the two sample groups.

4.8.2 Reliability

As for the first preliminary food knowledge test, the reliability of the final test was determined by the Cronbach's alpha coefficient and the K-R20 statistic. Both the Cronbach's alpha coefficient and the K-R20 statistic for the second preliminary food knowledge test administration were 0.934. As the numbers/scores for the Cronbach's alpha coefficient and the K-R20 statistic lie between zero and one, the higher the number, the greater reliability of the test (Bordens & Abbott, 2011: 275). The reliability of the final food knowledge test (included as Addendum G) could therefore also be seen as highly acceptable.

The reliability of the test content domains, i.e. fruit and vegetables and fats and oils, as separate tests were determined as enough items were retained in both the aforementioned content domains to serve as two separate knowledge tests. For the fruit and vegetables and the fats and oils knowledge tests both the Cronbach's alpha coefficient and the K-R20 statistic were 0.901 and 0.844 respectively. The reliability of the two individual tests could therefore be seen as highly acceptable.

4.9 Participant sample groups' demographic and biographic characteristic correspondence and differentiation

The Pearson's chi-square statistic was used to determine sample correspondence and differentiation between the two sample groups' demographic and biographic data to support the construct validity solely based on the programme of study. Of the total of 210 participants from both sample groups, 74% were female and 26% male. Seventy-two percent of the participants were between the ages of 18 and 22 years, i.e. young adults, while only 28% were 23 years and older. There was no significant difference ($p > 0.05$) between the sample groups in terms of their gender or their age as the participant sample gender and age characteristics were greatly reflected in the knowledgeable and less-knowledgeable sample groups (see Table 4.14).

Table 4.14: Demographic and biographic characteristics of the participant sample and sample groups

Demographic and biographic characteristics	Responses	Sample (n = 210)		Samples				p-value
				Knowledgeable (n = 119)		Less-knowledgeable (n = 91)		
		n	%	n	%	n	%	
Gender	Female	156	74.3	86	72.3	70	76.9	0.444
	Male	54	25.7	33	27.7	21	23.1	
Age	18 to 22 years	152	72.4	81	68.1	71	78.0	0.110
	23 years and older	58	27.6	38	31.9	20	22.0	
Studied the subject Consumer Science in Grade 12	Yes	73	34.8	56	47.1	17	18.7	0.000
	No	137	65.2	63	52.9	74	81.3	
Source mostly learned from about food choices, purchasing, storage and preparation	At home with family	87	41.4	29	24.4	58	63.7	0.000
	Friends	12	5.7	4	3.4	8	8.8	
	Books, articles in magazines, internet, etc.	33	15.7	27	22.7	6	6.6	
	Television and radio	13	6.2	6	5.0	7	7.7	
	School health services and school subjects such as Life Orientation and Consumer Studies	65	31.0	53	44.5	12	13.2	
Description of own knowledge level about food purchasing, storage and preparation compared to that of other young adults of the same age	Much less	28	13.3	2	1.7	26	28.6	0.000
	Somewhat less	22	10.5	7	5.9	15	16.5	
	About similar	65	31.0	37	31.1	28	30.8	
	Somewhat more	56	26.7	42	35.3	14	15.4	
	Much more	39	18.6	31	26.1	8	8.8	
Provision of mostly consumed meals	Prepared home/family food	84	40.0	35	29.4	49	53.8	0.003
	Food bought from kiosks on campus or other kiosks	33	15.7	18	15.1	15	16.5	
	Self-prepared food in a CPUT* residence	41	19.5	29	24.4	12	13.2	
	Self-prepared food in a private flat/residence	51	24.3	36	30.3	15	16.5	
	Ready-made meals bought from supermarkets	1	0.5	1	0.8	0	0.0	

* Cape Peninsula University of Technology

There was a significant difference ($p < 0.001$) between the two sample groups in terms of having the subject Consumer Studies at secondary school level. The percentage (47%) of participants in the knowledgeable sample group who did study the subject is much higher compared to the percentage (19%) of participants in the less-knowledgeable sample group who did so. Most (44.5%) of the participants from the knowledgeable sample group furthermore indicated that school subjects, such as Life Orientation and Consumer Studies, contributed greatly to their existing food knowledge, while most (63.7%) of the participants from the less-knowledgeable sample group indicated the home and the family as being their source for their food knowledge ($p < 0.001$). There was in addition a significant difference ($p < 0.001$) between the two sample groups in terms of their own perceived knowledge about food purchasing, storage and preparation compared to other young adults. Most (92.5%) of the participants within the knowledgeable group described their own perceived knowledge in this regard as about similar, somewhat more or much more compared to that of other young adults of the same age, while most (75.9%) of the participants in the less-knowledgeable sample group described their own perceived knowledge in this regard compared to other young adults of the same age as about similar, somewhat less and much less (see Table 4.13).

There was furthermore a significant difference ($p < 0.05$) between the two sample groups in terms of the types of meals mostly consumed. The types of meals consumed by most (59.7%) of the participants in the knowledgeable sample group comprised of self-prepared food in a private flat/residence and prepared home/family food. In contrast prepared home/family food formed the types of meals consumed by most (53.8%) of the participants in the less-knowledgeable sample group (see Table 4.14).

4.10 Norm test scores on retained items

Norm scores provide information regarding a participant's performance in comparison to a norm or average of performance by similar participants (Rodriguez, 1997: 1). In this study, standard scores were calculated for future use as norms as advised by Venter (2006: 17). The norm scores can be used to differentiate between participants on different achievement levels. The mean and median scores for the respective tests that can be utilised as norm scores are indicated in Table 4.15.

Table 4.15: Mean and median scores for the food knowledge tests by the participant sample and sample groups

Food knowledge tests	Mean and median knowledge scores of participants					
	Less-knowledgeable sample group		Overall sample		Knowledgeable sample group	
	Mean *	Median	Mean	Median	Mean	Median
Food, comprising fruit and vegetables as well as fats and oils as content domains (n=74)	33.6 ± 10.64	33	44.79 ± 14.6	45	53.34 ± 11.0	54
Fruit and vegetables as content domain (n=49)	22.32 ± 7.42	22	29.74 ± 9.71	30	35.41 ± 7.08	36
Fats and oils as content domain (n=25)	11.29 ± 4.22	11	15.05 ± 5.50	16	17.92 ± 4.55	18

* Mean ± standard deviation

Table 4.16 indicates the proposed norm scores for the knowledge test as a whole as well as for the two separate tests, i.e. fruit and vegetables and fats and oils as content domains, based on the mean and median scores as obtained by the participant sample and sample groups. Considering the above, a score of 45 for the knowledge test as a whole indicates the average achievement. Scores of 54 and above indicate an above average or good achievement, whereas scores of 33 and below indicate a below average or poor performance, allowing for a score of 34 to 53 to represent an average achievement level. For the fruit and vegetables test a score of 23 to 35 represents an average achievement with scores of 36 and above and 22 and below representing an above average/good and below average/poor performance respectively. For the fats and oils test a score of 12 to 17 indicates an average achievement, a score of 18 and above an above average/good achievement and a score of 11 and below a below average/poor achievement.

Table 4.16: Norm score standards for the respective food knowledge tests

Food knowledge tests	Norm score standards		
	Below average/Poor achievement*	Average achievement **	Above average/Good achievement***
Food, comprising fruit and vegetables as well as fats and oils as content domains (n=74)	≤ 33	45 (34 – 53)	≥ 54
Fruit and vegetables as content domain (n=49)	≤ 22	30 (23 – 35)	≥ 36
Fats and oils as content domain (n=25)	≤ 11	16 (12 – 17)	≥ 18

* Based on the mean and median knowledge scores obtained by the less-knowledgeable sample group

** Based on the mean and median knowledge scores obtained by the participant sample as a whole

*** Based on the mean and median knowledge scores obtained by the knowledgeable sample group

CHAPTER 5

DISCUSSION

5.1 Introduction

Each preliminary food knowledge test went through its own development, evaluation and pre-testing phases to obtain a sufficient number of retained test items that met the item analysis criteria and would form a valid and reliable food knowledge test for first-year students at a UOT in the Western Cape, SA. The test items constructed for each consecutive preliminary food knowledge test received fewer comments, suggestions and recommendations by the expert panellists which showed progression in the development of the food knowledge test.

5.2 Test item review, modification and elimination

In this section, aspects and lessons learnt related to the test items retained and discarded are discussed in general, i.e. not per pre-phase/working document. The panellist comments, suggestions and recommendations made in each evaluation and pre-testing phase, in most instances addressed general aspects of test item and test development that need to be considered when developing an assessment tool. Numerous textbooks are available on the subject of test development of which the guidelines and recommendations to do so are presented in Chapter 2. Although these guidelines and recommendations were considered throughout the development process, the application was found to be challenging as it is to be expected that each assessment tool and its items would differ, based on the expected content and outcomes.

5.2.1 Content validity and test item construction

Parmenter and Wardle (2000:269) advise that existing measures be used, or existing measures modified before developing a new assessment tool. As no published valid and reliable South African-based food knowledge tests could be obtained through journal databases and internet searches, all the test items used in this study were newly developed through a timeous process of changes and replacements and, in turn, assessed by expert panellists as advised by Parmenter and Wardle (2000: 269) and Whati *et al.* (2005: 1).

In the early stages of the test item development process, many of the test items were eliminated by the expert panellists as they were viewed as nutrition- rather than food-based. This difficulty in separation may have occurred because numerous available nutrition knowledge questionnaires were consulted to look at aspects such as the test item types, the test items themselves and the test lay-out. Although some items retained may appear to be nutrition linked, for example, referring to kilojoule (kJ) as a unit for energy, energy/fat content per 100 g of a particular food item or types of

fat and the impact on heart health (see items 54, 70 and 74, Addendum G), the objective of these items were to test the student participants' knowledge within specific content sub-domains such as food choice (i.e. healthy food choices) and purchasing where the above aspects are relevant. In this regard, Bordens and Abbott (2011:261) emphasise the importance of having a clear and concise definition of the construct of the test. It was therefore vital for this study to have a clear distinction between nutrition- and food-related content right at the start.

Whati *et al.* (2005: 2) used available nutrition-related data associated with younger South African children that were thought to perpetuate into adolescence, as well as issues related to adolescents worldwide that appeared to be relevant for South Africans to define the constructs of their questionnaire developed to measure nutrition knowledge of South African adolescents. With this in mind, the relevancy of test items and the expected food knowledge level of first-year students became two major focus points in this study as there were no existing measures to consider for guidance as to the expected food knowledge of young adults. Due to this uncertainty, provision for test items to be eliminated by the expert panel and in the item analysis was therefore made by developing the maximum number of test items in each sub-domain within both content domains.

Although any assessment tool should include a broad range of items so that participants' knowledge is thoroughly assessed, it should not be so broad as to lose focus and become confusing (Bordens & Abbott, 2011: 261) to the participants. Not only should the knowledge tested be relevant to the sample group, but also to the outcome(s) of the research study. Considering the relevancy of test items in relation to the above, the use of subject-related terminology, for example 'searing' and 'acidity', was a concern among the panellists. Throughout the development process, the relevancy of such terminology in the day-to-day food practices of students residing in residences or self-catering accommodation was questioned. Face validity evaluation of the test items by senior students familiar with the sample group provided valuable feedback in terms of subject vocabulary that would be suitable in order to avoid guessing of answers and loss of interest in the test completion, which inevitably would lead to the loss of data. In general, the use of 'everyday' language rather than complex words is highly recommended (Bordens & Abbott, 2011: 264), for example, using 'buying' rather than 'purchasing', which was applied in this study. The inclusion of technically inclined items was also questioned and many of these items were eliminated, modified or simplified. The number of items related to freezing, for example, was reduced as it was highlighted that the student sample group buy in small quantities due to shared storage space or lack thereof in residences or self-catering accommodation. Furthermore, the functional use(s) of ingredients, for example, the choice of fat for baking a cake, were also deemed irrelevant.

The contribution by the expert panellists in terms of sample group word use familiarity and knowledge level to answer test items was invaluable as many of the panellists work within an academic environment and in close contact with first-year students at a UOT. It is assumed that this feedback increased the percentage of retained items for the food knowledge test after the content and face validity evaluations, as concerns were pointed out and addressed, where possible, before the sample group administrations of the preliminary food knowledge tests.

The heart of the problem with questionnaires is that different participants may interpret the same words differently (Cohen, Manion & Morrison, 2000: 251). When developing a test item, the stem of the item therefore needs to be very specific in terms of the knowledge tested in order to avoid interpretation based on personal experience by the participants. The expert panel, for example, advised to make question/statement stems specific to the preparation method, use or state of a specific food item or ingredient. The state of the vegetable, i.e. raw or cooked, cut or sliced, peeled or with the skin, were therefore specified as there may be a difference in cooking time or preparation of the food item when not specified.

It was difficult to develop four alternatives for each item where each alternative acted as a successful distracter. The four alternatives proved to be problematic, based on the item analysis. For this reason only three alternatives per multiple-choice item were developed for the second preliminary and final food knowledge tests. This reduced the chance of one item being obviously incorrect. If consideration was given to the difficulty experienced in providing four successful distracters, and the decision then made to use only three distracters, the test development process might have eliminated the development phase of the first preliminary knowledge test. Consideration was therefore given to the provision of three rather than four distracters.

5.2.2 Face validity and test construction

A test should have continuity; that is, related items should be grouped together as this keeps the participant's attention on one issue at a time. An organised assessment tool is often much easier and more enjoyable for the participant to complete, which may also increase the full completion of the assessment tool (Bordens & Abbott, 2011: 267). In the preliminary food knowledge tests compiled the two content domains, i.e. fruit and vegetables and fats and oils, were kept separate in consideration of the above. Care was also taken with the lay-out of these tests. The intention was to present each test as an easy, attractive and interesting tool (Cohen *et al.*, 2000: 258) in order to motivate the participants to complete the relatively long tests in full. Short and clear instructions for the completion accompanied each preliminary test (see Addendums E and F). As a result the data of only four of the completed preliminary tests of the overall total (for pre-testing of the first and

second preliminary food knowledge tests) of 495 completed had to be discarded as they were not fully completed, which may be attributed to the aforementioned factors. The data of an overall total of 491 completed tests were therefore used successfully. Two tests from the first administration of the first preliminary test and two from the administration of the final test were fully completed by participants (on the day of answering) after the completed tests were checked for answers omitted.

The stem of the test item should be as concise as possible with no excessive verbiage while including the central idea though full sentences where possible (Bordens & Abbott, 2011: 264). This brought about eliminating the repetition of unnecessary words in the alternatives presented and minimised the amount of reading required. This is especially important if the test is relatively lengthy, as was the case with the preliminary and final food knowledge tests in this study.

Question writers should attempt to make the response options shorter than the stem. It is easier to understand a test item if the bulk of the reading is in the stem. Alternatives should therefore not only be shorter than the stem, but also equal in length where possible; where an alternative consists of one part, other alternatives within the same item should not consist of more than one part. This item construction guideline is not generally presented in textbooks, but was mentioned by the expert panellists during the evaluation phases of the preliminary tests. This was difficult to achieve in some of the items constructed, but should be considered. Test takers may use alternative length as a hint to the correct answer as the longest alternative is often correct. Question writers should therefore be careful to use linking words, for example 'and', in alternatives as it generally indicates that more than one concept/idea is located within an alternative.

Although the general formatting of the assessment tool is often viewed as less important, it should not be as it can negatively impact on the completion rate of the assessment tool. The panellists provided practical suggestions in order to ensure consistency in presentation and lay-out and to reduce misunderstandings, for example negative words being typed in bold and underlined, consistency in terms of language use, for example using only the word 'buying' instead of 'purchasing', and consistency in grammar and punctuation where the latter focused on appropriate use of the colon and/or question mark.

5.3 Item analysis

The guidelines for test item construction as provided by numerous authors (Nunnally, 1972; Thorndike & Hagen, 1977; Huysamen, 1983; Cohen *et al.*, 2000: 248; Babbie & Mouton, 2010) and presented in Chapter 2 were taken into consideration during the development of the test items. However, in the evaluation of the first preliminary test the use of four alternatives for each test item

delivered poor findings for the item analysis. The first administration of the first preliminary knowledge test delivered 55 items not meeting the criterion that an alternative (in this case a, b, c or d) had to be indicated as the correct answer by at least five percent of participants. Either one alternative (n = 28 items), two alternatives (n = 22 items) or even three alternatives (n = 5 items) did not meet this criterion. Similarly, for the second administration 50 items did not meet the criterion with either one alternative (n = 35 items), two alternatives (n = 14 items) or three alternatives (n = 1 item) not acting as a good distracter. These results provided the support to change the four alternatives to three alternatives during the item design process for the second preliminary food knowledge test.

The distribution of the answers to the alternatives in the second preliminary food test (in this case a, b or c) was much better. Of the 135 test items, only four items did not meet the criterion that alternatives had to be chosen by at least five percent of the participants to be suitable for inclusion. In all four of these items it was only one out of the three alternatives that were not adequately selected. As there were no existing items available for inclusion in the food knowledge test, developing four alternatives without having one being more obviously incorrect proved to be a challenging task. The inclusion of only three alternatives may additionally have supported the participants timewise in completing the second preliminary food knowledge test with its long list of 135 test items.

For a multiple-choice test item with three alternatives, such as in the final food knowledge test of this study, items with an easiness range between 0.45 and 0.90 can be selected for inclusion in a test (Nunnally, 1972: 189). However, due to the high number of retained items the same criteria of between 0.35 and 0.85 as the lower and upper cut-off points respectively for the IDI were applied throughout this study regardless of the number of alternatives within each test item, as indicated in Table 5.1. There was a reduction in the percentage of test items discarded in not meeting the IDI criteria in all the sub-domains but one (Section B: Storage) moving from the first to the second preliminary food knowledge test. This may also be ascribed to moving to three in the place of four alternatives for the final preliminary food knowledge test.

Table 5.1: Items not meeting the item difficulty index criteria (IDI) in the first and second preliminary food knowledge test administrations

Domain	Sub-domain	First preliminary food knowledge test			Second preliminary food knowledge test		
		Number of items*	Items not meeting the IDI criteria		Number of items	Items not meeting the IDI criteria	
			Number* *	%		Number	%
Section A: Fruit and vegetables	Choice and purchasing	14	4	28.6	39	5	12.8
	Storage	6	2	33.3	14	2	14.3
	Preparation	6	3	50.0	12	1	8.3
	Cooking	10	3	30.0	20	1	5.0
Section B: Fats and oils	Choice and purchasing	17	5	29.5	31	5	16.1
	Storage	7	4	57.1	4	3	75
	Preparation	4	2	50.0	6	2	33.3
	Cooking	8	2	25.0	9	0	0.0
Total number of items (n)		72	25	34.7	135	19	14.1

* Number of test items representing a sub-domain across the first and second administrations combined

** Nine of the total items did not meet the IDI criteria in both administrations

From the cooking sub-domain domain items found to be too difficult (IDI below 0.35) within the fruit and vegetables content domain assessed knowledge of the conventional cooking methods to retain the colour, texture and maximum nutritional value. These cooking methods for vegetables include aspects such as cooking with or without the lid and the amount and temperature of water used for cooking (Brown, 2008: 261). These aspects are possibly taught through formal instruction in food science-based subjects. However, the knowledge of entry-level university students are often based on the practice applied in the home by a mother/caregiver, which may not always represent the most effective cooking method(s) but rather be based on family tradition, as discussed in Chapter 2. These theoretical/scientific concepts might therefore not be part of the everyday practices of households as well as students who did not study food science and/or nutrition as subjects, especially if Consumer Studies was not a chosen subject at secondary school level. The subject Consumer Studies includes food-related topics such as healthy food choices, food safety and techniques and skills needed for food preparation (Department of Education, 2003).

From the choice and purchasing sub-domain in the fats and oils content domain, based on the IDI results, it was evident that participants struggled with the identification of food items based on energy value; i.e. foods with the highest or lowest energy value per 100 g or food ingredients that would add the most energy to a meal or a cup of coffee/tea. Although these items may be interpreted as nutrition- rather than food-based, making less informed food choices may impact

negatively on the dietary practices and future health of young adults and these items were therefore deemed acceptable by the expert panellists for inclusion in the final food knowledge test.

As mentioned above in the fruit and vegetables content domain, it is advantageous to have knowledge regarding cooking methods for optimum nutrient retention and minimum energy and (saturated) fat intake. Unfortunately, due to time constraints and lifestyle choices, as discussed in Chapter 2, students may choose pre-prepared meals and/or ingredients. These pre-prepared items and fast foods purchased, in general, provide more fat, cholesterol and energy compared to home-cooked meals (Serdula *et al.*, 1995: 236) that are generally higher in nutrients including dietary fibre, calcium, folate and vitamins B6, B12, C and E (Soliah *et al.*, 2006: 729). However, because purchased meals require less planning, cooking skills, kitchen equipment and preparation time, convenience takes priority over possible long-term health implications.

A relatively high percentage (75%) of items from the fats and oils storage sub-domain did not meet the IDI criteria, being too difficult (below 0.35). A possible explanation would be that students in residences and self-catering apartments do not regularly purchase items such as oil-based cooking spray, but rather versatile items such as butter/margarine that can be used for both cooking and spreading on bread or crackers. Students were therefore not familiar with the storage practices of less frequently purchased items. Similarly, participants were generally more knowledgeable regarding the storage of fresh fruit and vegetables. Students living in residences often do not have sufficient storage facilities, for example fridges. It was evident that students were generally aware of the types of food items available on the market, i.e. fresh, canned or dried, covered in the choice sub-domain of the fruit and vegetables content domain. This may be attributed to them having to choose items with a longer shelf life that would not require immediate consumption.

5.4 Strengths and limitations of the study

5.4.1 Strengths

The expert panellists utilised in this study were professionals working in the fields of food science and/or nutrition. Their comments, suggestions and recommendations with regard to the relevancy and accuracy of the test items were critical throughout the developmental process. This expertise contributed to the outcome of achieving two food knowledge tests, each representing a selected food knowledge content domain. This study supports Parmenter and Wardle (2000: 269) in utilising experts to contribute to the test item developmental process.

When conducting research, researchers need to ensure that access to the sample group is attainable and that the set-up is practical (Cohen *et al.*, 2000: 98). Using a captive audience permits the

researcher to collect large amounts of data in a relatively short time. It also reduces any volunteer bias if administered collectively such as during a class period (Bordens & Abbott, 2011: 271). In this study the accessibility, although challenging at times due to structured lecturing periods and academic time constraints to cover the syllabus content of a subject, increased the response rate as the participants were available during a class period and no additional effort was required from the participants. A concern about the captive audience setting was that participants may have felt pressured to participate. As a result special effort was made to reinforce the understanding that participation was voluntary.

Because no published South African food-based knowledge tests were available to use and/or modify, all the test items were newly compiled. The benefit of this undertaking was that the test items were relevant to the test content domains and the student group, namely first-year students. The content domains, namely fruit and vegetables and fats and oils, were also selected based on evidence presented in the literature review on the poor dietary practices of young adults, represented by university students. Food knowledge about these content domains may assist students to make food choices and apply food preparation and cooking practices in support of healthier eating practices.

Administering the first preliminary food knowledge test twice provided test item analysis evidence that could be used to improve the retention of test items and the reliability and validity of the second preliminary food knowledge test. The additional outcome of obtaining two valid and reliable food knowledge tests, namely with fruit and vegetables and fats and oils as content domains, were consequently achieved.

Using the multiple-choice question type for the food knowledge assessment in this study resulted in dichotomous scoring of the test items. The resultant processing of the data were therefore accurate and not time consuming as only one alternative is the correct answer. The multiple-choice question type also allowed for the assessment of participants on various cognitive levels, i.e. knowledge, comprehension, application of knowledge, analysis and evaluation.

Ultimately the major strength of this study is its outcomes, that is the provision of a valid and reliable test to determine the food knowledge of first-year students at a UOT in the Western Cape, SA, in addition to the provision of further valid and reliable tests to respectively determine the fruit and vegetables and the fats and oils knowledge of first-year students at a UOT in the Western Cape, SA. In addition to the programme of study the participant sample groups' demographic and biographic characteristic correspondence (gender and age) and differentiation (studied Consumer

Studies at school, source of food knowledge, own perceived food knowledge and meal provision) provided support for the test construct validity. These food knowledge tests, meeting the criteria of being valid and reliable assessment tools, are to our knowledge the first such assessment tools available for use in a South African context and suited for use at the group and individual levels as the generally accepted minimum reliability standards of 0.65 and 0.85 for groups and individuals were met respectively (Ebel & Frisbie, 1991: 87).

5.4.2 Limitations

Parmenter and Wardle (2000: 269) indicated that developing a new assessment tool is time-consuming and that the findings obtained in this process may be difficult to compare to that of other studies. Due to the unavailability of existing food knowledge tests to use as a 'golden standard' or to provide for a test item pool, the development of a food knowledge test in this study required more than one evaluation and pre-testing phase to retain enough items that met the item analysis criteria and could form a test with acceptable validity and reliability. This was indeed a time-consuming process and also contributed to a limited discussion of the results obtained in this process. Parmenter and Wardle (2000: 269) do acknowledge the fact that many researchers prefer to develop their own questionnaire in instances where a specific knowledge aspect is being investigated. However, the validity and/or reliability of available measures are often a concern in addition to having limitations, such as testing only limited knowledge areas and the absence of information on how the test items were developed (Parmenter & Wardle, 1999: 299). In this study the test considered two specifically selected knowledge content domains and the full extent of the development of the test items and the resultant test, having strong validity and reliability, is voided throughout the research findings.

The knowledgeable sample group was limited to the number of students registered for courses that offer formal education in food-related curriculum subjects at CPUT. This number determined the overall sample sizes of both student sample groups. Due to the preliminary test undergoing more than one developmental phase and more than one pre-testing phase, the participants from the Consumer Science: Food and Nutrition programme also had to be utilised on more than one occasion as part of the knowledgeable sample group. Although this is not optimal for reasons such as a lack of motivation to complete the test a second time, particularly in the case of a long test, and participants possibly remembering their answers on the first testing, it was one of the only two suited student groups available at the institution. However, as these students represented the knowledgeable group, the acquired knowledge due to a lapse of time before completing the test again was not considered to be problematic. The two preliminary tests also had major differences in

terms of the scope of knowledge in each content domain to negatively influence the reliability of the data gathered on more than one occasion.

The food knowledge test developed in this study is limited to a specific population group, namely first-year students at a UOT in the Western Cape, SA a concern of the Faculty of Applied Sciences Research Ethics Committee of the institution upon approval of the study method in 2011. The validity and reliability of the test for application at other tertiary institutions and among young adult groups in SA will have to be determined before application in such different settings.

CHAPTER 6

CONCLUSIONS

A valid and reliable self-administered food knowledge questionnaire in the format of a test was developed. The test can be used to determine the food knowledge of first-year students at a UOT in the Western Cape, SA. Through the completion of the test, participants can be assessed on their food knowledge pertaining to choice, purchasing, storage, preparation and cooking methods in terms of fruit and vegetables and fats and oils as dietary constituents.

Because the developmental process had to be repeated in this study, lessons learnt in the first developmental phase were successfully implemented in the second developmental phase and as a result more test items than expected were retained. This resulted in not only a food knowledge test found valid and reliable, consisting of 74 multiple-choice test items with three alternatives (a, b and c) covering two content domains, i.e. fruit and vegetables and fats and oils, but additionally two separate tests respectively representing a fruit and vegetables knowledge test consisting of 49 test items and a fats and oils knowledge test consisting of 25 test items. Through the lengthy developmental process that resulted in the development of two preliminary food knowledge tests, the additional objective, namely to have two separate valid and reliable self-administered food knowledge tests to be used independently, covering the aforementioned content domains, was accomplished.

All the test items included in the aforementioned knowledge tests meet the rules for test item construction and the criteria for the test item analysis to determine knowledge on food choice, purchasing, storage, preparation and cooking methods within the respective content domains. Furthermore, all the aforementioned tests strongly meet the criteria for both construct validity and reliability and can therefore be used with confidence to assess the food knowledge level of first-year students at a UOT in the Western Cape on a group and the individual level. The standard/norm scores determined for the final tests can be used to assess the level of food knowledge as average-, above average/good- or below average/poor.

CHAPTER 7

RECOMMENDATIONS

An additional prospective objective of the study was to attain two valid and reliable food knowledge tests with the following two separate content domains: fruit and vegetables and fats and oils. As this additional objective was reached after the item analysis and the construct validity and reliability determinations of the second preliminary food knowledge test, the future test user may decide which one of the two tests is suited for their required use. The final food knowledge test consisting of both the aforementioned content domains may be deemed too lengthy and cumbersome to participants and/or researchers to be completed in one sitting as it consists of 74 multiple-choice test items. If the test is to be used as a whole, it is recommended that the two content domains must have clear headings, i.e. Section A: Fruit and Vegetables and Section B: Fats and Oils. This may improve the overall structure and coherence of the test, enabling participants to “find their way” through the test (Cohen *et al.*, 2000: 258). It is also recommended that the two aforementioned sections must be numbered separately, i.e. numbers 1 to 49 and 1 to 25 for sections A and B respectively. This method of numbering may appear more manageable to the participants compared to numbering test items from numbers 1 to 74, which appear extremely lengthy.

The food knowledge test was developed for use by first-year students at a UOT in the Western Cape, SA. The appropriateness of the food knowledge test to other young adult population groups should be determined to broaden its use. This would require determining its validity and reliability among student groups at other tertiary institutions by means of pre-testing. This is strongly recommended as no other South African food knowledge tests exist. The two content domains included in the food knowledge test in this study in addition address two major areas of concern with regards to the general dietary habits of young adults, as represented by students. It is believed that food knowledge and skills may improve the dietary habits of individuals as one requires food knowledge and skills when choosing, purchasing, storing, preparing and cooking food items.

The food knowledge test from this study can be used at a UOT, Western Cape, SA, in the following ways:

- To assess the food knowledge of students entering tertiary education at the group level to determine if guidance and possible teaching, supplementary to programmes of study, is necessary to equip students with basic food knowledge to assist them in their own food provision. As the food knowledge test developed in this study is norm-referenced, the standard scores may be used to determine and interpret students' level of knowledge in comparison with other participants of the study population to ascertain the need for

individual teaching opportunities. It can be done by using the average, above average/good and below average/poor score cut-off points to interpret the knowledge level of student groups of the content domain being tested. To implement such additional teaching opportunities at any higher education institution, it will be practical to consider the use of available communication resources in order to make the information available to as many students as possible, while not making it a costly exercise. At CPUT the use of eLearning (i.e. Blackboard) may be a useful tool as all students on campus have access to the eLearning platform if the information is made available in a public area that is accessible to all students and not only students enrolled for a specific course. Information can then be presented in a visual manner, e.g. video demonstrations and video lectures. This may ultimately contribute to the consumption of an improved or healthier diet and better overall health status which is needed to support academic potential.

- To assess the individual and group progress of students studying food-related programmes through its application upon them entering tertiary education and after completion of the curriculum content which includes the content domains, i.e. fruit and vegetables and fats and oils. Based on the current curriculum at CPUT in the programme of Consumer Science: Food and Nutrition, this follow-up assessment could therefore be done at the end of the first academic year in which fruit and vegetables are studied as a module, or at the end of the second academic year after the completion of the fats and oils as a module in the subject Food and Food Science I and II respectively. For the programme Hospitality Management the assessment could be done at the beginning and the end of the first academic year as both modules, i.e. fruit and vegetables and fats and oils, are studied in the subject Culinary Theory I.

The food knowledge test may further be used to investigate possible associations between theoretical food knowledge and observed food preparation practices, attitudes towards food preparation and dietary habits of young adults. If food knowledge in such research undertakings proves to be a contributing factor to the application of food skills and/or the healthfulness of young adults' dietary habits, the importance of teaching young children basic food knowledge should be undertaken. In SA the importance of school subjects such as Life Orientation and Consumer Studies may for some learners be the only exposure to information related to food choice, purchasing and preparation as activities of daily living in order to improve their long-term health. Life Orientation is currently a compulsory subject for learners at secondary school level while Consumer Studies is a selected subject. Although a part of the Life Orientation syllabus teaches basic nutrition, it is recommended that the subject should also include, where possible, the formal teaching of basic

food knowledge and skills. Fewer households currently rely on home-prepared meals than before. Therefore the opportunity for children and adolescents to acquire food knowledge and skills through observation of and participation in food preparation at home are less. When young adults leave their homes to study at tertiary institutions they have to rely on their existing knowledge for their own food provision, which should take on the form of healthy meals. This is especially true for students residing in institutional residences and other settings that do not offer catered food provision systems.

When developing a food knowledge assessment tool, using the multiple-choice test item type, the following recommendations from this study include:

- The stem of the test items to be as concise as possible, though consisting of full sentences.
- The bulk of the reading to be included in the stem of the test items.
- Alternatives to be equal in length and shorter than the stem, where possible.
- Alternatives to consist of equal parts, i.e. to include the same number of facts/ideas, as the length of alternatives is often a hint towards the correct answer.
- Attention to be given to consistency in writing the test items, i.e. punctuation and language use consistent throughout the test.
- Language use to be kept as simple as possible and relevant to the 'everyday' language of the sample group.
- Knowledge tested to be relevant to the student sample group.
- Test items to be developed with the study objectives in mind.

Any researcher planning to develop a knowledge assessment tool should investigate the availability of panellists knowledgeable in the content domain(s) and familiar with the expected knowledge level of those the test is being developed for to partake in the face and content validity evaluations throughout the developmental process. Working closely with such an expert panel provides the researcher with invaluable information and insight to aspects such as relevancy of knowledge tested and appropriate language use. This information cannot be obtained from published sources.

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ADDENDUM A

Ethical approval by the Cape Peninsula University of Technology

Faculty of Applied Sciences Research Ethics Committee

ADDENDUM B

Participant information leaflet and consent form

ADDENDUM C

Content and face validity evaluation by the expert panellists (n = 6) of the final working document test items for the first preliminary food knowledge test

ADDENDUM D

Content and face validity evaluation by the expert panellists (n = 8) of the final working document test items for the second preliminary food knowledge test

ADDENDUM E

First preliminary food knowledge test

NOTE: Only section 1 (i.e. test items) included

ADDENDUM F

Second preliminary food knowledge test

NOTE: Only section 1 (i.e. test items) included

ADDENDUM G

**Food knowledge test for first-year students at a University of Technology in the
Western Cape, South Africa**

15 January 2012

Ms R van der Vyver
Consumer Science: Food and Nutrition
Cape Peninsula University of Technology

Dear Ms van der Vyver

Development and application of a food knowledge test for first year students at a University of Technology in the Western Cape, South Africa. (Ref 07/2011)

The Ethics Committee has considered your application for Ethics approval for the above project and would like to advise that approval for the project is hereby granted.

We wish you every success with your research.

Kind regards



Dr Maretha Opperman (RD (SA))
Chair: Ethics Committee, Faculty of Applied Science
CPUT

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH STUDY: Development of a food knowledge test for first-year students at a university of technology in the Western Cape, South Africa

PRINCIPAL INVESTIGATOR: Ms Raché van der Vyver

ADDRESS: Office 3.81a, Programme: Consumer Science: Food and Nutrition, Department of Agricultural and Food Sciences, Cape Peninsula University of Technology (CPUT), Cape Town Campus

CONTACT NUMBER AND E-MAIL: (021) 460 4213 / vandervyver@cput.ac.za

You are being invited to take part in a research study. Please take some time to read the information presented here, which will explain the details of the study. You are welcome to ask the researcher any questions about any part of the study that you do not fully understand.

Your participation is **entirely voluntary** and you are free to decline to participate.

This research study has been approved by the Applied Sciences Research Ethics Committee, CPUT and will be conducted according to the ethical guidelines and principles of the Medical Research Council (MRC) Guidelines on Ethics for Medical Research.

What is this research study about?

Research has shown that young adults often consume foods of poor nutritional quality. Such eating behaviour of young adults, as represented by university students, is a concern. Due to the importance of food knowledge in supporting healthy eating, the researcher aims to develop a valid and reliable knowledge test to assess food knowledge of first-year students at a university of technology in the Western Cape, South Africa. The food knowledge related to fat, fruits and vegetables is considered as these aspects of the eating behavior of young adults that can be improved upon.

Why have you been invited to participate?

The aim of the study is to develop a food knowledge test to assess the food knowledge of first-year students at a university of technology in the Western Cape, South Africa. You have therefore been invited to participate in this research study as you form part of this group of students.

What will your responsibilities be?

You will be asked to complete a questionnaire consisting of two (2) sections including (i)

questions on food knowledge, and (ii) demographic and related information (such as your age, gender, etc).

Will you benefit from taking part in this study?

There is no direct personal benefit to you in taking part in this study. However, the study also aims to use the results to prepare recommendations for institutional consideration to support food knowledge and food and nutrition practices of students living in self-catering facilities at CPUT if found to be needed.

Are there any risk(s) involved in your taking part in this study?

There are no risks involved in taking part in this study.

What will happen in the unlikely event of some form of injury occurring as a direct result of your taking part in this research project?

No injury is expected to directly occur as a result of your participation in this study.

Will you be paid to take part in this research and are there any costs involved?

No, you will not be paid to take part in this study.

Is there anything else that you should know or do?

All the participant information obtained during this study will be kept confidential, but the information obtained from the whole participant group will be summarised and used for publication in a scientific journal as the information collected will contribute in providing information about the food knowledge of young adults residing in South Africa. You will remain anonymous in the study as you will receive a participant number that will be filled in on your questionnaire.

Declaration by participant

By signing below, I agree to take part in a research project entitled *Development of a food knowledge test for first-year students at a university of technology in the Western Cape, South Africa.*

I declare that:

- I have read this participant information leaflet and consent form and it is written in a language I fully understand.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is voluntary and I have not been pressurised to participate.
- I may choose to leave the study at any time and will not be penalised for doing so.

Signed at (*place*) on (*date*)2013.

.....
Signature of participant

Declaration by researcher

I declare that:

- I explained the information in this leaflet to
- I encouraged her/him to ask questions and took adequate time to answer them.
- I am satisfied that she/he adequately understands all aspects of the study, as discussed above.

Signed at (*place*) on (*date*)2013.

.....
Signature of researcher

Addendum C: Content and face evaluation by the expert panellists (n = 6) of the final working document test items for the first preliminary food knowledge test

Knowledge test item*		CONTENT VALIDITY		FACE VALIDITY		Acceptable as is / adapted for final knowledge test
		Number of panellists (n = 6) finding item to be acceptable	Comments / Suggestions	Number of panellists (n = 6) finding item to be acceptable	Comments / Suggestions	
1.	To avoid fresh apple slices from browning when added to a fruit salad: a) briefly place the apple slices in boiling water. b) sprinkle salt water on the surface of the apple slices. c) cut the apple into very thin slices. d) sprinkle lemon juice on the surface of the apple slices.	66.7% (n=4)	Start alternative with a verb, e.g.: a) <u>place</u> the apple slices briefly in boiling water. Alternative (c) obviously incorrect; suggestion: 'Leave the peel on the apple when slicing'. Too scientific – is this relevant to sample group?	100% (n=6)		Adapted for final test according to suggestions under content validity.
2.	What is the best way to clean potatoes, carrots and sweet potatoes? a) Soak in water with salt added. b) Rinse under cold water. c) Rinse under hot water. d) Soak in water with bleach added.	83.3% (n=5)	Alternative (d) obviously wrong; suggestion: 'Soak in water with vinegar added'.	100% (n=6)		Accepted for final test according to suggestion under content validity.
3.	If you are making a salad but your lettuce leaves are slightly wilted what can you do to overcome the problem? a) Place the leaves in warm water. b) Place the leaves in cold water. c) Throw the leaves in water with salt added. d) Place the leaves in water with bleach added.	83.3% (n=5)	Replace the word 'wilted'. Alternative (d) obviously incorrect; suggestion: 'Soak in water with vinegar added'.	83.3% (n=5)		Adapted for final test according to alternative (d) suggestion under content validity.
4.	When peeling vegetables, why should you not peel them too thickly? a) Thick peeling removes the layer of nutrients under the skin. b) Thick peeling leads to colour loss. c) Thick peeling causes them to dry out quicker. d) Thick peeling leads to the loss of taste.	100% (n=6)		100% (n=6)		Acceptable as is.

5.	<p>Is it necessary to wash pears before consumption?</p> <p>a) No, all fruits are washed when packaged.</p> <p>b) Yes, pesticides and dirt may be present on the surface of pears.</p> <p>c) No, the flavour of the pears may change.</p> <p>d) Yes, it will improve the nutritional value of the pears.</p>	100% (n=6)		83.3% (n=5)	Note: Not only relevant to pears.	Acceptable as is.
6.	<p>What should you do with potatoes after peeling them?</p> <p>a) Place them in the refrigerator.</p> <p>b) Place them in boiling water.</p> <p>c) Place them under dry kitchen towel.</p> <p>d) Place them in cold water.</p>	83.3% (n=5)	Alternative (b) could also be correct if the water is not cooled down.	100% (n=6)		Acceptable as is (in practice).
7.	<p>What is important when stir-frying vegetables?</p> <p>a) When mixture looks dry add more oil.</p> <p>b) Oil should be hot before adding vegetables.</p> <p>c) Add all the vegetables at once.</p> <p>d) Stir with a wooden spoon.</p>	66.7% (n=4)	<p>Start alternatives with a verb, i.e.:</p> <p>a) Add more oil when mixture looks dry.</p> <p>b) Add vegetables when oil is hot.</p> <p>Alternative (d) acceptable answer, but odd one out.</p> <p>Question unclear; rather 'Why is it important that oil should be hot before adding the vegetables when preparing a stir-fry?'</p>	83.3% (n=5)		Discarded.
8.	<p>How should you cook broccoli to retain the colour and texture?</p> <p>a) Add broccoli to cold water, and cook with a lid on the pot.</p> <p>b) Add broccoli to boiling water, and cook with a lid on the pot.</p> <p>c) Add broccoli to boiling water, and cook without a lid on the pot.</p> <p>d) Add broccoli to cold water, and cook without a lid on the pot.</p>	100% (n=6)		100% (n=6)	<p>Add: '...to retain the colour, texture and nutrients?'</p> <p>Rather put in the following order: a, d, b & c.</p>	Adapted according to comments under face validity.

9.	How should you cook cauliflower to retain the colour and texture? a) Add cauliflower to cold water, and cook with lid on the pot. b) Add cauliflower to boiling water, and cook with lid on the pot. c) Add cauliflower to boiling water, and cook without a lid on. d) Add cauliflower to cold water, and cook without a lid on the pot.	100% (n=6)		100% (n=6)	Add: '...to retain the colour, texture and nutrients?'. Rather put in the following order: a, d, b & c.	Adapted according to comments under face validity.
10.	If the instructions on pre-packaged vegetables ask to 'roast' the vegetables, which of the following methods will you follow? a) Partially boil, but not fully cook the vegetables. b) Place the vegetables, covered with foil, in a pre-heated oven and heat. c) Place the vegetables, uncovered, in a pre-heated oven and heat. d) Heat the vegetables in fat.	83.3% (n=5)	Verbs different.	83.3% (n=5)	Substitute 'ask' with 'suggest'.	Adapted according to comments under content- and face validity.
11.	When cooking finely sliced carrots, which of the following cooking methods will be the best to retain as many nutrients as possible? a) Roasting. b) Steaming. c) Boiling. d) Stir-frying.	100% (n=6)		100% (n=6)		Acceptable as is.
12.	Which of the following factors shorten the cooking time of peeled butternut pieces? a) Place the butternut pieces in boiling water. b) Place the butternut pieces in cold water. c) Cut the butternut in very large pieces. d) Use a small pot to cook.	100% (n=6)		100% (n=6)		Acceptable as is.
13.	Which of the following cooking methods will be the quickest to cook legumes? a) Baking. b) Pressure cooking. c) Grilling. d) Steaming.	100% (n=6)		100% (n=6)	Rather use the word 'beans' or 'lentils'. First year students are supposed to know what legumes are, but very few do.	Adapted according to comment under face validity.

14.	To avoid losing the nutrients contained in vegetables after cooking: a) serve and eat immediately. b) cover until serving. c) leave to stand a few minutes before serving. d) microwave before serving.	100% (n=6)		100% (n=6)	May be too easy.	Acceptable as is.
15.	Which cooking method is described as placing vegetables in a rack or basket above boiling water and covering the pot or pan with a lid? a) Parboiling. b) Boiling. c) Poaching. d) Steaming.	100% (n=6)		100% (n=6)		Acceptable as is.
16.	If you were planning on making a stew that was to cook on a low heat in a pot for at least 45 minutes, which of the following vegetables would not be a good choice to add at the beginning of the cooking process? a) Carrots. b) Baby marrows. c) Green beans. d) Potatoes.	100% (n=6)		83.3% (n=5)	Too long, shorten the question to make it clearer.	Discarded.
17.	When boiling vegetables, what will increase the cooking time of vegetables? a) Cooking vegetables cut into small pieces. b) Adding salt to the boiling water. c) Cooking vegetable cut into large pieces. d) Adding vinegar to the boiling water.	83.3% (n=5)		83.3% (n=5)	When boiling vegetables, <i>which factor...</i>	Adapted according to suggestion under face validity.
18.	Which does not affect the flavour of cooked vegetables? a) The age of the vegetables. b) How long the vegetables were stored. c) The temperature at which the vegetables are cooked. d) The vitamin content of vegetables.	100% (n=6)		83.3% (n=5)	'Which of the <i>following</i> does not affect...'	Adapted according to suggestion under face validity.

19.	When making a meat and vegetable stew the vegetables must: a) be added after browning the meat. b) be pre-cooked and then added. c) be added to the last 30 minutes of cooking. d) be cooked separately and added before serving it.	83.3% (n=5)	Specify the type of vegetables, e.g. carrots. Spinach also a vegetable and is added minutes before serving.	83.3% (n=5)	Alternative (c) 'be added <i>during</i> the last 30 minutes of cooking.	Adapted according to comments under content- and face validity.
20.	Where is the best place to store potatoes in the kitchen? a) In a cupboard in an airtight container. b) At room temperature in a paper bag. c) At room temperature exposed to sunlight. d) In the refrigerator in a plastic bag.	100% (n=6)	b) In a paper bag at room temperature. c) Exposed to sunlight at room temperature / c) Room temperature but not in sunlight. d) in a plastic bag in the refrigerator.	83.3% (n=5)	Question is asking what the best place is for storage, therefore change position of 'room temperature' and 'in a paper bag' within sentence structure.	Adapted according to comments under content- and face validity.
21.	How should you store green, unripe bananas to ripen them? a) In the refrigerator in a plastic bag. b) In a warm place in a paper bag. c) In a cupboard, uncovered. d) In a cupboard, in an airtight container.	100% (n=6)		100% (n=6)		Accepted as is.
22.	What should you do with potatoes that have turned green in colour? a) Place in the refrigerator and use within a week. b) Peel to remove the green coloured parts before using. c) Throw away and do not use. d) Keep in a warm place until the colour returns to normal before using.	100% (n=6)		100% (n=6)		Acceptable as is.
23.	How long can leftover carrots be kept in the refrigerator? a) 1 day. b) 2-3 days. c) 4-6 days. d) 1 week.	83.3% (n=5)	Cooked/uncooked? Could be formulated better: '...in the refrigerator after cooking/peeling?'	100% (n=6)		Adapted according to suggestions under content validity.
24.	What is the best method to store canned fruits to keep their quality longer? a) In a cool, dry place. b) In the refrigerator. c) In a dry, warm place. d) In a dry, humid place.	83.3% (n=5)	Best Before dates on tinned goods – may be too obvious; too scientific.	100% (n=6)		Kept as is.

25.	The following types of apricots are not available all year round? a) Dried apricots. b) Canned apricots. c) Frozen apricots. d) Fresh apricots.	100% (n=6)		83.3% (n=5)		Kept as is.
26.	Which of the following fruits have the shortest shelf-life? a) Strawberries. b) Apples. c) Oranges. d) Pears.	100% (n=6)	Correct answer too obvious; maybe include grapes as an option.	100% (n=6)		Adapted according to suggestion under content validity.
27.	Which of the following factors is a sign of good quality when buying broccoli? a) Visible dirt on the surface of the broccoli. b) Stems light green and firm. c) Overall colour is yellow-green. d) Florets not tightly closed.	100% (n=6)		100% (n=6)	Grammar – ‘which <i>one</i> of the following...’	Adapted according to suggestion under content validity.
28.	Which of the following vegetables are classified as root vegetables? a) Cabbage. b) Broccoli. c) Carrot. d) Baby marrow.	100% (n=6)		100% (n=6)	May be too easy (school level).	Accepted as is.
29.	When buying pre-packaged butternut the following package should be bought: a) the butternut pieces are cut into different sizes. b) the inside of the package is moist. c) the butternut pieces are a pale yellow colour. d) the package is sealed with no visible damage.	100% (n=6)	Answer too obvious.	83.3% (n=5)		Accepted as is.
30.	If you do not have a refrigerator at home, what would be the best option when buying vegetables for use within a few days? a) Buy small quantities of fresh vegetables. b) Buy only one kind of vegetable. c) Buy pre-packaged vegetables. d) Buy frozen vegetables.	100% (n=6)		100% (n=6)		Acceptable as is.

31.	<p>When buying fruits or vegetables, what would indicate to you that no chemical pesticides have been used on plants?</p> <p>a) Fresh fruits or vegetables. b) Organic fruits or vegetables. c) Tinned fruits or vegetables. d) Pre-packaged fruits or vegetables.</p>	100% (n=6)	Alternative (b) 'organic certified fruits or vegetables'.	83.3% (n=6)	<p>When buying fruits or vegetables, which words/which description...</p> <p>a) 'Fresh...' b) 'Organic...' c) 'Tinned...' d) 'Pre-packaged...'</p>	Acceptable as is.
32.	<p>Which of the following indicated that an avocado is ready for use?</p> <p>a) The skin of the avocado gives slightly to gentle pressure. b) The colour of the avocado is dark green to black. c) The skin of the avocado is smooth and firm. d) The stalk of the avocado is still attached.</p>	100% (n=6)		100% (n=6)		Acceptable as is.
33.	<p>Which of the following fruit is a citrus fruit?</p> <p>a) Melon. b) Guava. c) Orange. d) Apricot.</p>	100% (n=6)		83.3% (n=5)	May be too easy.	Kept as is.
34.	<p>Which one of the following factors is not a reason for buying pre-packaged cut vegetables?</p> <p>a) It is less expensive. b) Convenience. c) Less time consuming to prepare. d) Availability in small quantities.</p>	83.3% (n=5)	Correct answer too obvious.	100% (n=6)		Acceptable as is.
35.	<p>What is the reason for drying pears?</p> <p>a) Drying improves the texture of pears. b) Drying increases the moisture content of pears. c) Drying lowers the sugar content of pears. d) Drying makes pears available all year round.</p>	83.3% (n=5)	<p>Correct answer too obvious.</p> <p>Alternative (a) can be right for certain applications.</p> <p>Alternative (b) obviously incorrect; suggestion: 'Drying improves the taste of pears'.</p>	100% (n=6)	Why is it useful to dry pears?	Adapted according to suggestions under content- and face validity.
36.	<p>Which of the following food items is not a legume?</p> <p>a) Dried beans. b) Split peas. c) Lentils. d) Corn.</p>	100% (n=6)		100% (n=6)		Acceptable as is.

37.	Which of the following best describe an aubergine (eggplant)? a) Glossy, smooth skin with a deep purple colour. b) Glossy, smooth skin with a dark green colour. c) Dull, smooth skin with a light green colour. d) Dull, smooth skin with a slightly beige colour.	83.3% (n=5)	Alternatives (c) and (d) could be slightly less obvious as distracters. Add 'and white flesh' to each option. May be too easy in terms of general knowledge.	100% (n=6)		Adapted according to suggestion under content validity.
38.	Which of the following vegetables is not suitable for stir-frying? a) Butternut. b) Carrots. c) Green beans. d) Sweet peppers.	83.3% (n=5)	In some stir-fry packages, there are butternut strips. Change alternative (a) to potatoes.	100% (n=6)	May be too easy.	Adapted according to suggestion under content validity.
39.	Which of the following vegetables are suitable for grilling? a) Cabbage. b) Spinach. c) Baby marrow. d) Peas.			100% (n=6)		Acceptable as is.
40.	If you wanted to increase your fibre intake through adding a tablespoon of dried fruit to your breakfast cereal, your best option would be to use: a) dried pear. b) dried prune. c) dried apricot. d) dried apple.	100% (n=6)		66.7% (n=4)	May be too difficult; sample group may not have the knowledge of the fibre content of different fruit types.	Discarded.
41.	When should you strain oil used for deep fat frying? a) Right after using it once it is cold. b) At least once a week. c) At least once a month. d) Just before using it.	100% (n=6)		100% (n=6)		Acceptable as is.
42.	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) Strain through a paper filter. c) Throw away and do not use. d) Add a small amount of salt to it before using.	100% (n=6)		100% (n=6)		Acceptable as is.

43.	If a recipe indicates 'cream the butter', what should you do? a) Melt the butter and add cream. b) Beat the butter. c) Buy creamed butter. d) Use butter with a high fat content.	100% (n=6)		100% (n=6)		Acceptable as is.
44.	What could you do to reduce the fat content of meat before cooking it? a) Put the meat in boiling water. b) Freeze the meat. c) Trim off the visible fat. d) Dip the meat into breadcrumbs.	100% (n=6)		100% (n=6)		Acceptable as is.
45.	If a recipe indicates 'melt the butter' what should you do? a) Leave the butter at room temperature. b) Put the butter in the refrigerator. c) Whisk the butter. d) Place the butter in a pot and heat on low.	66.7% (n=4)	Alternative (b) obviously incorrect; suggestion: 'Add warm water to the butter'.	66.7% (n=6)	May be too easy.	Discarded.
46.	Before adding foods to oil when shallow-frying, oil should: a) turn slightly darker in colour. b) be hot. c) spatter. d) smoke slightly.	100% (n=6)		100% (n=6)		Acceptable as is.
47.	When shallow-frying, smoking oil is an indication that: a) the oil has become too old to use. b) the oil has become too hot to use. c) there is not enough oil in the pan. d) water is mixed with the oil in the pan.	100% (n=6)		100% (n=6)	May be too difficult, i.e. scientific.	Kept as is.
48.	What is the best fat to use for deep-frying? a) Olive oil b) Sunflower oil. c) Margarine. d) Lard.	100% (n=6)		100% (n=6)		Acceptable as is.
49.	If foods are not crisp after deep-frying, what could be the cause? a) The temperature of the oil was too low. b) The oil used was too old. c) The food added was too dry. d) The fryer was not clean.	83.3% (n=5)	Alternative (d) obviously incorrect; suggestion: 'The wrong type of oil was used'.	100% (n=6)		Kept as is.

50.	<p>What could be a reason for fried food being too greasy?</p> <p>a) Fryer not cleaned properly. b) Frying at too low a temperature. c) Not frying food for long enough. d) Frying at too high a temperature.</p>	100% (n=6)	Alternative (a) obviously wrong; suggestion: 'Frying in the wrong type of oil'.	100% (n=6)		Kept as is.
51.	<p>What cooking method is used when enough oil is used to cover the food in the saucepan?</p> <p>a) Stir-frying. b) Deep-frying. c) Grilling. d) Shallow-frying.</p>	100% (n=6)		100% (n=6)	'Which cooking method...'	Adapted according to suggestion under face validity.
52.	<p>What 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) Stir-frying. b) Deep-frying. c) Grilling. d) Shallow-frying.</p>	100% (n=6)		100% (n=6)	'Which cooking method...'	Acceptable as is.
53.	<p>Which of the following cooking methods require the least amount of oil when cooking with oil?</p> <p>a) Deep-frying. b) Shallow-frying. c) Sauteing. d) Stir-frying.</p>	100% (n=6)		83.3% (n=5)	May be irrelevant to sample group.	Kept as is.
54.	<p>Why is fat added when baking a cake?</p> <p>a) To increase the energy content of the cake. b) To improve the flavour and colour of the cake? c) To make the cake rise when baked in the oven. d) To prevent the cake from sticking to the tin.</p>	83.3% (n=5)	Rather say: 'Why is fat added to the <i>ingredients</i> when baking a cake?'	83.3% (n=4)	This question could be misunderstood based on face validity.	Adapted according to comments under content validity.
55.	<p>Which of the following methods use the least amount of fat to cook food?</p> <p>a) Searing. b) Shallow-frying. c) Roasting. d) Stir-frying.</p>	100% (n=6)		100% (n=6)		Acceptable as is.

56.	<p>Why is fish sometimes dipped into egg and flour before frying it?</p> <p>a) To prevent the fish from drying out.</p> <p>b) To hide the fishy smell.</p> <p>c) To decrease the cooking time of the fish.</p> <p>d) To increase the portion sizes.</p>	100% (n=6)		100% (n=6)		Acceptable as is.
57.	<p>Which of the following cooking methods will cause chicken thighs to absorb the least fat during cooking?</p> <p>a) Shallow-fry chicken thighs until cooked.</p> <p>b) Brown chicken thighs and roast in the oven until cooked.</p> <p>c) Deep-fry chicken thighs until cooked.</p> <p>d) Brown the chicken thighs in a little oil and then deep-fry until cooked.</p>	100% (n=6)		100% (n=6)		Acceptable as is.
58.	<p>Where should tub margarine be stored?</p> <p>a) In the refrigerator.</p> <p>b) In a cool, dry place.</p> <p>c) On the countertop in the kitchen.</p> <p>d) In a closed cupboard.</p>	100% (n=6)		83.3% (n=5)	Too easy.	Kept as is.
59.	<p>Which of the following may lead to rancidity in a bottle of oil?</p> <p>a) Placing it in direct sunlight.</p> <p>b) Placing it in the refrigerator.</p> <p>c) Placing it in a dark cupboard.</p> <p>d) Placing it in a paper bag.</p>	100% (n=6)		100% (n=6)		Acceptable as is.
60.	<p>Which of the following could be frozen to extend the shelf-life?</p> <p>a) Canola oil.</p> <p>b) Butter.</p> <p>c) Cream.</p> <p>d) Olive oil.</p>	83.3% (n=5)	Cream can also be frozen to extend shelf-life; replace with 'sesame oil'.	100% (n=6)		Acceptable as is.
61.	<p>If olive oil gets a cloudy appearance when stored in the refrigerator:</p> <p>a) throw away the oil.</p> <p>b) keep the oil at room temperature before use.</p> <p>c) put the oil in a pot over high heat and then use.</p> <p>d) filter the oil before use.</p>	100% (n=6)		100% (n=6)		Acceptable as is.

62.	Which of the following fats is the best choice when making shortbread biscuits? a) Tub margarine. b) Butter. c) Medium fat spread. d) Sunflower oil.	100% (n=6)		100% (n=6)		Acceptable as is.
63.	Which of the following is the least expensive? a) Olive oil b) Sesame seed oil. c) Canola oil. d) Sunflower oil.	100% (n=6)		100% (n=6)		Acceptable as is.
64.	Which of the following types of canned tuna has the lowest fat content? a) Tuna in salted water. b) Tuna in vegetable oil. c) Tuna in sunflower oil. d) Tuna in salad dressing.	100% (n=6)		100% (n=6)		Acceptable as is.
65.	The best container to purchase oil in to increase the shelf-life of the oil is: a) Copper. b) Plastic. c) Glass. d) Aluminium	100% (n=6)	Change alternative (c) to tinted glass.	100% (n=6)	'The best container to purchase oil in <i>order</i> to...'	Adapted according to comments under content- and face validity.
66.	Which of the following cold desserts has the lowest energy value? a) Frozen yogurt. b) Crème caramel. c) Mousse. d) Sorbet.	100% (n=6)		100% (n=6)		Acceptable as is.
67.	Why should butter rather than margarine be chosen when cooking? a) Less butter than margarine can be used. b) Butter gives a better flavour to foods than margarine. c) Butter is healthier than margarine. d) Butter can be heated to a higher temperature than margarine.	100% (n=6)		100% (n=6)		Acceptable as is.
68.	Which of the following types of milk is suitable for someone who needs to limit their energy intake? a) Low fat milk. b) Condensed milk. c) 2% milk. d) Skimmed milk.	100% (n=6)		100% (n=6)		Acceptable as is.

69.	Which of the following fats are not derived from plants? a) Sunflower oil. b) Cream. c) Olive oil. d) Palm oil.	100% (n=6)		83.3% (n=5)	Common knowledge – too easy.	Kept as is.
70.	Which of the following options will add the most energy to a cup of coffee when a medium amount is added? a) Full cream milk. b) Coffee creamers. c) Skimmed milk. d) 2% milk.	100% (n=6)	Change alternative (b) to condensed milk.	83.3% (n=5)	Study group may not be familiar with coffee creamers.	Kept as is.
71.	Which of the following chicken pieces (Per 100 g) will have the least fat? a) Chicken leg with skin. b) Chicken breast without skin. c) Chicken thigh without skin. d) Lean wing with skin.	100% (n=6)		100% (n=6)	Grammar: 'Which of the following chicken <i>portions...</i> '	Adapted according to suggestion under face validity.
72.	Which of the following meat choices (per 100 g) will have the least fat? a) Beef steak. b) Roast leg of lamb. c) Chicken breast without skin. d) Lean beef mince.	66.7% (n=4)		83.3% (n=5)	'Which of the following meat choices (per 100 g) will have the <i>highest</i> fat content?'	Discarded.
73.	When buying 'good fats' to promote heart health, choose: a) block margarine. b) sunflower oil. c) canola oil. d) cream.	100% (n=6)		100% (n=6)		Acceptable as is.
74.	Which of the following fats will give the best flavour to scones? a) Cream. b) Canola oil. c) Butter. d) Tub margarine.	100% (n=6)		100% (n=6)		Acceptable as is.
75.	Which of the following is best for baking a layer cake using the creaming method? a) Tub margarine. b) Block margarine. c) Olive oil. d) Cream.	100% (n=6)		100% (n=6)		Acceptable as is.

76.	To reduce the energy content of Spaghetti Bolognaise use: a) lean beef mince. b) very lean beef mince. c) regular beef mince. d) a combination of full fat and lean beef mince.	100% (n=6)		83.3% (n=5)	May be too easy; the correct answer obviously correct.	Kept as is.
77.	Which of the following is the preferred choice for salad dressings when making a Greek salad? a) Olive oil. b) Sunflower oil. c) Melted butter. d) Cream.	100% (n=6)		83.3% (n=5)	May be too easy; the correct answer obviously correct.	Kept as is.
78.	Which of the following foods has the highest energy content per 100 g? a) Raisins. b) Potatoes. c) Bananas. d) Avocados.	100% (n=6)		100% (n=6)		Acceptable as is.
79.	Which of the following has the lowest energy content per 100 g? a) Ostrich mince. b) Regular beef mince. c) Pork mince. d) Chicken mince.	100% (n=6)		100% (n=6)		Acceptable as is.

*Correct alternative to knowledge test item indicated in bold

Addendum D: Content and face evaluation by the expert panellists (n = 8) of the final working document test items for the second preliminary food knowledge test

Knowledge test item*		New / adapted from first preliminary test	CONTENT VALIDITY		FACE VALIDITY		Acceptable as is / adapted for final knowledge test
			Number of panellists (n = 10) finding item to be acceptable	Comments / Suggestions	Number of panellists (n = 10) finding item to be acceptable	Comments / Suggestions	
1.	Which part of broccoli is not eaten? a) Stalks b) Leaves c) Florets	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
2.	Which option best describes the appearance of an apricot? a) Large, round fruit with smooth yellow skin b) Small, round fruit with velvety orange skin c) Medium, round fruit with skin ranging from yellow to deep red	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
3.	When storing cooked vegetables in the refrigerator: a) check that the refrigerator is not too fully packed b) use deep containers to decrease cooking time c) wait until the vegetables are completely cold before placing them in the refrigerator	New	n=7 (87.5%)	Replace alternative (c) with 'place the warm vegetables in the refrigerator'.	n=8 (100%)		Adapted for test according to suggestion under content validity.
4.	When re-heating cooked butternut which of the following options is not a factor to consider? a) Heat large quantities at a time b) Stir frequently if heated in the microwave c) Heat as close to serving time as possible	New	n=8 (100%)		n=8 (100%)		Acceptable as is.

5.	<p>If you are making a salad but your lettuce leaves are slightly wilted what can you do to overcome this problem?</p> <p>a) Place the leaves in cold water b) Place the leaves in water with salt added c) Place the leaves in a container in a shaded area</p>	Question 3 (kept as is)	n=8 (100%)		n=7 (87.5%)	Will students know the term 'wilted'?	Kept as is; no suitable term to replace 'wilted'.
6.	<p>How should you cook cauliflower to retain the colour, texture and nutrients?</p> <p>a) Add cauliflower to cold water, and cook without a lid on the pot b) Add cauliflower to boiling water, and cook with a lid on the pot c) Add cauliflower to boiling water, and cook without a lid on the pot</p>	Question 8 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
7.	<p>Which of the following cooking methods will be the quickest to cook dried peas or beans?</p> <p>a) Boiling b) Pressure cooking c) Steaming</p>	Question 12 (adapted)	n=8 (100%)		n=8 (100%)		Acceptable as is.
8.	<p>Which cooking method is described as placing vegetables in a rack or basket over boiling water and covering the pot with a lid?</p> <p>a) Stewing b) Poaching c) Steaming</p>	Question 14 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
9.	<p>Which one of the following factors does not affect the flavour of cooked vegetables?</p> <p>a) Age of the vegetables b) Temperature at which the vegetables are cooked c) Vitamin content of the vegetables</p>	Question 15 (adapted)	n=8 (100%)		n=8 (100%)		Acceptable as is.

10.	What does the 'Net Weight' of canned pears indicate? a) Weight of the pears without the syrup b) Weight of the pears and the syrup c) Weight of the syrup without the pears	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
11.	Once opened, dried fruit should be consumed within a) 2-3 weeks. b) 4-6 weeks. c) 2 months.	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
12.	In South Africa, which fresh fruit is typically available in summer months? a) Oranges b) Grapes c) Guavas	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
13.	Which of the following is not an example of lettuce? a) Iceberg b) Butter head c) Rocket	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
14.	If a recipe asks for <i>julienne</i> carrots, you should prepare the carrots by cutting them into a) slices. b) cubes. c) matchsticks.	New	n=8 (100%)		n=7 (87.5%)	Replace alternative (a) with the word 'strips'.	Kept as is; 'strips' not descriptive enough.
15.	The leaves of which vegetable can be used as a herb? a) Carrot b) Celery c) Spinach	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
16.	<i>Kalamata</i> is a type of a) prune. b) raisin. c) olive.	New	n=8 (100%)		n=7 (87.5%)	Swop alternatives (b) and (c).	Adapted according to suggestion under face validity.
17.	In South Africa, mushrooms are available a) during the summer months. b) during the winter months. c) throughout the year.	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
18.	Which of the following is not a citrus fruit? a) Clementine b) Nectarine c) Grapefruit	Question 31 (adapted)	n=8 (100%)		n=8 (100%)		Acceptable as is.

19.	Which of the following does not refer to baby marrows? a) Zucchini b) Courgettes c) Patty pans	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
20.	When buying fresh pre-packed mixed vegetables, the 'best before' date refers to the date up to which it a) may be safely used if stored properly. b) may be displayed on the supermarket shelf. c) will remain in optimum condition.	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
21.	When making <i>guacamole</i> , which of the following ingredients will you need? a) Avocado, garlic, lemon juice and chilli b) Courgettes, lemon juice, peppers and parsley c) Onion, garlic, spinach and chilli	New	n=7 (87.5%)	Change (b) to <i>baby marrows</i> , lemon juice, peppers and parsley.	n=8 (100%)		Kept as is.
22.	When making a traditional <i>moussaka</i> you will need the following vegetables: a) tomatoes, sweet peppers and chillies b) butternut, onion and chickpeas c) potatoes, onions and aubergines	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
23.	When buying cauliflower, which one of the following factors indicates that the cauliflower is no longer fresh? a) Firm, compact heads b) Yellow-coloured florets c) Attached leaves are bright green	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
24.	To prevent avocado flesh turning brown: a) dip avocado slices in cold water b) refrigerate c) cover with plastic wrap	New	n=7 (87.5%)	Does alternative (c) always work; may still change colour?	n=8		Kept as is; in theory plastic wrap should prevent browning.
25.	'Concentrate' juice a) has the same nutritional value as non-concentrate juice. b) is healthier than non-concentrate juice. c) contains far less water as non-concentrate juice.	New	n=8 (100%)		n=8 (100%)	Replace 'as' with 'compared to'.	Adapted according to suggestion under face validity.

26.	<p>When preparing an assortment of fresh vegetables for dinner:</p> <ul style="list-style-type: none"> a) cook all the vegetables together, starting with the one that will take the longest b) cut the vegetables that will take the longest into large pieces c) cook all the vegetables with the same colour together at the same time 	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
27.	<p>When cooking asparagus:</p> <ul style="list-style-type: none"> a) place the asparagus in cold salted water b) place the asparagus under the grill in the oven c) place the asparagus in boiling salted water 	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
28.	<p>When storing opened canned sweetcorn:</p> <ul style="list-style-type: none"> a) place in an air-tight container and refrigerate for up to 2 days b) place in a non-airtight container and refrigerate for up to 2 days c) leave the left-over sweetcorn in the tin and refrigerate for up to 2 days 	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
29.	<p>If you do not have lemon juice in the home when cooking, what can be used in its place?</p> <ul style="list-style-type: none"> a) Rooibos tea b) Carbonated cold drink c) Vinegar 	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
30.	<p>If you do not have bottled tomato sauce in the home when making a stew, what can be used in its place without compromising flavour?</p> <ul style="list-style-type: none"> a) Mixture of tomato puree and water b) Mixture of fresh tomatoes blended with water c) Tomato soup powder 	New	n=8 (100%)		n=8 (100%)		Acceptable as is.

31.	Which one of the following statements is true about dried apricots (per 100 g)? a) Dried apricots have a lower sugar content than fresh apricots b) Dried apricots have a higher sugar content than fresh apricots c) Dried apricots have the same sugar content as fresh apricots	New	n=8 (100%)		n=7 (87.5%)	Remove the '100 g' – may confuse participants.	Adapted according to suggestion under face validity.
32.	To avoid fresh apple slices from browning when added to a fruit salad sprinkle a) salt water on the apple slices. b) hot water on the apple slices. c) orange juice on the apple slices.	Question 1 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
33.	If the instructions on pre-packed vegetables recommend to 'roast' the vegetables, which of the following methods will you follow? a) Place the vegetables in a pot with a small amount of boiling water, cover and heat on high temperature b) Place the vegetables, covered with foil, in a pre-heated oven and heat c) Place the vegetables, uncovered, in a pre-heated oven and heat	Question 9 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
34.	To avoid losing the nutrients contained in sweet potato after cooking: a) refrigerate after cooking and re-heat before serving b) serve and eat immediately c) wrap in foil and keep in a warm place	Question 13 (adapted)	n=8 (100%)		n=8 (100%)		Acceptable as is.
35.	When making a meat and vegetable stew the vegetables must a) be added after browning the meat. b) be added during the last 30 minutes of cooking. c) be pre-cooked and then added.	Question 17 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.

36.	How should you store green, unripe bananas to ripen them? a) In a warm place in a paper bag b) In the refrigerator c) In a cupboard, uncovered	Question 19 (kept as is)	n=8 (100%)		n=7 (87.5%)	Is this relevant to student sample group?	Kept as is; storage practice.
37.	What should you do with potatoes that have turned green in colour? a) Peel to remove the green coloured parts before using b) Throw away and no not use c) Cook in the skin and remove afterwards	Question 20 (kept as is)	n=8 (100%)		n=7 (87.5%)	Alternative (c): 'Cook in the skin and remove the skin afterwards'.	Adapted according to suggestion under face validity.
38.	How long can leftover cooked vegetables be kept in the refrigerator after cooking? a) 1 day b) 2-3 days c) Up to 1 week	Question 21 (adapted)	n=8 (100%)		n=8 (100%)		Acceptable as is.
39.	When buying broccoli which one of the following factors is a sign of good quality broccoli? a) Stems light green and firm b) Overall colour is yellow-green c) Florets not open	Question 25 (kept as is)	n=8 (100%)		n=7 (87.5%)	Swop alternatives (a) and (c).	Adapted according to suggestion under face validity.
40.	If you do not have a refrigerator at home, what would be the best option when buying vegetables for use within a few days? a) Buy small quantities of fresh vegetables b) Buy pre-packed vegetables c) Buy fresh vegetables with green leaves	Question 28 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
41.	When buying fruit or vegetables, which description indicates to you that no chemical fertilizers and pesticides were used on the plants? a) Fresh b) Organic c) Genetically modified	Question 29 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
42.	Which one of the following vegetables is not suitable for stir-frying? a) Potatoes b) Green beans c) Sweet peppers	Question 36 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.

43.	Which one of the following vegetables is suitable for grilling? a) Baby marrow b) Spinach c) Peas	Question 37 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
44.	Which one of the following best describes an aubergine? a) Glossy, smooth skin with a deep purple colour and white flesh b) Glossy, smooth skin with a dark green colour and white flesh c) Glossy, smooth skin with a dark red colour and white flesh	Question 35 (kept as is)	n=8 (100%)		n=7 (87.5%)	Swop alternatives (a) and (c).	Adapted according to suggestion under face validity.
45.	The shelf-life of canned apricot jam cannot be affected by a) extreme temperatures. b) storage conditions. c) packaging and labelling.	New	n=7 (87.5%)	Alternative (c): The packaging can refer to damage of the tin and can reduce shelf-life; remove 'packaging'.	n=8 (100%)		Adapted according to suggestion under content validity.
46.	The best way to store dried fruit is: a) in an air-tight container in a cool, dry place b) in an air-tight container in a warm, dry place c) in an open container in a cool, dry and ventilated place	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
47.	Which one of the following fruits should be chosen if you want to increase your fibre intake? a) Berries b) Figs c) Bananas	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
48.	When making Spinach and Feta muffins, which one of the following can be used as a substitute if spinach is not available? a) Celery b) Zucchini c) Swiss chard	New	n=8 (100%)		n=7 (87.5%)	Will students know the terms 'Zucchini' and 'Swiss chard'?	Kept as is.
49.	Which one of the following best describes the dish <i>ratatouille</i> ? a) Chopped vegetables in a mustard sauce b) Braised dish with aubergine, onions, peppers, courgettes and tomatoes c) Savoury tart with an onion filling	New	n=8 (100%)		n=8 (100%)		Acceptable as is.

50.	Which of the following is not a suitable reason for blanching vegetables? a) It softens vegetables b) It loosens the skin of vegetables c) It increases the strong flavour of vegetables	New	n=8 (100%)		n=7 (87.5%)	May be too difficult for student sample group?	Kept as is.
51.	If the recipe instructions ask you to 'poach' pears you will: a) cover the pears with butter and then bake b) cook the pears at temperatures below boiling point in sufficient liquid to partially cover the fruit c) plunge the pears into boiling hot water for 3 minutes and leave to cool	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
52.	When preparing a mushroom: a) use the whole mushroom b) trim the mushroom stalk level with the cap and throw away the stalk c) trim the mushroom stalk level with the cap and throw away the cap	New	n=6 (75%)	Add a dish to the stem of the question for clarification. May be confusing as seen some baked mushrooms where the stalk must be removed.	n=7	Confusing.	Discarded.
53.	What method should you follow when peeling soft-skinned fruit, for example nectarines? a) Immerse the whole fruit in boiling water for 10 seconds and then loosen the skin with a knife b) Dip the knife in hot water before peeling the fruit c) Place in the freezer for 10 seconds and then peel	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
54.	When buying fruit, generally the heavier the piece of fruit is in the hand: a) the more unripe it will be b) the older and more tasteless it will be c) the juicier and better tasting it will be	New	n=8 (100%)		n=8 (100%)		Acceptable as is.

55.	When buying fully ripened fruit: a) place in an air-tight container in a cool, dry place b) refrigerate immediately c) place in a paper bag in a dry place	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
56.	If pears need to ripen at home what should you do? a) Refrigerate them b) Place them in a bowl with bananas, uncovered c) Place them in an air-tight container	New	n=8 (100%)		n=7 (87.5%)	Is this applicable to student sample group?	Kept as is; storage practice.
57.	Which of the following fruit is not suitable for grilling? a) Banana b) Pineapple c) Apple	Question 37 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
58.	Which of the following does not refer to an aubergine? a) Brinjal b) Yuca c) Eggplant	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
59.	In a supermarket, chilled foods refer to perishable products a) stored at temperatures between 0° to 7°C. b) stored at temperatures between -18°C to 0°C. c) obtained from the deli counter.	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
60.	When preparing apples to make an apple tart the term 'coring' refers to removal of the a) skin of the apples. b) pips and central parts of the apples. c) pips of the apples, by cutting the apples in halves.	New	n=7 (87.5%)	Alternative (c): Replace with 'flesh of the apple'.	n=7 (87.5%)	Swop alternatives (b) and (c).	Adapted according to suggestion under face validity.
61.	When planning to make a <i>Waldorf</i> salad, you need to buy a) eggs, walnuts and cheese. b) apples, walnuts and celery. c) tomatoes, anchovies and walnuts.	New	n=8 (100%)		n=8 (100%)		Acceptable as is.

62.	When cooking frozen carrots: a) defrost under running, boiling water b) defrost in the refrigerator c) cook from the frozen state	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
63.	A chef's knife is used for a) peeling potatoes. b) chopping, slicing and dicing potatoes. c) removing the eyes from potatoes.	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
64.	A reason for using a vegetable at the peak of its season is: a) colour and flavour are at their best b) the cooking time will be less c) it will provide more energy	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
65.	To preserve colour of cooked green beans that will not be eaten immediately: a) refrigerate immediately after cooking b) place in ice water until they are cold c) take off the heat and let stand until cold	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
66.	To promote even cooking of butternut: a) cut butternut into pieces with uniform sizes b) use a small pot with a lid and just enough water to cover the butternut pieces c) soak the butternut in hot water before cooking	New	n=8 (100%)		n=7 (87.5%)	Alternative (a): Replace 'uniform' with 'equal'.	Adapted according to suggestion under face validity.
67.	When cooking carrots to <i>al denté</i> it means that the carrots are cooked until: a) firm to the bite, not soft or mushy b) soft and watery c) firm with still a crunchy, hard texture	New	n=8 (100%)		n=8 (100%)		Acceptable as is.

68.	If you do not have a refrigerator at home to store salad, carrots and cabbage: a) wrap items in damp newspaper and store in a cool, dry place b) place items in a vegetable basket, uncovered c) place items in an airtight container in a cool, dry place	New	n=8 (100%)		n=7 (87.5%)	Swop alternatives (a) and (c).	Adapted according to suggestion under face validity.
69.	Which best describe the cooking method when 'blanching' vegetables? a) Vegetables are partially cooked in boiling water b) Vegetables are fried briefly with a small amount of fat c) Vegetables are exposed to dry heat in the oven for 5 minutes	New	n=7 (87.5%)	Alternative (a) refers to parboiling so cannot be correct.	n=8 (100%)		Stem of the item changed to 'parboiling' for inclusion in preliminary test.
70.	Which of the following factors will shorten the cooking time of peeled butternut pieces? a) Place the butternut pieces in boiling water b) Cut the butternut in large pieces c) Use the smallest pot available	New	n=8 (100%)		n=7 (87.5%)	Swop alternatives (a) and (c).	Adapted according to suggestion under face validity.
71.	When cooking finely sliced carrots, which of the following cooking methods will be best to retain as many nutrients as possible? a) Boiling b) Steaming c) Stir-frying	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
72.	When boiling sweet potatoes, which factor will increase the cooking time? a) Using just enough water to cover the bottom of the saucepan but not the potatoes b) Using a large saucepan c) Using boiling water	Question 15 (adapted)	n=5 (62.5%)	Similar to item 70.	n=6 (75%)		Discarded.
73.	Which of the following is an advantage of drying pears? a) Drying makes pears available all-year round b) Drying make pears tastier c) Drying improves the appearance of pears	Question 33 (adapted)	n=7 (87.5%)	Alternative (b) also correct as drying intensifies flavours. Replace with (b) Dried pears are cheaper than fresh pears.	n=8 (100%)		Adapted according to suggestion under content validity.

74.	Only high-quality peaches are used for canning because a) marks on the surface of the peaches will be visible b) the shelf-life is longer c) the sugar content needs to be high	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
75.	When making an apple sauce which type of apples would be the best to use? a) Starking b) Granny Smith c) Golden Delicious	New	n=8 (100%)		n=7 (87.5%)	Will students know the difference?	Kept as is; buying practice.
76.	When making a banana loaf, which bananas would be best to use? a) Green bananas b) Overripe bananas c) Just ripe bananas	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
77.	When buying pre-packed butternut which packet should you choose? a) The butternut pieces are all cut into equal sizes b) The inside of the package is moist c) The butternut pieces are a pale yellow colour	Question 27 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
78.	When 'parboiling' vegetables, it means: a) partially cook the vegetables in a moderate amount of fat b) partially cook the vegetables in a boiling liquid c) place vegetables in a water bath and in the oven for approximately one hour	New	n=6 (75%)	Same as Questions 70/72.	n=6		Discarded.
79.	Which of the following fruits will not discolour when making a fruit salad? a) Apple b) Kiwi fruit c) Bananas	New	n=8 (100%)		n=8 (100%)		Acceptable as is.

80.	Which of the following best describes and 'extender' when used for making a beef lasagne? a) Soy added to the minced beef to replace part of the meat b) Soya used instead of the minced beef c) Soya added to the mince beef to improve the texture of the meat	New	n=7 (87.5%)	Alternative (c) is also correct; replace 'texture' with 'colour'.	n=8 (100%)		Adapted according to suggestion under content validity.
81.	What is the best way to store potatoes in the kitchen? a) In the refrigerator, in a plastic bag b) In a vegetable basket, uncovered c) In a cupboard, in a paper bag	Question 18 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
82.	Which one of the following factors is not a reason for buying pre-packed cut vegetables? a) It is less expensive b) Less time consuming to prepare c) Availability in small quantities	Question 32 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
83.	How will you clean cabbage before using it? a) Rinse in cold water b) Rinse under a tap with running warm water c) Rinse in cold water with lemon juice added	New	n=8 (100%)		n=8 (100%)	Swop alternatives (a) and (c).	Adapted according to suggestion under face validity.
84.	How should you cook boiled potatoes? a) Add potatoes to cold water, and cook without a lid on the pot b) Add potatoes to cold water, and cook with the lid at a slant c) Add potatoes to boiling water, and cook with a lid on the pot	New	n=8 (100%)		n=8 (100%)		Acceptable as is.

85.	<p>What would be the best sequence to add the vegetables when broccoli, mangetout and carrots are boiled together for a mixed vegetables dish?</p> <p>a) Broccoli, carrots and then mangetout</p> <p>b) Mangetout, carrots and then broccoli</p> <p>c) Carrots, broccoli and then mangetout</p>	New	n=8 (100%)		n=7 (87.5%)	Will students now the term 'mangetout'?	Kept as is.
86.	<p>What is the best way to clean mushrooms to retain flavour and nutrients?</p> <p>a) Rinse under cold, running water</p> <p>b) Wipe mushrooms with a damp cloth</p> <p>c) Place in slightly salted water for a few minutes</p>	New	n=7 (87.5%)	Replace 'texture' with 'flavour and nutrients'.	n=8 (100%)		Adapted according to suggestion under content validity.
87.	<p>Which one best describes the cooking method to 'sauté' onions?</p> <p>a) To stir with a wooden spoon in hot fat for 3-4 minutes</p> <p>b) To cook onions under the grill</p> <p>c) To wrap the onions in foil and place in a pre-heated oven for 20 minutes at 180°C</p>	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
88.	<p>When planning to prepare roasted winter vegetables, you will need to buy</p> <p>a) carrots, parsnips, turnips and butternut.</p> <p>b) potatoes, carrots, tomatoes and garlic.</p> <p>c) courgettes, mushrooms, yellow peppers and tomatoes.</p>	New	n=7 (87.5%)	<p>Change:</p> <p>a) parsnips, turnips and butternut</p> <p>b) potatoes, carrots and yellow peppers</p> <p>c) baby marrows, mushrooms and tomatoes</p>	n=7	Shorten alternatives – maximum three per alternative	Adapted according to suggestions under content- and face validity.
89.	<p>Which of the following is the preferred choice for salad dressings when making a Greek salad?</p> <p>a) Olive oil</p> <p>b) Sunflower oil</p> <p>c) Canola oil</p>	Question 72 (kept as is)	n=8 (100%)		n=7 (87.5%)	Change sequence of alternatives to (b), (c) and (a).	Adapted according to suggestion under face validity.

90.	If well wrapped, how long can you freeze butter for? a) Up to three months b) Up to six months c) Up to nine months	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
91.	What does 98% fat free mean? a) 2 g fat per product b) 2 g fat per 98 g c) 2 g fat per 100 g	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
92.	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	Question 43 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
93.	Which cooking method is used when enough oil is used to cover the food in the saucepan? a) Sautéing b) Deep-frying c) Stir-frying	Question 47 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
94.	When should you strain oil used for deep-frying? a) When it changes colour b) Right after using it once it is cooled c) No need to be strained if used for deep-frying	Question 38 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
95.	Which type of fat is the best to use for deep-frying? a) Sunflower oil b) Butter c) Olive oil	Question 44 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
96.	Which one of the following cooking methods will cause chicken thighs to absorb the least fat during cooking? a) Oven roast chicken thighs until cooked b) Deep-fry chicken thighs until cooked c) Shallow-fry chicken thighs until cooked	Question 53 (kept as is)	n=8 (100%)		n=7 (87.5%)	Remove 'chicken until cooked' from all alternatives and list only the cooking method.	Adapted according to suggestion under face validity.

97.	If olive oil gets a cloudy appearance when stored in the refrigerator: a) throw away the oil and do not use b) keep the oil at room temperature before use c) filter the oil before use	Question 57 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
98.	Which one of the following fats is the best choice when making shortbread biscuits? a) Butter b) Block margarine c) Low-fat spread	Question 58 (kept as is)	n=8 (100%)		n=7 (87.5%)	Swop alternatives (a) and (c).	Adapted according to suggestion under face validity.
99.	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	Question 60 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
100.	Which one of the following cold desserts has the lowest energy value? a) Frozen yoghurt b) Ice cream c) Sorbet	Question 62 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
101.	Which one of the following chicken pieces (per 100 g) will have the least fat? a) Chicken thigh without skin b) Skin breast without skin c) Chicken wing without skin	Question 67 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
102.	To reduce the energy content of <i>Spaghetti Bolognaise</i> use a) lean beef mince. b) regular beef mince. c) use half soya and half regular mince.	Question 71 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
103.	Foods with hidden fat include: a) fat on steak b) avocados c) tub margarine	New	n=7 (87.5%)	Alternatives may be too easy to distinguish.	n=8 (100%)		Kept as is.

104.	<p>What equipment should you use to prepare and improve the healthiness of frozen potato chips?</p> <p>a) an air-fryer b) a deep-fryer c) a microwave</p>	New	n=6 (75%)	<p>Suggestion: What method should you use to prepare frozen potato chips that will not increase the fat content of the chips.</p> <p>Replace alternative (c) with 'shallow-fry'.</p>	n=6 (75%)	<p>Only list equipment and remove all other words, i.e. 'an' and 'a'.</p> <p>Replace alternative (a) with 'Oven-baked' – air-fryer new technology students may not be familiar with</p>	Adapted according to suggestions under content- and face validity.
105.	<p>When making a <i>beef Stroganov</i>, which one of the following is typically added to the sauce?</p> <p>a) Mayonnaise b) Cream c) Yoghurt</p>	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
106.	<p>The shelf-life of oil-based cooking spray is</p> <p>a) 1 month. b) 2 months. c) 12 months.</p>	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
107.	<p>Which one of the following is an example of oily fish?</p> <p>a) Hake b) Salmon c) Sole</p>	New	n=8 (100%)		n=6 (75%)	Alternative (b): Snoek or Sardines (more familiar to study group).	Adapted according to suggestion under face validity (replace with Sardines).
108.	<p>Which one of the following lamb cuts (per 100 g) will have the least fat?</p> <p>a) Leg b) Shoulder c) Loin</p>	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
109.	<p>If you find that the oil you use for frying has an unpleasant smell, what should you do?</p> <p>a) Heat it up and cool down before using b) Throw away and do not use c) Strain the oil before using</p>	Question 39 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
110.	<p>What is meant by the term 'basting'?</p> <p>a) Insert strips of fat into meat cuts b) Wrap strips of thinly sliced fat around the meat c) Moistening meat during cooking with melted fat</p>	New	n=8 (100%)		n=8 (100%)		Acceptable as is.

111.	Which one of the following meats (per 100 g) will have the least fat? a) Pork shoulder b) Veal shoulder c) Lam shoulder	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
112.	When buying oil to promote heart health, choose: a) sunflower oil b) vegetable oil c) canola oil	Question 68 (adapted)	n=8 (100%)		n=8 (100%)		Acceptable as is.
113.	What could be a reason for fried potatoes being too greasy? a) Frying temperatures too low b) Not frying for long enough c) Frying temperature too high	Question 46 (adapted)	n=8 (100%)		n=8 (100%)		Acceptable as is.
114.	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? a) Searing b) Deep-frying c) Shallow-frying	Question 48 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
115.	Which one of the following types of milk is suitable to limit energy intake? a) 1% milk b) 2% milk c) Skimmed milk	Question 64 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
116.	When buying pork, which of the following will hold moisture during cooking? a) Cuts with a good layer of fat on the exterior b) Cuts with no visible fat on the exterior c) Vacuum packed cuts	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
117.	Canola oil is not useful for a) frying. b) general cooking. c) adding flavour to food.	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
118.	Which one of the following cheeses (per 100 g) has the highest energy value? a) Cottage cheese b) Cheddar cheese c) Gouda/Sweetmilk cheese	New	n=8 (100%)		n=8 (100%)		Acceptable as is.

119.	Which one of the following is not a reason for using fat in cake-making? a) Fats increases the shelf-life of the cake b) To prevent the cake from sticking to the cake tin c) Fat moistens the batter	Question 50 (adapted)	n=8 (100%)		n=7 (87.5%)	Remove 'fats' from alternatives (a) and (c).	Adapted according to suggestion under face validity,
120.	When reading food labels, a kilojoule is a unit of: a) total fat b) energy c) cholesterol	New	n=8 (100%)		n=7 (87.5%)	Change sequence of alternatives to (b), (c) and (a).	Adapted according to suggestion under face validity.
121.	What does the term 'light' refer to when appearing on the label of olive oil? a) it refers to the colour of the oil b) It refers to the lower energy value of the oil c) It refers to the weight of the oil per 100ml	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
122.	'Breeding' food to be deep fried means: a) coating the food with crumbs b) frying the food with dry spices c) coating the food in flour and egg	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
123.	Why must most foods intended to be deep-fried firstly be breaded or battered? 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	Question 52 (adapted)	n=8 (100%)		n=8 (100%)		Acceptable as is.
124.	Why should butter rather than margarine be chosen when cooking? a) Butter gives a better flavour to foods b) Butter is healthier than margarine c) Butter can be heated to a higher temperature	Question 63 (kept as is)	n=8 (100%)		n=7 (87.5%)	Swop alternatives (a) and (b).	Adapted according to suggestion under face validity.
125.	Which one of the following foods (per 100 g) has the highest energy value? a) Raisins b) Potatoes c) Avocados	Question 73 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.

126.	Which one of the following minced meats (per 100 g) has the lowest energy value? a) Ostrich mince b) Pork mince c) Regular beef mince	Question 74 (kept as is)	n=7 (87.5%)	Confusing.	n=6 (75%)	Not applicable to student sample group.	Discarded.
127.	When reading and interpreting food labels, one gram (g) of fat provides: a) 17 kilojoules b) 38 kilojoules c) 60 kilojoules	New	n=6 (75%)	Nutrition-based question.	n=7 (87.5%)		Discarded.
128.	Which one of the following fats has the longest shelf-life? a) Fresh cream b) Butter c) Margarine	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
129.	Which one of the following birds has the highest energy value per 100 g of raw, skinless meat? a) Chicken b) Turkey c) Duck	New	n=6 (75%)	Not a good question.	n=6 (75%)	Too difficult. Not applicable to student sample group.	Discarded.
130.	Which one of the following raw nuts (per 100 g) has the highest energy value? a) Cashew nuts b) Walnuts c) Peanuts	New	n=6 (75%)		n=6 (75%)	Not applicable to student sample group.	Discarded.
131.	According to legislation, butter must consist of at least: a) 100% fat b) 80% fat c) 60% fat	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
132.	When a food item is labelled as 'fat free', it means that: a) the item contains 0.0 g of fat per 100 g b) the item contains less than 0.15 g of fat per 100 g c) the item contains less than 2 g of fat per 100 g	New	n=7 (87.5%)	Nutrition-based question.	n=8 (100%)		Kept as is; labelling/buying practices.
133.	Which of the following is a fat replacer and suitable to use for frying? a) Aspartame b) Sorbitol c) Olestra	New	n=8 (100%)		n=7 (87.5%)	May be too difficult.	Kept as is; awareness of new inventions/ alternatives available.

134.	Which one best describes margarine labelled as 'Halal'? a) Margarine made from only vegetable fats b) Margarine made from only vegetable fats and marine fats c) Margarine made from only olive oil	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
135.	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	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
136.	When reading a food label, which of the following fats may contribute to heart disease? a) Unsaturated fatty acids b) Polyunsaturated fatty acids c) Trans fatty acids	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
137.	What 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	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
138.	Which of the following options will add the most energy to a cup of coffee when a medium amount is used? a) Full cream milk b) Coffee creamers c) Milk powder	Question 66 (kept as is)	n=8 (100%)		n=8 (100%)		Acceptable as is.
139.	When making <i>Frech toast</i> , 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	New	n=8 (100%)		n=8 (100%)		Acceptable as is.
140.	The best fat to use when making pastry is: a) soft margarine b) olive oil c) butter	New	n=8 (100%)		n=8 (100%)		Acceptable as is.

*Correct alternative to knowledge test item indicated in bold



PROGRAMME: CONSUMER SCIENCE: FOOD AND NUTRITION
DEPARTMENT OF AGRICULTURAL AND FOOD SCIENCES
FACULTY OF APPLIED SCIENCES

**FAT, FRUIT AND VEGETABLE
KNOWLEDGE
AND INTAKE QUESTIONNAIRE**

This questionnaire is part of a MTech: Consumer Science: Food and Nutrition research study. The aim of the study is to develop a valid and reliable knowledge test to assess food knowledge of first-year students at a university of technology in the Western Cape, South Africa. In addition, the study aims to determine associations between the food knowledge and the fat, fruit and vegetable intake of students as these foods are included in the food knowledge questions.

The information supplied will be anonymous as only a participant number will be filled in on your questionnaire. The questionnaire consists of three (3) sections that only include multiple-choice questions. The questionnaire will take about 45 minutes (one lecture period) to answer. Your participation in answering the questionnaire is highly appreciated.

Participant

SECTION B: DIETARY FAT & FRUIT AND VEGETABLE INTAKE

Instructions for completion of this section:

Think about your eating habits over the past year or so and then indicate approximately how often you eat **each** of the following foods. Mark an "X" in one box for **each** food.

Fat intake	Once or less than once per month	2 - 3 times per month	1 - 2 times per week	3 - 4 times per week	5+ times per week	For office use only
Hamburger or cheeseburgers						1
Red meat, e.g. beef and mutton						2
Fried chicken (with skin)						3
Hot dogs, frankfurters, salami, Russians, sausages						4
Cold cuts, lunch meats, ham (with fat), etc.						5
Salad dressings, mayonnaise, etc.						6
Margarine or butter						7
Eggs						8
Bacon or pork sausages						9
Cheese or cheese spread						10
Full-cream milk						11
Potato chips ('slap chips')						12
Potato crisps, corn chips, popcorn, etc.						13
Ice-cream						14
Doughnuts, cake, cookies, puddings, etc.						15
For office use only						16
						17

Fruit and vegetable intake	Less than once per week	About once per week	2 - 3 times per week	4 - 6 times per week	Every day	For office use only
Orange juice, guava juice, vitamin C-rich fruit						18
Not counting juice, about how often do you eat any fruit						19
Green salad						20
Potatoes						21
Dried beans, e.g. baked beans, kidney beans, legumes						22
About how often do you eat any other vegetables						23
High-fibre/bran cereal or high-fibre porridge or oat porridge						24
Wholewheat bread or brown bread						25
For office use only						26
						27

SECTION B: DEMOGRAPHIC AND RELATED INFORMATION

Instructions for completion of this section:

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

- | | For office use only |
|---|----------------------------|
| 1. Your gender?
a) Male
b) Female | <input type="text"/> 1 |
| 2. Your age?
a) 18 - 22 years
b) 23 years and older | <input type="text"/> 2 |
| 3. Did you study the subject 'Consumer Studies' in Grade 12?
a) Yes
b) No | <input type="text"/> 3 |
| 4. Where / From whom did you learn mostly about food choices, purchasing, storage and preparation?
a) At home with family.
b) Friends.
c) Books, articles in magazines, internet, etc.
d) Television and radio.
e) School health services and school subjects such as Life Orientation and Consumer Studies. | <input type="text"/> 4 |
| 5. How would you describe your knowledge about food purchasing, storage and preparation compared to other students?
a) Much less.
b) Somewhat less.
c) About similar.
d) Somewhat more.
e) Much more. | <input type="text"/> 5 |
| 6. How interested are you in aspects related to food such as food purchasing, storage and preparation?
a) Very interested (involved in these food preparation aspects whenever possible).
b) Somewhat interested (will sometimes be involved in these food preparation aspects).
c) Not interested (do not care to be involved in food preparation). | <input type="text"/> 6 |
| 7. How would you describe your food consumption compared to other students?
a) Eat similar foods.
b) Eat more fruits and vegetables.
c) Eat less fatty foods.
d) Eat more fruits and vegetables and less fatty foods. | <input type="text"/> 7 |

Thank you for participating in this study by completing the questionnaire.

1

SECTION A: FOOD KNOWLEDGE

Instructions for completion of this section:

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

For office use only

1. To avoid fresh apple slices from browning when added to a fruit salad:

- a) place the apple slices briefly in boiling water.
- b) sprinkle salt water on the surface of the apple slices.
- c) leave the peel on the apple when slicing.
- d) sprinkle lemon juice on the surface of the apple slices.

1 A1

2. What is the **best** way to clean potatoes, carrots and sweet potatoes before boiling?

- a) Soak in water with salt added.
- b) Rinse under cold water.
- c) Rinse under hot water.
- d) Soak in water with vinegar added.

2 A2

3. If you are making a salad but your lettuce leaves are slightly wilted what can you do to overcome this problem?

- a) Place the leaves in warm water.
- b) Place the leaves in cold water.
- c) Place the leaves in water with salt added.
- d) Place the leaves in water with vinegar added.

3 A3

4. When peeling vegetables, why should you not peel them too thickly?

- a) Thick peeling removes the layer of nutrients under the skin.
- b) Thick peeling leads to colour loss.
- c) Thick peeling causes them to dry out quicker.
- d) Thick peeling leads to the loss of taste.

4 A4

5. Is it necessary to wash pears before consumption?

- a) No, all fruits are washed when packaged.
- b) Yes, pesticides and dirt may be present on the surface of the pears.
- c) No, the flavour of the pears may change.
- d) Yes, it will improve the nutritional value of the pears.

5 A5

6. What should you do with potatoes after peeling and before cooking them?

- a) Place them in the refrigerator.
- b) Place them in boiling water.
- c) Place them under a dry kitchen towel.
- d) Place them in cold water.

6 A6

7. How should you cook broccoli to retain the colour, texture and nutrients?

- a) Add broccoli to cold water, and cook with a lid on the pot.
- b) Add broccoli to cold water, and cook without a lid on the pot.
- c) Add broccoli to boiling water, and cook with a lid on the pot.
- d) Add broccoli to boiling water, and cook without a lid on the pot.

7 A7

8. How should you cook cauliflower to retain the colour, texture and nutrients?

- a) Add cauliflower to cold water, and cook with a lid on the pot.
- b) Add cauliflower to cold water, and cook without a lid on the pot.
- c) Add cauliflower to boiling water, and cook with a lid on the pot.
- d) Add cauliflower to boiling water, and cook without a lid on the pot.

8 A8

9. If the instructions on pre-packaged vegetables recommend to 'roast' the vegetables, which of the following methods will you follow?

- a) Boil vegetables partially, not fully.
- b) Place the vegetables, covered with foil, in a pre-heated oven and heat.
- c) Place the vegetables, uncovered, in a pre-heated oven and heat.
- d) Heat the vegetables in fat.

9 A9

10. When cooking finely sliced carrots, which of the following cooking methods will be best to retain as many nutrients as possible?

- a) Roasting.
- b) Steaming.
- c) Boiling.
- d) Stir-frying.

10 A10

11. Which of the following factors will **shorten** the cooking time of peeled butternut pieces?

- a) Place the butternut pieces in boiling water.
- b) Place the butternut pieces in cold water.
- c) Cut the butternut in very large pieces.
- d) Use a small pot to cook.

11 A11

12. Which of the following cooking methods will be the **quickest** to cook lentils?

- a) Baking.
- b) Pressure cooking.
- c) Grilling.
- d) Steaming.

12 A12

13. To avoid losing the nutrients contained in vegetables after cooking:

- a) serve and eat immediately.
- b) cover until serving.
- c) leave it to stand a few minutes before serving.
- d) microwave before serving.

13 A13

14. Which cooking method is described as placing vegetables in a rack or basket above boiling water and covering the pot with a lid?

- a) Parboiling.
- b) Boiling.
- c) Poaching.
- d) Steaming.

14 A14

15. When boiling vegetables, which factor will **increase** the cooking time of vegetables?

- a) The age of the vegetables.
- b) How long the vegetables were stored.
- c) The temperature at which the vegetables is cooked.
- d) The vitamin content of the vegetables.

15 A15

16. Which of the following factors **does not** affect the flavour of cooked vegetables?

- a) The age of the vegetables.
- b) How long the vegetables were stored.
- c) The temperature at which the vegetables is cooked.
- d) The vitamin content of the vegetables.

16 A16

17. When making a meat and vegetable stew the carrots must:

- a) be added after browning the meat.
- b) be pre-cooked and then added.
- c) be added during the last 30 minutes of cooking.
- d) be cooked separately and added before serving it.

17 A17

18. What is the **best** way to store potatoes in the kitchen?

- a) In a cupboard in an airtight container.
- b) At room temperature in a paper bag.
- c) At room temperature exposed to sunlight.
- d) In the refrigerator in a plastic bag.

18 A18

19. How should you store green, unripe bananas to ripen them?

- a) In the refrigerator in a plastic bag.
- b) In a warm place in a paper bag.
- c) In a cupboard, uncovered.
- d) In a cupboard in an airtight container.

19 A19

20. What should you do with potatoes that have turned green in colour?

- a) Place in the refrigerator and use within a week.
- b) Peel to remove the green coloured parts before using.
- c) Throw away and do not use.
- d) Keep in a warm place until the colour returns to normal before using.

20 A20

21. How long can leftover carrots be kept in the refrigerator after cooking?

- a) 1 day.
- b) 2 - 3 days.
- c) 4 - 6 days.
- d) 1 week.

21 A21

22. What is the **best** method to store unopened canned fruits to keep their quality longer?

- a) In a cool, dry place.
- b) In the refrigerator.
- c) In a dry, warm place.
- d) In a dry, humid place.

22 A22

23. The following types of apricots are **not** available all year round?

- a) Dried apricots.
- b) Canned apricots.
- c) Frozen apricots.
- d) Fresh apricots.

23 A23

24. Which of the following fruits have the **shortest** shelf-life?

- a) Strawberries.
- b) Apples.
- c) Oranges.
- d) Pears.

24 A24

25. Which one of the following factors is a sign of good quality when buying broccoli:

- a) visible dirt on the surface.
- b) stems light green and firm.
- c) overall colour is yellow-green.
- d) florets not tightly closed.

25 A25

26. Which of the following vegetables are classified as root vegetables?

- a) Cabbage.
- b) Broccoli.
- c) Carrot.
- d) Baby marrow.

26 A26

27. When buying pre-packaged butternut the following package should be bought:

- a) the butternut pieces are cut into different sizes.
- b) the inside of the package is moist.
- c) the butternut pieces are a pale yellow colour.
- d) the package is sealed with no visible damage.

27 A27

28. If you do not have a refrigerator at home, what would be the **best** option when buying vegetables for use within a few days?

- a) Buy small quantities of fresh vegetables.
- b) Buy only one kind of vegetable.
- c) Buy pre-packaged vegetables.
- d) Buy frozen vegetables.

28 A28

29. When buying fruits or vegetables, which description indicates to you that **no** chemical pesticides have been used on the plants?

- a) "Fresh" fruits or vegetables.
- b) "Organic" fruits or vegetables.
- c) "Tinned" fruits or vegetables.
- d) "Pre-packaged" fruits or vegetables.

29 A29

30. Which of the following indicates that an avocado is ready for use?

- a) The skin of the avocado gives slightly to gentle pressure.
- b) The colour of the avocado is dark green to black.
- c) The skin of the avocado is smooth and firm.
- d) The stalk of the avocado is still attached.

30 A30

31. Which of the following fruit is a citrus fruit?

- a) Sweet melon.
- b) Guava.
- c) Orange.
- d) Apricot.

31 A31

32. Which one of the following factors is **not** a reason for buying pre-packaged cut vegetables?

- a) It is less expensive.
- b) Convenient.
- c) Less time consuming to prepare.
- d) Availability in small quantities.

32 A32

33. Why is it useful to dry pears?

- a) Drying improves the texture of pears.
- b) Drying increases the moisture content of pears.
- c) Drying lowers the sugar content of pears.
- d) Drying makes pears available all year round.

33 A33

34. Which of the following food items is **not** a legume?
- a) Dried beans.
 - b) Split peas.
 - c) Lentils.
 - d) Corn.
35. Which one of the following **best** describe an aubergine (egg plant)?
- a) Glossy, smooth skin with a deep purple colour and white flesh.
 - b) Glossy, smooth skin with a dark green colour and white flesh.
 - c) Dull, smooth skin with a light green colour and white flesh.
 - d) Dull, smooth skin with a slightly beige colour and white flesh.
36. Which one of the following vegetable types is **not** suitable for stir-frying?
- a) Potatoes.
 - b) Carrots.
 - c) Green beans.
 - d) Sweet peppers.
37. Which of the following vegetable types are suitable for grilling?
- a) Cabbage.
 - b) Spinach.
 - c) Baby marrow.
 - d) Peas.
38. When should you strain oil for deep fat frying?
- a) Right after using it once it is cooled.
 - b) At least once a week.
 - c) At least once a month.
 - d) Just before using it.
39. 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) Strain through a paper filter.
 - c) Throw away and do not use.
 - d) Add a small amount of salt to it before using.
40. If a recipe indicates 'cream the butter', what should you do?
- a) Melt the butter and add cream.
 - b) Beat the butter.
 - c) Buy creamed butter.
 - d) Use butter with a high fat content.
- 34 A34
- 35 A35
- 36 A36
- 37 A37
- 38 A38
- 39 A39
- 40 A40

41. What could you do to reduce the fat content of meat before cooking it?

- a) Put the meat in boiling water.
- b) Freeze the meat.
- c) Trim off the visible fat.
- d) Dip the meat into breadcrumbs.

41 A41

42. Before adding foods to oil when shallow-frying the oil should:

- a) turn slightly darker in colour.
- b) be hot.
- c) spatter.
- d) smoke lightly.

42 A42

43. When shallow-frying, smoking oil is an indication that:

- a) the oil has become too old to use.
- b) the oil has become too hot to use.
- c) there is not enough oil in the pan.
- d) water is mixed with the oil in the pan.

43 A43

44. Which type of fat is the **best** to use for deep-frying?

- a) Olive oil.
- b) Sunflower oil.
- c) Margarine.
- d) Lard.

44 A44

45. If foods are not crisp after deep-frying, what could be the cause?

- a) The temperature of the oil was too low.
- b) The oil used was too old.
- c) The food added was too dry.
- d) The fryer was not clean.

45 A45

46. What could be a reason for fried food being too greasy?

- a) Fryer not cleaner properly.
- b) Frying temperature too low.
- c) Not frying food for long enough.
- d) Frying temperure too high.

46 A46

47. Which cooking method is used when enough oil is used to cover the food in the saucepan?

- a) Stir-frying.
- b) Deep-frying.
- c) Grilling.
- d) Shallow-frying.

47 A47

48. 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?
- a) Stir-frying.
 - b) Deep-frying.
 - c) Grilling.
 - d) Stir-frying.
49. Which one of the following cooking methods requires the least amount of oil when cooking with oil?
- a) Deep-frying.
 - b) Shallow-frying.
 - c) Sautéing.
 - d) Stir-frying.
50. Why is fat added to the ingredients when baking a cake?
- a) To increase the energy content of the cake.
 - b) To improve the flavour, texture and colour of the cake.
 - c) To make the cake rise when baked in the oven.
 - d) To prevent the cake from sticking to the cake tin.
51. Which of the following methods use the **least** amount of fat to cook the food?
- a) Searing.
 - b) Shallow-frying.
 - c) Roasting.
 - d) Stir-frying.
52. Why is fish sometimes dipped in egg and flour before frying it?
- a) To prevent the fish from drying out.
 - b) To hide the fishy smell.
 - c) To decrease the cooking time of the fish.
 - d) To increase the fish portion sizes.
53. Which of the following cooking methods will cause chicken thighs to absorb the **least** fat during cooking?
- a) Shallow-fry chicken thighs until cooked.
 - b) Oven roast chicken thighs until cooked.
 - c) Deep-fry chicken thighs until cooked.
 - d) Sauté chicken thighs until cooked.
54. Where should tub margarine be stored?
- a) In the refrigerator.
 - b) In a cool, dry place.
 - c) On the countertop in the kitchen.
 - d) In a closed cupboard.
- 48 A48
- 49 A49
- 50 A50
- 51 A51
- 52 A52
- 53 A53
- 54 A54

55. Which of the following may lead to rancidity in a bottle of oil?
a) Placing it in direct sunlight.
b) Placing it in the refrigerator.
c) Placing it in a dark cupboard.
d) Placing it in a paper bag.
56. Which of the following could be frozen to extend the shelf-life?
a) Canola oil.
b) Butter.
c) Cream.
d) Olive oil.
57. If olive oil gets a cloudy appearance when stored in the refrigerator:
a) throw away the oil.
b) keep the oil at room temperature before use.
c) put the oil in a pot over high heat and then use.
d) filter the oil before use.
58. Which of the following fats is the **best** choice when making shortbread biscuits?
a) Tub margarine.
b) Butter.
c) Medium-fat spread.
d) Cream.
59. Which of the following is the least expensive oil?
a) Olive oil.
b) Sesame seed oil.
c) Canola oil.
d) Sunflower oil.
60. Which of the following types of tuna has the **lowest** energy value?
a) Tuna in salted water.
b) Tuna in vegetable oil.
c) Tuna in sunflower oil.
d) Tuna in salad dressing.
61. The **best** container to buy oil in order to increase the shelf-life of the oil is:
a) copper.
b) plastic.
c) tinted glass.
d) aluminium.
- 55 A55
- 56 A56
- 57 A57
- 58 A58
- 59 A59
- 60 A60
- 61 A61

62. Which of the following cold desserts has the **lowest** energy value?

- a) Frozen yoghurt.
- b) Crème caramel.
- c) Mousse.
- d) Sorbet.

62 A62

63. Why should butter rather than margarine be chosen when cooking?

- a) Less butter than margarine can be used.
- b) Butter gives a better flavour to foods than margarine.
- c) Butter is healthier than margarine.
- d) Butter can be heated to a higher temperature than margarine.

63 A63

64. Which of the following types of milk is suitable for someone who needs to limit their energy intake?

- a) Low fat milk.
- b) Condensed milk.
- c) 2% milk.
- d) Skimmed milk.

64 A64

65. Which of the following fats are **not** derived from plants?

- a) Sunflower oil.
- b) Cream.
- c) Olive oil.
- d) Palm oil.

65 A65

66. Which of the following options will add the **most** energy to a cup of coffee when a medium amount is added?

- a) Full cream milk.
- b) Coffee creamers.
- c) Skimmed milk.
- d) 2% milk.

66 A66

67. Which of the following chicken pieces (per 100g) will have the **least** fat?

- a) Chicken leg with skin.
- b) Chicken breast without skin.
- c) Chicken thigh without skin.
- d) Chicken wing with skin.

67 A67

68. When buying 'good fats' to promote heart health, choose:

- a) block margarine.
- b) sunflower oil.
- c) canola oil.
- d) cream.

68 A68

69. Which of the following fats will give the **best** flavour to scones?

- a) Cream.
- b) Canola oil.
- c) Butter.
- d) Tub margarine.

69 A69

70. Which of the following is **best** for baking a layer cake using the creaming method?

- a) Tub margarine.
- b) Block margarine.
- c) Olive oil.
- d) Cream.

70 A70

71. To reduce the energy content of spaghetti bolognese use:

- a) lean beef mince.
- b) very lean beef mince.
- c) regular beef mince.
- d) a combination of full fat and lean beef mince.

71 A71

72. Which of the following is the preferred choice for salad dressings when making a Greek salad?

- a) Olive oil.
- b) Sunflower oil.
- c) Melted butter.
- d) Cream.

72 A72

73. Which of the following foods has the **highest** energy content per 100g?

- a) Raisins.
- b) Potatoes.
- c) Bananas.
- d) Avocados.

73 A73

74. Which of the following has the **lowest** energy content per 100g?

- a) Ostrich mince.
- b) Regular beef mince.
- c) Pork mince.
- d) Chicken mince.

74 A74

SECTION A: FOOD KNOWLEDGE

**Face Validity
YES / NO**

1. To avoid fresh apple slices from browning when added to a fruit salad:

- a) place the apple slices briefly in boiling water.
- b) sprinkle salt water on the surface of the apple slices.
- c) leave the peel on the apple when slicing.
- d) sprinkle lemon juice on the surface of the apple slices.

2. What is the **best** way to clean potatoes, carrots and sweet potatoes before boiling?

- a) Soak in water with salt added.
- b) Rinse under cold water.
- c) Rinse under hot water.
- d) Soak in water with vinegar added.

3. If you are making a salad but your lettuce leaves are slightly wilted what can you do to overcome this problem?

- a) Place the leaves in warm water.
- b) Place the leaves in cold water.
- c) Place the leaves in water with salt added.
- d) Place the leaves in water with vinegar added.

4. When peeling vegetables, why should you not peel them too thickly?

- a) Thick peeling removes the layer of nutrients under the skin.
- b) Thick peeling leads to colour loss.
- c) Thick peeling causes them to dry out quicker.
- d) Thick peeling leads to the loss of taste.

5. Is it necessary to wash pears before consumption?

- a) No, all fruits are washed when packaged.
- b) Yes, pesticides and dirt may be present on the surface of the pears.
- c) No, the flavour of the pears may change.
- d) Yes, it will improve the nutritional value of the pears.

6. What should you do with potatoes after peeling and before cooking them?

- a) Place them in the refrigerator.
- b) Place them in boiling water.
- c) Place them under a dry kitchen towel.
- d) Place them in cold water.

7. How should you cook broccoli to retain the colour, texture and nutrients?

- a) Add broccoli to cold water, and cook with a lid on the pot.
- b) Add broccoli to cold water, and cook without a lid on the pot.
- c) Add broccoli to boiling water, and cook with a lid on the pot.
- d) Add broccoli to boiling water, and cook without a lid on the pot.

8. How should you cook cauliflower to retain the colour, texture and nutrients?

- a) Add cauliflower to cold water, and cook with a lid on the pot.
- b) Add cauliflower to cold water, and cook without a lid on the pot.
- c) Add cauliflower to boiling water, and cook with a lid on the pot.
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9. If the instructions on pre-packaged vegetables recommend to 'roast' the vegetables, which of the following methods will you follow?

- a) Boil vegetables partially, not fully.
- b) Place the vegetables, covered with foil, in a pre-heated oven and heat.
- c) Place the vegetables, uncovered, in a pre-heated oven and heat.
- d) Heat the vegetables in fat.

10. When cooking finely sliced carrots, which of the following cooking methods will be best to retain as many nutrients as possible?

- a) Roasting.
- b) Steaming.
- c) Boiling.
- d) Stir-frying.

11. Which of the following factors will **shorten** the cooking time of peeled butternut pieces?

- a) Place the butternut pieces in boiling water.
- b) Place the butternut pieces in cold water.
- c) Cut the butternut in very large pieces.
- d) Use a small pot to cook.

12. Which of the following cooking methods will be the **quickest** to cook lentils?

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- c) Grilling.
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- c) leave it to stand a few minutes before serving.
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- a) The age of the vegetables.
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16. Which of the following factors **does not** affect the flavour of cooked vegetables?

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- a) be added after browning the meat.
- b) be pre-cooked and then added.
- c) be added during the last 30 minutes of cooking.
- d) be cooked separately and added before serving it.

18. What is the **best** way to store potatoes in the kitchen?

- a) In a cupboard in an airtight container.
- b) At room temperature in a paper bag.
- c) At room temperature exposed to sunlight.
- d) In the refrigerator in a plastic bag.

19. How should you store green, unripe bananas to ripen them?

- a) In the refrigerator in a plastic bag.
- b) In a warm place in a paper bag.
- c) In a cupboard, uncovered.
- d) In a cupboard in an airtight container.

20. What should you do with potatoes that have turned green in colour?

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- b) Peel to remove the green coloured parts before using.
- c) Throw away and do not use.
- d) Keep in a warm place until the colour returns to normal before using.

21. How long can leftover carrots be kept in the refrigerator after cooking?

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- c) 4 - 6 days.
- d) 1 week.

22. What is the **best** method to store unopened canned fruits to keep their quality longer?

- a) In a cool, dry place.
- b) In the refrigerator.
- c) In a dry, warm place.
- d) In a dry, humid place.

23. The following types of apricots are **not** available all year round?

- a) Dried apricots.
- b) Canned apricots.
- c) Frozen apricots.
- d) Fresh apricots.

24. Which of the following fruits have the **shortest** shelf-life?

- a) Strawberries.
- b) Apples.
- c) Oranges.
- d) Pears.

25. Which one of the following factors is a sign of good quality when buying broccoli:

- a) visible dirt on the surface.
- b) stems light green and firm.
- c) overall colour is yellow-green.
- d) florets not tightly closed.

26. Which of the following vegetables are classified as root vegetables?

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- b) Broccoli.
- c) Carrot.
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28. If you do not have a refrigerator at home, what would be the **best** option when buying vegetables for use within a few days?

- a) Buy small quantities of fresh vegetables.
- b) Buy only one kind of vegetable.
- c) Buy pre-packaged vegetables.
- d) Buy frozen vegetables.

29. When buying fruits or vegetables, which description indicates to you that **no** chemical pesticides have been used on the plants?

- a) "Fresh" fruits or vegetables.
- b) "Organic" fruits or vegetables.
- c) "Tinned" fruits or vegetables.
- d) "Pre-packaged" fruits or vegetables.

30. Which of the following indicates that an avocado is ready for use?

- a) The skin of the avocado gives slightly to gentle pressure.
- b) The colour of the avocado is dark green to black.
- c) The skin of the avocado is smooth and firm.
- d) The stalk of the avocado is still attached.

31. Which of the following fruit is a citrus fruit?

- a) Sweet melon.
- b) Guava.
- c) Orange.
- d) Apricot.

32. Which one of the following factors is **not** a reason for buying pre-packaged cut vegetables?

- a) It is less expensive.
- b) Convenient.
- c) Less time consuming to prepare.
- d) Availability in small quantities.

33. Why is it useful to dry pears?

- a) Drying improves the texture of pears.
- b) Drying increases the moisture content of pears.
- c) Drying lowers the sugar content of pears.
- d) Drying makes pears available all year round.

34. Which of the following food items is **not** a legume?

- a) Dried beans.
- b) Split peas.
- c) Lentils.
- d) Corn.

35. Which one of the following **best** describe an aubergine (egg plant)?

- a) Glossy, smooth skin with a deep purple colour and white flesh.
- b) Glossy, smooth skin with a dark green colour and white flesh.
- c) Dull, smooth skin with a light green colour and white flesh.
- d) Dull, smooth skin with a slightly beige colour and white flesh.

36. Which one of the following vegetable types is **not** suitable for stir-frying?

- a) Potatoes.
- b) Carrots.
- c) Green beans.
- d) Sweet peppers.

37. Which of the following vegetable types are suitable for grilling?

- a) Cabbage.
- b) Spinach.
- c) Baby marrow.
- d) Peas.

38. When should you strain oil for deep fat frying?

- a) Right after using it once it is cooled.
- b) At least once a week.
- c) At least once a month.
- d) Just before using it.

39. 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) Strain through a paper filter.
- c) Throw away and do not use.
- d) Add a small amount of salt to it before using.

40. If a recipe indicates 'cream the butter', what should you do?

- a) Melt the butter and add cream.
- b) Beat the butter.
- c) Buy creamed butter.
- d) Use butter with a high fat content.

41. What could you do to reduce the fat content of meat before cooking it?

- a) Put the meat in boiling water.
- b) Freeze the meat.
- c) Trim off the visible fat.
- d) Dip the meat into breadcrumbs.

42. Before adding foods to oil when shallow-frying the oil should:

- a) turn slightly darker in colour.
- b) be hot.
- c) spatter.
- d) smoke lightly.

43. When shallow-frying, smoking oil is an indication that:

- a) the oil has become too old to use.
- b) the oil has become too hot to use.
- c) there is not enough oil in the pan.
- d) water is mixed with the oil in the pan.

44. Which type of fat is the **best** to use for deep-frying?

- a) Olive oil.
- b) Sunflower oil.
- c) Margarine.
- d) Lard.

45. If foods are not crisp after deep-frying, what could be the cause?

- a) The temperature of the oil was too low.
- b) The oil used was too old.
- c) The food added was too dry.
- d) The fryer was not clean.

46. What could be a reason for fried food being too greasy?

- a) Fryer not cleaner properly.
- b) Frying temperature too low.
- c) Not frying food for long enough.
- d) Frying temperure too high.

47. Which cooking method is used when enough oil is used to cover the food in the saucepan?

- a) Stir-frying.
- b) Deep-frying.
- c) Grilling.
- d) Shallow-frying.

48.

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?

- a) Stir-frying.
- b) Deep-frying.
- c) Grilling.
- d) Stir-frying.

49. Which one of the following cooking methods requires the least amount of oil when cooking with oil?

- a) Deep-frying.
- b) Shallow-frying.
- c) Sautéing.
- d) Stir-frying.

50. Why is fat added to the ingredients when baking a cake?

- a) To increase the energy content of the cake.
- b) To improve the flavour, texture and colour of the cake.
- c) To make the cake rise when baked in the oven.
- d) To prevent the cake from sticking to the cake tin.

51. Which of the following methods use the **least** amount of fat to cook the food?

- a) Searing.
- b) Shallow-frying.
- c) Roasting.
- d) Stir-frying.

52. Why is fish sometimes dipped in egg and flour before frying it?

- a) To prevent the fish from drying out.
- b) To hide the fishy smell.
- c) To decrease the cooking time of the fish.
- d) To increase the fish portion sizes.

53. Which of the following cooking methods will cause chicken thighs to absorb the **least** fat during cooking?

- a) Shallow-fry chicken thighs until cooked.
- b) Oven roast chicken thighs until cooked.
- c) Deep-fry chicken thighs until cooked.
- d) Sauté chicken thighs until cooked.

54. Where should tub margarine be stored?

- a) In the refrigerator.
- b) In a cool, dry place.
- c) On the countertop in the kitchen.
- d) In a closed cupboard.

55. Which of the following may lead to rancidity in a bottle of oil?

- a) Placing it in direct sunlight.
- b) Placing it in the refrigerator.
- c) Placing it in a dark cupboard.
- d) Placing it in a paper bag.

56. Which of the following could be frozen to extend the shelf-life?

- a) Canola oil.
- b) Butter.
- c) Cream.
- d) Olive oil.

57. If olive oil gets a cloudy appearance when stored in the refrigerator:

- a) throw away the oil.
- b) keep the oil at room temperature before use.
- c) put the oil in a pot over high heat and then use.
- d) filter the oil before use.

58. Which of the following fats is the **best** choice when making shortbread biscuits?

- a) Tub margarine.
- b) Butter.
- c) Medium-fat spread.
- d) Cream.

59. Which of the following is the least expensive oil?

- a) Olive oil.
- b) Sesame seed oil.
- c) Canola oil.
- d) Sunflower oil.

60. Which of the following types of tuna has the **lowest** energy value?

- a) Tuna in salted water.
- b) Tuna in vegetable oil.
- c) Tuna in sunflower oil.
- d) Tuna in salad dressing.

61. The **best** container to buy oil in order to increase the shelf-life of the oil is:

- a) copper.
- b) plastic.
- c) tinted glass.
- d) aluminium.

62. Which of the following cold desserts has the **lowest** energy value?

- a) Frozen yoghurt.
- b) Crème caramel.
- c) Mousse.
- d) Sorbet.

63. Why should butter rather than margarine be chosen when cooking?

- a) Less butter than margarine can be used.
- b) Butter gives a better flavour to foods than margarine.
- c) Butter is healthier than margarine.
- d) Butter can be heated to a higher temperature than margarine.

64. Which of the following types of milk is suitable for someone who needs to limit their energy intake?

- a) Low fat milk.
- b) Condensed milk.
- c) 2% milk.
- d) Skimmed milk.

65. Which of the following fats are **not** derived from plants?

- a) Sunflower oil.
- b) Cream.
- c) Olive oil.
- d) Palm oil.

66. Which of the following options will add the **most** energy to a cup of coffee when a medium amount is added?

- a) Full cream milk.
- b) Coffee creamers.
- c) Skimmed milk.
- d) 2% milk.

67. Which of the following chicken pieces (per 100g) will have the **least** fat?

- a) Chicken leg with skin.
- b) Chicken breast without skin.
- c) Chicken thigh without skin.
- d) Chicken wing with skin.

68. When buying 'good fats' to promote heart health, choose:

- a) block margarine.
- b) sunflower oil.
- c) canola oil.
- d) cream.

69. Which of the following fats will give the **best** flavour to scones?

- a) Cream.
- b) Canola oil.
- c) Butter.
- d) Tub margarine.

70. Which of the following is **best** for baking a layer cake using the creaming method?

- a) Tub margarine.
- b) Block margarine.
- c) Olive oil.
- d) Cream.

71. To reduce the energy content of spaghetti bolognese use:

- a) lean beef mince.
- b) very lean beef mince.
- c) regular beef mince.
- d) a combination of full fat and lean beef mince.

72. Which of the following is the preferred choice for salad dressings when making a Greek salad?

- a) Olive oil.
- b) Sunflower oil.
- c) Melted butter.
- d) Cream.

73. Which of the following foods has the **highest** energy content per 100g?

- a) Raisins.
- b) Potatoes.
- c) Bananas.
- d) Avocados.

74. Which of the following has the **lowest** energy content per 100g?

- a) Ostrich mince.
- b) Regular beef mince.
- c) Pork mince.
- d) Chicken mince.



PROGRAMME: CONSUMER SCIENCE: FOOD AND NUTRITION
DEPARTMENT OF AGRICULTURAL AND FOOD SCIENCES
FACULTY OF APPLIED SCIENCES

FAT, FRUIT AND VEGETABLE KNOWLEDGE QUESTIONNAIRE

This questionnaire is part of a MTech: Consumer Science: Food and Nutrition research study. The aim of the study is to develop a valid and reliable knowledge test to assess food knowledge of first-year students at a university of technology in the Western Cape, South Africa.

The information supplied will be anonymous as only a participant number will be filled in on your questionnaire. The questionnaire consists of two (2) parts that only include multiple-choice questions. The questionnaire will take about 45 minutes (one lecture period) to answer. Your participation in answering the questionnaire is highly appreciated.

Participant

SECTION A: FOOD KNOWLEDGE

Instructions for completion of this section:

Please answer all the questions by circling the letter that precedes your answer. Only one letter may be chosen as your answer.

For office use only

- | | | |
|--|---|----|
| 1. Which part of broccoli is not eaten?
a) Stalks
b) Leaves
c) Florets | 1 | A1 |
| 2. Which option best describes the appearance of an apricot?
a) Large, round fruit with smooth yellow skin.
b) Small, round fruit with velvety orange skin.
c) Medium, round fruit with skin ranging from yellow to deep red. | 2 | A2 |
| 3. When storing cooked vegetables in the refrigerator:
a) check that the refrigerator is not too fully packed.
b) use deep containers to decrease cooling time.
c) place the warm vegetables in the refrigerator. | 3 | A3 |
| 4. When re-heating cooked butternut which one of the following options is not a factor to consider?
a) Heat large quantities at a time.
b) Stir frequently if heated in microwave.
c) Heat as close to serving time as possible. | 4 | A4 |
| 5. If you are making a salad but the lettuce leaves are slightly wilted what should you do to overcome this problem?
a) Place the leaves in a container in a shaded area.
b) Place the leaves in water with salt added.
c) Place the leaves in cold water. | 5 | A5 |
| 6. How should you cook cauliflower to retain the colour, texture and nutrients?
a) Add cauliflower to cold water, and cook without a lid on the pot.
b) Add cauliflower to boiling water, and cook with a lid on the pot.
c) Add cauliflower to boiling water, and cook without a lid on the pot. | 6 | A6 |
| 7. Which one of the following cooking methods will be the quickest to cook dried peas or beans?
a) Boiling
b) Pressure cooking
c) Steaming | 7 | A7 |
| 8. Which cooking method is described as placing vegetables in a basket above boiling water?
a) Stewing
b) Poaching
c) Steaming | 8 | A8 |

Continue on opposite page...

9. Which one of the following factors does **not** affect the flavour of cooked vegetables?
- a) Age of the vegetables.
 - b) Temperature at which the vegetables are cooked.
 - c) Vitamin content of the vegetables.
10. What does the 'Net Weight' of canned pears indicate?
- a) Weight of the pears without the syrup.
 - b) Weight of the pears and the syrup.
 - c) Weight of the syrup without the pears.
11. Once opened, dried fruit should be consumed within
- a) 2-3 weeks.
 - b) 4-6 weeks.
 - c) 2 months.
12. In South Africa, which fresh fruit is typically available in summer months?
- a) Oranges
 - b) Grapes
 - c) Guavas
13. Which of the following is **not** an example of lettuce?
- a) Iceberg
 - b) Butter head
 - c) Rocket
14. If a recipe asks for *julienne* carrots, you should prepare the carrots by cutting them into
- a) slices.
 - b) cubes.
 - c) matchsticks.
15. The leaves of which vegetable can be used as a herb?
- a) Carrot
 - b) Celery
 - c) Spinach
16. *Kalamata* is a type of
- a) prune.
 - b) olive.
 - c) raisin.
17. In South Africa, mushrooms are available
- a) during the summer months.
 - b) during the winter months.
 - c) throughout the year.
- 9 A9
- 10 A10
- 11 A11
- 12 A12
- 13 A13
- 14 A14
- 15 A15
- 16 A16
- 17 A17

Continue on next page...

18. Which one of the following is **not** a citrus fruit?
a) Clementine
b) Nectarine
c) Grapefruit
19. Which one of the following does **not** refer to baby marrows?
a) Zucchini
b) Courgettes
c) Patty pans
20. When buying fresh pre-packed mixed vegetables, the 'best before' date refers to the date up to which it
a) may be safely used if stored properly.
b) may be displayed on the supermarket shelf.
c) will remain in optimum condition.
21. When making *guacamole*, which of the following ingredients will you need?
a) Avocado, garlic, lemon juice and chilli.
b) Baby marrows, lemon juice, peppers and parsley.
c) Onion, garlic, spinach and tomato.
22. When making a traditional *moussake*, which of the following vegetables will you need?
a) Tomatoes, sweet peppers and chillis.
b) Butternut, onion and chickpeas.
c) Potatoes, onions and aubergines.
23. When buying cauliflower, which one of the following factors indicates that the cauliflower is **no** longer fresh?
a) Firm, compact heads.
b) Yellow-coloured florets.
c) Attached leaves are bright green.
24. To prevent avocado flesh turning brown:
a) dip avocado slices in cold water.
b) refrigerate.
c) cover with plastic wrap.
25. 'Concentrate' juice
a) has the same nutritional value as non-concentrate juice.
b) is healthier than non-concentrate juice.
c) contains far less water compared to non-concentrate juice.
26. When preparing an assortment of fresh vegetables for dinner:
a) cook all the vegetables together, starting with the one that will take the longest.
b) cut the vegetables that will take the longest to cook into large pieces.
c) cook all the vegetables with the same colour together at the same time.
- 18 A18
- 19 A19
- 20 A20
- 21 A21
- 22 A22
- 23 A23
- 24 A24
- 25 A25
- 26 A26

Continue on opposite page...

27. When cooking asparagus:
- a) place the asparagus in cold salted water.
 - b) place the asparagus under the grill in the oven.
 - c) place the asparagus in boiling salted water.
28. When storing left-over canned sweetcorn:
- a) place in an air-tight container and refrigerate for up to 2 days.
 - b) place in a non-airtight container and refrigerate for up to 2 days.
 - c) leave the tin and refrigerate for up to 2 days.
29. If you do not have lemon juice in the home when cooking, what product can be used in its place?
- a) Rooibos tea
 - b) Carbonated cold drink
 - c) Vinegar
30. If you do not have bottled tomato sauce in the home when making a stew, what can be used in its place without changing the flavour?
- a) Mixture of tomato puree and water.
 - b) Mixture of fresh tomatoes blended with water.
 - c) Tomato soup powder.
31. Which one of the following statements is true about dried apricots?
- a) Dried apricots have a lower sugar content than fresh apricots.
 - b) Dried apricots have a higher sugar content than fresh apricots.
 - c) Dried apricots have the same sugar content as fresh apricots.
32. To avoid fresh apple slices from browning when added to a fruit salad sprinkle
- a) salt water on the apple slices.
 - b) hot water on the apple slices.
 - c) orange juice on the apple slices.
33. If the instructions on pre-packed vegetables recommend to 'roast' the vegetables, which one of the following methods should you follow?
- a) Place the vegetables in a pot with a small amount of boiling water, cover and heat on high temperature.
 - b) Place the vegetables, covered with foil, in a pre-heated oven and heat.
 - c) Place the vegetables, uncovered, in a pre-heated oven and heat.
34. To avoid losing the nutrients contained in sweet potato after cooking:
- a) refrigerate after cooking and re-heat before serving.
 - b) serve and eat immediately.
 - c) wrap in foil and keep in a warm place.
35. When making a meat and vegetable stew the vegetables must
- a) be added after browning the meat.
 - b) be added during the last 30 minutes of cooking.
 - c) be pre-cooked and then added.

27 A27

28 A28

29 A29

30 A30

31 A31

32 A32

33 A33

34 A34

35 A35

Continue on next page...

36. How should you store green, unripe bananas to ripen them?
a) In a warm place in a paper bag.
b) In the refrigerator.
c) In a cupboard, uncovered. 36 A36
37. What should you do with potatoes that have turned green in colour?
a) Peel to remove the green coloured parts before using.
b) Throw away and do not use.
c) Cook in the skin and remove the skin afterwards. 37 A37
38. How long can leftover cooked vegetables be kept in the refrigerator after cooking?
a) 1 day
b) 2-3 days
c) Up to 1 week 38 A38
39. When buying broccoli which one of the following factors is a sign of good quality broccoli?
a) Florets not open.
b) Overall colour is yellow-green.
c) stems light green and firm. 39 A39
40. If you do not have a refrigerator at home, what would be the best option when buying vegetables for use within a few days?
a) Buy small quantities of fresh vegetables.
b) Buy pre-packed vegetables.
c) Buy fresh vegetables with green leaves. 40 A40
41. When buying fruit or vegetables, which description indicates to you that no chemical fertilizers and pesticides were used on the plants?
a) Fresh
b) Organic
c) Genetically modified 41 A41
42. Which one of the following vegetables is **not** suitable for stir-frying?
a) Potatoes
b) Green beans
c) Sweet peppers 42 A42
43. Which one of the following vegetables is suitable for grilling?
a) Baby marrow
b) Spinach
c) Peas 43 A43
44. Which one of the following best describes an aubergine?
a) Glossy, smooth skin with a dark red colour and white flesh.
b) Glossy, smooth skin with a dark green colour and white flesh.
c) Glossy, smooth skin with a deep purple colour and white flesh. 44 A44

Continue on opposite page...

45. The shelf-life of canned apricot jam **cannot** be affected by
- a) extreme temperatures.
 - b) storage conditions.
 - c) labelling.
46. The best way to store dried fruit is:
- a) in an air-tight container in a cool, dry place.
 - b) in an air-tight container in a warm, dry place.
 - c) in an open container in a cool, dry and ventilated place.
47. Which one of the following fruits should be chosen if you want to increase your fibre intake?
- a) Berries
 - b) Figs
 - c) Bananas
48. When making Spinach and Feta muffins, which one of the following can be used as a substitute if spinach is not available?
- a) Celery
 - b) Zucchini
 - c) Swiss chard
49. Which one of the following best describes the dish *ratatouille*?
- a) Chopped, vegetables in a mustard sauce.
 - b) Braised dish with aubergine, onions, peppers, baby marrows and tomatoes.
 - c) Savoury tart with an onion filling.
50. Which of the following is **not** a suitable reason for blanching vegetables?
- a) It softens vegetables.
 - b) It loosens the skin of vegetables.
 - c) It increases the strong flavour of vegetables.
51. If the recipe instructions ask you to 'poach' pears you will:
- a) cover the pears with butter and then bake.
 - b) cook the pears at temperatures below boiling point in sufficient liquid to partially cover the fruit.
 - c) plunge the pears into boiling hot water for 3 minutes and leave to cool.
52. What method should you follow when peeling soft-skinned fruit, for example nectarines?
- a) Immerse the whole fruit in boiling water for 10 seconds and then loosen the skin with a knife.
 - b) Dip the knife in hot water before peeling the fruit.
 - c) Place in the freezer for 10 seconds and then peel.
53. When buying fruit, generally the heavier the piece of fruit weighs in the hand:
- a) the more unripe it will be.
 - b) the older and more tasteless it will be.
 - c) the juicier and better tasting it will be.

Continue on next page...

54. When buying fully ripened fruit:
a) place in a air-tight container in a cool, dry place.
b) refrigerate immediately.
c) place in a paper bag in a dry place. 54 A54
55. If pears need to ripen at home what should you do?
a) Refrigerate them.
b) Place them in a bowl with bananas, uncovered.
c) Place them in an air-tight container. 55 A55
56. Which of the following fruits is **not** suitable for grilling?
a) Banana
b) Pineapple
c) Apple 56 A56
57. Which of the following does **not** refer to an aubergine?
a) Brinjal
b) Yuca
c) Eggplant 57 A57
58. In a supermarket, chilled foods refer to perishable products
a) stored at temperatures between 0 to 7°C.
b) stored at temperatures between -18 to 0°C.
c) obtained from the deli counter. 58 A58
59. When preparing apples to make an apple tart the term 'coring' refers to removal of the
a) skin of the apples.
b) flesh of the apples.
c) pips and central parts of the apples. 59 A59
60. When planning to make a *Waldorf* salad, you need to buy:
a) eggs, walnuts and cheese.
b) apples, walnuts and celery.
c) tomatoes, anchovis and walnuts. 60 A60
61. When cooking frozen carrots:
a) defrost under running, boiling water.
b) defrost in the refrigerator.
c) cook from the frozen state. 61 A61
62. A chef's knife is used for
a) peeling potatoes.
b) chopping, slicing and dicing potatoes.
c) removing the eyes from potatoes. 62 A62

Continue on opposite page...

63. A reason for using a vegetable at the peak of its season is:
- a) the colour and flavour are at their best.
 - b) the cooking time will be less.
 - c) it will provide more energy.
- 63 A63
64. To preserve the colour of cooked green beans that will not be eaten immediately:
- a) refrigerate immediately after cooking.
 - b) place in ice water until they are cold.
 - c) take off the heat and let stand until cold.
- 64 A64
65. To promote even cooking of butternut:
- a) cut butternut into pieces with equal sizes.
 - b) use a small pot with a lid and just enough water to cover the whole butternut.
 - c) soak the butternut in hot water before cooking.
- 65 A65
66. When cooking carrots to *al dente* it means that the carrots are cooked until:
- a) firm to the bite, not soft nor mushy.
 - b) soft and watery.
 - c) firm with still a crunchy, hard texture.
- 66 A66
67. If you do not have a refrigerator at home to store carrots and cabbage:
- a) place items in an airtight container in a cool, dry place.
 - b) place items in a vegetable basket, uncovered.
 - c) wrap items in damp newspaper and store in a cool, dry place.
- 67 A67
68. Which one best describes the cooking method when 'parboiling' vegetables?
- a) Vegetables are partially cooked in boiling water.
 - b) Vegetables are fried briefly with a small amount of fat.
 - c) Vegetables are exposed to dry heat in the oven for 5 minutes.
- 68 A68
69. Which one of the following factors will shorten the cooking time of peeled butternut pieces?
- a) Use the smallest pot available.
 - b) Cut the butternut in large pieces.
 - c) Place the butternut pieces in boiling water.
- 69 A69
70. When cooking finely sliced carrots, which one of the following cooking methods will be best to retain as many nutrients as possible?
- a) Boiling
 - b) Steaming
 - c) Stir-frying
- 70 A70
71. Which one of the following is an advantage of drying pears?
- a) Drying makes pears available all-year round.
 - b) Dried pears are cheaper than fresh pears.
 - c) Drying improves the appearance of pears.
- 71 A71

Continue on next page...

72. Only high-quality peaches are used for canning because
- a) marks on the surface of the peaches will be visible.
 - b) the shelf life is longer.
 - c) the sugar content needs to be high.
- 72 A72
73. When making an apple sauce which type of apple would be the best to use?
- a) Starking
 - b) Granny Smith
 - c) Golden Delicious
- 73 A73
74. When making a banana loaf, which bananas would be best to use?
- a) Green bananas
 - b) Overripe bananas
 - c) Just ripe bananas
- 74 A74
75. When buying pre-packed butternut which packet should you choose?
- a) The butternut pieces are all cut into equal sizes.
 - b) The inside of the package is moist.
 - c) The butternut pieces are a pale yellow colour.
- 75 A75
76. Which of the following fruits will **not** discolour when making a fruit salad?
- a) Apple
 - b) Kiwi fruit
 - c) Banana
- 76 A76
77. Which one of the following best describes an 'extender' when used for the making of a beef lasagne?
- a) Soya added to the minced beef to replace part of the meat.
 - b) Soya used instead of the minced beef.
 - c) Soya added to the minced beef to improve the colour of the meat.
- 77 A77
78. What is the best way to store potatoes in the kitchen?
- a) In the refrigerator, in a plastic bag.
 - b) In a vegetable basket, uncovered.
 - c) In a cupboard, in a paper bag.
- 78 A78
79. Which one of the following factors is **not** a reason for buying pre-packed cut vegetables?
- a) It is less expensive.
 - b) Less time consuming to prepare.
 - c) Availability in small quantities.
- 79 A79
80. How should you clean cabbage before using it?
- a) Rinse in cold water with lemon juice added.
 - b) Rinse under a tap with running warm water.
 - c) Rinse in cold water.
- 80 A80

Continue on opposite page...

81. How should you cook boiled potatoes?
a) Add potatoes to cold water, and cook without a lid on the pot.
b) Add potatoes to cold water, and cook with the lid at a slant on the pot.
c) Add potatoes to boiling water, and cook with a lid on the pot.
82. What would be the best sequence to add the vegetables when broccoli, baby marrows and carrots are boiled together for a mixed vegetable dish:
a) Broccoli, carrots and then baby marrows.
b) Babay marrows, carrots and then broccoli.
c) Carrots, broccoli and then baby marrows.
83. What is the best way to clean mushrooms to retain texture?
a) Rinse under cold, running water.
b) Wipe mushrooms with a damp cloth.
c) Place in slightly salted water for a few minutes.
84. Which one best describes the cooking method to 'sauté' onions?
a) To stir with a wooden spoon in hot fat for 3-4 minutes.
b) To cook onions under a grill.
c) To wrap the onions in foil and place in a pre-heated oven for 20 minutes at 180°C.
85. To prepare roasted winter vegetables, you will need to buy:
a) parsnips, turnips and butternut.
b) potatoes, carrots and yellow peppers.
c) baby marrows, mushrooms and tomatoes.
86. 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
87. If well wrapped, how long can you freeze butter for?
a) Up to three months.
b) Up to six months.
c) Up to nine months.
88. What does 98% fat free mean?
a) 2g fat per product.
b) 2g fat per 98g.
c) 2g fat per 100g.
89. 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.
- 81 A81
- 82 A82
- 83 A83
- 84 A84
- 85 A85
- 86 A86
- 87 A87
- 88 A88
- 89 A89

Continue on next page...

90. Which cooking method is used when food is submerged in hot oil?
a) Sautéing
b) Deep-frying
c) Stir-frying
91. When should you strain oil used for deep-frying?
a) When it changes colour.
b) Right after using it once it is cooled.
c) No need to be strained if used for deep-frying.
92. Which type of fat is the best to use for deep-frying?
a) Sunflower oil
b) Butter
c) Olive oil
93. Which one of the following cooking methods will cause chicken thighs to absorb the least fat during cooking?
a) Oven roast
b) Deep-fry
c) Shallow-fry
94. If olive oil gets a cloudy appearance when stored in the refrigerator:
a) throw away the oil and do not use.
b) keep the oil at room temperature before use.
c) filter the oil before use.
95. Which one of the following fats is the best choice when making shortbread biscuits?
a) Low-fat spread
b) Block margarine
c) Butter
96. 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.
97. Which one of the following cold desserts has the lowest energy value?
a) Frozen yoghurt
b) Ice cream
c) Sorbet
98. Which one of the following chicken pieces (per 100g) has the least fat?
a) Chicken thigh without skin.
b) Chicken breast without skin.
c) Chicken wing without skin.
- 90 A90
- 91 A91
- 92 A92
- 93 A93
- 94 A94
- 95 A95
- 96 A96
- 97 A97
- 98 A98

Continue on opposite page...

99. To reduce the energy content of spaghetti bolognaise use:
- a) lean beef mince.
 - b) regular beef mince.
 - c) use half soya and half regular mince.
100. Foods with hidden fat include:
- a) fat on steak.
 - b) avocados.
 - c) tub margarine.
101. What method should you use to prepare frozen potato chips that will not increase the fat content of the chips?
- a) Oven-baked
 - b) Deep-fry
 - c) Shallow-fry
102. When making *beef stroganov*, which one of the following is typically added to the sauce?
- a) Mayonnaise
 - b) Sour cream
 - c) Yoghurt
103. The shelf-life of oil-based cooking spray is
- a) 1 month.
 - b) 6 months.
 - c) 12 months.
104. Which one of the following is an example of oily fish?
- a) Hake
 - b) Sardines
 - c) Sole
105. Which one of the following lamb cuts (per 100g) has the least fat?
- a) Leg
 - b) Shoulder
 - c) Loin
106. 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.
107. What is meant by the term 'basting'?
- a) Insert strips of fat into meat cuts.
 - b) Wrap strips of thinly sliced fat around the meat.
 - c) Moistening meat during cooking with melted fat.
- 99 A99
- 100 A100
- 101 A101
- 102 A102
- 103 A103
- 104 A104
- 105 A105
- 106 A106
- 107 A107

Continue on next page...

108. Which one of the following meats (per 100g) has the least fat?
a) Pork shoulder
b) Veal shoulder
c) Lamb shoulder
109. When buying oil to promote heart health, choose:
a) sunflower oil.
b) vegetable oil.
c) canola oil.
110. 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.
111. 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?
a) Searing
b) Deep-frying
c) Shallow-frying
112. Which one of the following types of milk is suitable to limit energy intake?
a) 1% milk
b) 2% milk
c) Skimmed milk
113. When buying pork, which of the following will hold moisture during cooking?
a) Cuts with a good layer of fat on the exterior.
b) Cuts with no visible fat on the exterior.
c) Vacuum packed cuts.
114. Canola oil is **not** useful for
a) frying.
b) general cooking.
c) adding flavour to food.
115. Which one of the following cheeses (per 100g) has the highest energy value?
a) Cottage cheese
b) Cheddar cheese
c) Gouda / Sweetmilk cheese
116. Which one of the following is **not** a reason for using fats in cake-making?
a) Increases the shelf-life of the cake.
b) Prevents the cake from sticking to the cake tin.
c) Moistens the batter.
- 108 A108
- 109 A109
- 110 A110
- 111 A111
- 112 A112
- 113 A113
- 114 A114
- 115 A115
- 116 A116

Continue on opposite page...

117. When reading food labels, a kilojoule is a unit of:
- a) energy.
 - b) cholesterol.
 - c) total fat.
118. What does the term 'light' refer to when appearing on the label of olive oil?
- a) It refers to the colour of the oil.
 - b) It refers to the lower energy value of the oil.
 - c) It refers to the weight of the oil per 100ml.
119. 'Breading' foods to be deep fried means:
- a) coating the food with crumbs.
 - b) frying the food with dry spices.
 - c) coating the food in flour and egg.
120. Why should most foods intended to be deep fried firstly be breaded or battered?
- 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.
121. Why should butter rather than margarine be chosen when cooking?
- a) Butter is healthier than margarine.
 - b) Butter gives a better flavour to foods.
 - c) Butter can be heated to a higher temperature.
122. Which one of the following foods (per 100g) has the highest energy value?
- a) Raisins
 - b) Potatoes
 - c) Avocados
123. What will be the healthiest way to cook beef steak?
- a) Sear.
 - b) Crumb and fry in a little oil.
 - c) Batter and fry in oil.
124. Which one of the following fats has the longest shelf life?
- a) Fresh cream
 - b) Butter
 - c) Margarine
125. What will be the healthiest way to cook chicken breast strips?
- a) Grill
 - b) Sauté
 - c) Stir-fry
126. According to legislation, butter must consist of at least:
- a) 100% fat.
 - b) 80% fat.
 - c) 60% fat.

Continue on next page...

127. When a food item is labelled as 'fat free', it means that:
- a) the item contains 0.0g of fat per 100g.
 - b) the item contains less than 0.5g of fat per 100g.
 - c) the item contains less than 2g fat per 100g.
- 127 A127
128. Which one of the following is a fat replacer and suitable to use for frying?
- a) Aspartame
 - b) Sorbitol
 - c) Olestra
- 128 A128
129. 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.
- 129 A129
130. 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.
- 130 A130
131. When reading a food label, which one of the following fats may contribute to heart disease?
- a) Unsaturated fatty acids
 - b) Polyunsaturated fatty acids
 - c) Trans fatty acids
- 131 A131
132. 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
- 132 A132
133. Which one of the following options will add the most energy to a cup of coffee when a medium amount is added?
- a) Full cream milk
 - b) Coffee creamers
 - c) Milk powder
- 133 A133
134. 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.
- 134 A134
135. The best fat to use when making pastry is:
- a) soft margarine.
 - b) olive oil.
 - c) butter.
- 135 A135



PROGRAMME: CONSUMER SCIENCE: FOOD AND NUTRITION
DEPARTMENT OF AGRICULTURAL AND FOOD SCIENCES
FACULTY OF APPLIED SCIENCES

FAT, FRUIT AND VEGETABLE KNOWLEDGE QUESTIONNAIRE

This questionnaire is part of a MTech: Consumer Science: Food and Nutrition research study. The aim of the study is to develop a valid and reliable knowledge test to assess food knowledge of first-year students at a university of technology in the Western Cape, South Africa.

The information supplied will be anonymous as only a participant number will be filled in on your questionnaire. The questionnaire consists of two (2) parts that only include multiple-choice questions. The questionnaire will take about 45 minutes (one lecture period) to answer. Your participation in answering the questionnaire is highly appreciated.

Participant

PART 1: FOOD KNOWLEDGE

Instructions for completion of this section:

**Please answer all the questions by circling the letter that precedes your answer.
Only one letter may be chosen as your answer.**

For office use only

SECTION A: FRUIT AND VEGETABLES

1. When storing left-over canned sweetcorn:
 - a) place in an air-tight container and refrigerate for up to 2 days.
 - b) place in a non-airtight container and refrigerate for up to 2 days.
 - c) leave the tin and refrigerate for up to 2 days.

1 A1

2. When buying cauliflower, which one of the following factors indicates that the cauliflower is **no** longer fresh?
 - a) Firm, compact heads.
 - b) Yellow-coloured florets.
 - c) Attached leaves are bright green.

2 A2

3. Which of the following fruits will **not** discolour when making a fruit salad?
 - a) Apple
 - b) Kiwi fruit
 - c) Banana

3 A3

4. If a recipe asks for *julienne* carrots, you should prepare the carrots by cutting them into
 - a) slices.
 - b) cubes.
 - c) matchsticks.

4 A4

5. To promote even cooking of butternut:
 - a) cut butternut into pieces with equal sizes.
 - b) use a small pot with a lid and just enough water to cover the whole butternut.
 - c) soak the butternut in hot water before cooking.

5 A5

6. A reason for using a vegetable at the peak of its season is:
 - a) the colour and flavour are at their best.
 - b) the cooking time will be less.
 - c) it will provide more energy.

6 A6

7. Which one best describes the cooking method when 'parboiling' vegetables?
 - a) Vegetables are partially cooked in boiling water.
 - b) Vegetables are fried briefly with a small amount of fat.
 - c) Vegetables are exposed to dry heat in the oven for 5 minutes.

7 A7

Continue on next page...

8. If you do not have a refrigerator at home, what would be the best option when buying vegetables for use within a few days?
- a) Buy small quantities of fresh vegetables.
 - b) Buy pre-packed vegetables.
 - c) Buy fresh vegetables with green leaves.
9. The best way to store dried fruit is:
- a) in an air-tight container in a cool, dry place.
 - b) in an air-tight container in a warm, dry place.
 - c) in an open container in a cool, dry and ventilated place.
10. Which one best describes the cooking method to 'sauté' onions?
- a) To stir with a wooden spoon in hot fat for 3-4 minutes.
 - b) To cook onions under a grill.
 - c) To wrap the onions in foil and place in a pre-heated oven for 20 minutes at 180°C.
11. The leaves of which vegetable can be used as a herb?
- a) Carrot
 - b) Celery
 - c) Spinach
12. When preparing apples to make an apple tart the term 'coring' refers to removal of the
- a) skin of the apples.
 - b) flesh of the apples.
 - c) pips and central parts of the apples.
13. Which one of the following vegetables is **not** suitable for stir-frying?
- a) Potatoes
 - b) Green beans
 - c) Sweet peppers
14. To avoid fresh apple slices from browning when added to a fruit salad sprinkle
- a) salt water on the apple slices.
 - b) hot water on the apple slices.
 - c) orange juice on the apple slices.
15. Which of the following does **not** refer to an aubergine?
- a) Brinjal
 - b) Yuca
 - c) Eggplant
- 8 A8
- 9 A9
- 10 A10
- 11 A11
- 12 A12
- 13 A13
- 14 A14
- 15 A15

Continue on next page...

16. Which one of the following factors does **not** affect the flavour of cooked vegetables?
- a) Age of the vegetables.
 - b) Temperature at which the vegetables are cooked.
 - c) Vitamin content of the vegetables.
17. When preparing an assortment of fresh vegetables for dinner:
- a) cook all the vegetables together, starting with the one that will take the longest.
 - b) cut the vegetables that will take the longest to cook into large pieces.
 - c) cook all the vegetables with the same colour together at the same time.
18. Which one of the following best describes an aubergine?
- a) Glossy, smooth skin with a dark red colour and white flesh.
 - b) Glossy, smooth skin with a dark green colour and white flesh.
 - c) Glossy, smooth skin with a deep purple colour and white flesh.
19. Which one of the following is an advantage of drying pears?
- a) Drying makes pears available all-year round.
 - b) Dried pears are cheaper than fresh pears.
 - c) Drying improves the appearance of pears.
20. When making *guacamole*, which of the following ingredients will you need?
- a) Avocado, garlic, lemon juice and chilli.
 - b) Baby marrows, lemon juice, peppers and parsley.
 - c) Onion, garlic, spinach and tomato.
21. What is the best way to clean mushrooms to retain texture?
- a) Rinse under cold, running water.
 - b) Wipe mushrooms with a damp cloth.
 - c) Place in slightly salted water for a few minutes.
22. Which one of the following does **not** refer to baby marrows?
- a) Zucchini
 - b) Courgettes
 - c) Patty pans
23. 'Concentrate' juice
- a) has the same nutritional value as non-concentrate juice.
 - b) is healthier than non-concentrate juice.
 - c) contains far less water compared to non-concentrate juice.
- 16 A16
- 17 A17
- 18 A18
- 19 A19
- 20 A20
- 21 A21
- 22 A22
- 23 A23

Continue on next page...

24. When cooking carrots to *al denté* it means that the carrots are cooked until:
- a) firm to the bite, not soft nor mushy.
 - b) soft and watery.
 - c) firm with still a crunchy, hard texture.
- 24 A24
25. When making a banana loaf, which bananas would be best to use?
- a) Green bananas
 - b) Overripe bananas
 - c) Just ripe bananas
- 25 A25
26. The shelf-life of canned apricot jam **cannot** be affected by
- a) extreme temperatures.
 - b) storage conditions.
 - c) labelling.
- 26 A26
27. If the recipe instructions ask you to 'poach' pears you will:
- a) cover the pears with butter and then bake.
 - b) cook the pears at temperatures below boiling point in sufficient liquid to partially cover the fruit.
 - c) plunge the pears into boiling hot water for 3 minutes and leave to cool.
- 27 A27
28. When buying pre-packed butternut which packet should you choose?
- a) The butternut pieces are all cut into equal sizes.
 - b) The inside of the package is moist.
 - c) The butternut pieces are a pale yellow colour.
- 28 A28
29. To prevent avocado flesh turning brown:
- a) dip avocado slices in cold water.
 - b) refrigerate.
 - c) cover with plastic wrap.
- 29 A29
30. What method should you follow when peeling soft-skinned fruit, for example nectarines?
- a) Immerse the whole fruit in boiling water for 10 seconds and then loosen the skin with a knife.
 - b) Dip the knife in hot water before peeling the fruit.
 - c) Place in the freezer for 10 seconds and then peel.
- 30 A30
31. When cooking finely sliced carrots, which one of the following cooking methods will be best to retain as many nutrients as possible?
- a) Boiling
 - b) Steaming
 - c) Stir-frying
- 31 A31

Continue on next page...

32. If you do not have bottled tomato sauce in the home when making a stew, what can be used in its place without changing the flavour?

- a) Mixture of tomato puree and water.
- b) Mixture of fresh tomatoes blended with water.
- c) Tomato soup powder.

32 A32

33. When making Spinach and Feta muffins, which one of the following can be used as a substitute if spinach is not available?

- a) Celery
- b) Zucchini
- c) Swiss chard

33 A33

34. To avoid losing the nutrients contained in sweet potato after cooking:

- a) refrigerate after cooking and re-heat before serving.
- b) serve and eat immediately.
- c) wrap in foil and keep in a warm place.

34 A34

35. How should you store green, unripe bananas to ripen them?

- a) In a warm place in a paper bag.
- b) In the refrigerator.
- c) In a cupboard, uncovered.

35 A35

36. What would be the best sequence to add the vegetables when broccoli, baby marrows and carrots are boiled together for a mixed vegetable dish:

- a) Broccoli, carrots and then baby marrows.
- b) Baby marrows, carrots and then broccoli.
- c) Carrots, broccoli and then baby marrows.

36 A36

37. If pears need to ripen at home what should you do?

- a) Refrigerate them.
- b) Place them in a bowl with bananas, uncovered.
- c) Place them in an air-tight container.

37 A37

38. Which part of broccoli is **not** eaten?

- a) Stalks
- b) Leaves
- c) Florets

38 A38

39. In a supermarket, chilled foods refer to perishable products

- a) stored at temperatures between 0 to 7°C.
- b) stored at temperatures between -18 to 0°C.
- c) obtained from the deli counter.

39 A39

Continue on next page...

40. To preserve the colour of cooked green beans that will not be eaten immediately:
- a) refrigerate immediately after cooking.
 - b) place in ice water until they are cold.
 - c) take off the heat and let stand until cold.
- 40 A40
41. Which one of the following factors is **not** a reason for buying pre-packed cut vegetables?
- a) It is less expensive.
 - b) Less time consuming to prepare.
 - c) Availability in small quantities.
- 41 A41
42. To prepare roasted winter vegetables, you will need to buy:
- a) parsnips, turnips and butternut.
 - b) potatoes, carrots and yellow peppers.
 - c) baby marrows, mushrooms and tomatoes.
- 42 A42
43. Which one of the following cooking methods will be the quickest to cook dried peas or beans?
- a) Boiling
 - b) Pressure cooking
 - c) Steaming
- 43 A43
44. Which of the following is **not** a suitable reason for blanching vegetables?
- a) It softens vegetables.
 - b) It loosens the skin of vegetables.
 - c) It increases the strong flavour of vegetables.
- 44 A44
45. What should you do with potatoes that have turned green in colour?
- a) Peel to remove the green coloured parts before using.
 - b) Throw away and do not use.
 - c) Cook in the skin and remove the skin afterwards.
- 45 A45
46. Which one of the following best describes an 'extender' when used for the making of a beef lasagne?
- a) Soya added to the minced beef to replace part of the meat.
 - b) Soya used instead of the minced beef.
 - c) Soya added to the minced beef to improve the colour of the meat.
- 46 A46
47. When cooking frozen carrots:
- a) defrost under running, boiling water.
 - b) defrost in the refrigerator.
 - c) cook from the frozen state.
- 47 A47

Continue on next page...

48. How should you cook boiled potatoes?

- a) Add potatoes to cold water, and cook without a lid on the pot.
- b) Add potatoes to cold water, and cook with the lid at a slant on the pot.
- c) Add potatoes to boiling water, and cook with a lid on the pot.

48 A48

49. If the instructions on pre-packed vegetables recommend to 'roast' the vegetables, which one of the following methods should you follow?

- a) Place the vegetables in a pot with a small amount of boiling water, cover and heat on high temperature.
- b) Place the vegetables, covered with foil, in a pre-heated oven and heat.
- c) Place the vegetables, uncovered, in a pre-heated oven and heat.

49 A49

SECTION B: FATS AND OILS

50. 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.

50 A50

51. Which cooking method is used when food is submerged in hot oil?

- a) Sautéing
- b) Deep-frying
- c) Stir-frying

51 A51

52. Which type of fat is the best to use for deep-frying?

- a) Sunflower oil
- b) Butter
- c) Olive oil

52 A52

53. 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

53 A53

54. When reading food labels, a kilojoule is a unit of:

- a) energy.
- b) cholesterol.
- c) total fat.

54 A54

55. What will be the healthiest way to cook beef steak?

- a) Sear.
- b) Crumb and fry in a little oil.
- c) Batter and fry in oil.

55 A55

Continue on next page...

56. 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.
- 57 A57
57. 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.
- 58 A58
58. 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.
- 59 A59
59. When buying oil to promote heart health, choose:
- a) sunflower oil.
 - b) vegetable oil.
 - c) canola oil.
- 60 A60
60. 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.
- 61 A61
61. Which one of the following fats is the best choice when making shortbread biscuits?
- a) Low-fat spread
 - b) Block margarine
 - c) Butter
- 62 A62
62. 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
- 63 A63
63. The best fat to use when making pastry is:
- a) soft margarine.
 - b) olive oil.
 - c) butter.
- 64 A64

Continue on next page...

64. 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.

65 A65

65. 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.

66 A66

66. Why should butter rather than margarine be chosen when cooking?

- a) Butter is healthier than margarine.
- b) Butter gives a better flavour to foods.
- c) Butter can be heated to a higher temperature.

67 A67

67. To reduce the energy content of spaghetti bolognese use:

- a) lean beef mince.
- b) regular beef mince.
- c) use half soya and half regular mince.

68 A68

68. 'Breading' foods to be deep fried means:

- a) coating the food with crumbs.
- b) frying the food with dry spices.
- c) coating the food in flour and egg.

69 A69

69. Which one of the following meats (per 100g) has the least fat?

- a) Pork shoulder
- b) Veal shoulder
- c) Lamb shoulder

70 A70

70. 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?

- a) Searing
- b) Deep-frying
- c) Shallow-frying

71 A71

71. Why should most foods intended to be deep fried firstly be breaded or battered?

- 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.

72 A72

Continue on next page...

72. Which one of the following cold desserts has the lowest energy value?

- a) Frozen yoghurt
- b) Ice cream
- c) Sorbet

73 A73

73. When reading a food label, which one of the following fats may contribute to heart disease?

- a) Unsaturated fatty acids
- b) Polyunsaturated fatty acids
- c) Trans fatty acids

74 A74

74. When buying pork, which of the following will hold moisture during cooking?

- a) Cuts with a good layer of fat on the exterior.
- b) Cuts with no visible fat on the exterior.
- c) Vacuum packed cuts.

75 A75

PART 2: DEMOGRAPHIC AND RELATED INFORMATION

Instructions for completion of this section:

Please answer all the questions by circling the letter that precedes your answer.

Only one letter may be chosen as your answer.

1. Your gender?

- a) Male
- b) Female

1

2. Your age?

- a) 18 - 22 years
- b) 23 years and older

2

3. Did you study the subject 'Consumer Studies' in Grade 12?

- a) Yes
- b) No

3

4. Where / From whom did you learn **mostly** about food choices, purchasing, storage and preparation?

- a) At home with family.
- b) Friends.
- c) Books, articles in magazines, internet, etc.
- d) Television and radio.
- e) School health services and school subjects such as Life Orientation and Consumer Studies.

4

5. How would you describe your knowledge about food purchasing,

storage and preparation compared to other students?

- a) Much less.
- b) Somewhat less.
- c) About similar.
- d) Somewhat more.
- e) Much more.

 5

6. Which of the following meals do you mostly consume?

- a) Prepared at home / family food.
- b) Food bought from kiosks on campus or other kiosks.
- c) Self-prepared food in a CPUT residence.
- d) Self-prepared food in a private fat / residence.
- e) Ready-made meals bought from supermarkers.

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Thank you for participating in this study by completing the questionnaire.

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