

**INVESTIGATING THE CONSUMPTION OF PROCESSED MEAT,
MEAT AND MEAT ALTERNATIVES AND RELATED FACTORS
AFFECTING THEIR PURCHASES AND CONSUMPTION AMONGST
UNDERGRADUATE STUDENTS AT THE UNIVERSITY OF
KWAZULU-NATAL, PIETERMARITZBURG CAMPUS**

By

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Thesis submitted in partial fulfilment of the requirement for the degree

MASTER OF SCIENCE in DIETETICS

SCHOOL OF AGRICULTURAL, EARTH AND ENVIRONMENTAL
SCIENCES
COLLEGE OF AGRICULTURE, ENGINEERING AND SCIENCE
UNIVERSITY OF KWAZULU-NATAL

DECEMBER 2017

ABSTRACT

Due to the recent publication by the International Agency of Cancer Research (2015a) that indicated that processed meat was carcinogenic and red meat probably carcinogenic. The consumption and knowledge of processed meat in the undergraduate students at University of KwaZulu-Natal was a concern. Due to the limited published research available on the subject. Therefore, this study aims to investigate the consumption of processed meat, meat and meat alternatives and related factors affecting their purchases and consumption amongst undergraduate students at the University of KwaZulu-Natal, Pietermaritzburg campus.

A cross-sectional study was conducted on undergraduate students at the University of KwaZulu-Natal on the Pietermaritzburg Campus (N=189). The students were requested to complete a questionnaire consisting of socio-demographic questions, socio-economic questions, a food frequency and nutrition knowledge questions. For the purpose of the study, the questionnaire was developed using current literature and expert input from the study supervisor.

The results showed that the students consumed eggs and cold meat the most frequently every day compared to other meat alternatives and meat. Legumes and fast foods were eaten the least by the majority of the participants. They indicated eating it “never or less than once a month” when compared to other meat and meat alternatives. The participants also considered price to be the main factor when deciding which food to purchase, followed by taste. It was also evident that the students had a poor overall level of nutrition knowledge regarding good sources of protein, fat content, salt content and general health of meat, processed meat and meat alternatives.

The results of this study show similarities between previously published studies regarding factors when considering purchasing and nutrition knowledge. Due to the lack of locally published research concerning the consumption and knowledge of students regarding meat, processed meat and meat alternatives, this study forms a reference point to the importance of the need of nutrition education in undergraduate students at the University of KwaZulu-Natal.

PREFACE

The work in this dissertation was carried out by Megan Ann Birkett from the Dietetics and Human Nutrition, School of Agricultural, Earth and Environmental Sciences at the University of KwaZulu-Natal in Pietermaritzburg, South Africa, under the supervision of Suna Kassier and co-supervision of Prof Frederick Veldman. The work presented in this study is the original work of the author and has not; in any form for a degree or diploma; been submitted to any other tertiary institution. Appropriate acknowledgement was given where use was made of external sources of information and authors.

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ACKNOWLEDGEMENTS

I would like to acknowledge numerous people, without whom this study would not have been possible.

To my supervisor Suna Kassier, my co-supervisor, Prof Frederik Veldman and Magda Botha; thank you for your constant support, guidance and assurance throughout this year. To Brett Truter, your constant belief in me has helped more than you realize in completing this study.

Finally, I would like to thank my parents, Lesley and Alan Birkett for always being ready to help when needed, this study wouldn't have been possible without it.

DEDICATION

This dissertation is dedicated to Nicci Maxwell, whom without I would never have been able to get this far academically. Thank you.

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LIST OF ABBREVIATIONS

AICR:	American Institute for Cancer Research
AMI:	American Meat Institute
CANSA:	The Cancer Association of South Africa
CPI:	Consumer Price Index
DOH:	Department of Health
FAO:	Food and Agricultural Organisation
FBDGSA:	Food Based Dietary Guidelines of South Africa
FSA:	Food Standards Agency
GAIN:	Global Agricultural Information Network
HCA's:	Heterocyclic amine
IARC:	International Agency for Research on Cancer
MRC:	Medical Research Council
NAMC:	National Agricultural Marketing Council
NCD's:	Non-communicable Disease
NHS:	National Health Service
NIOH:	National Institute for Occupational Health
NOCs:	N-nitroso compounds
PACSA:	Pietermaritzburg Agency for Community Social Action
PAH's:	Polycyclic aromatic hydrocarbons
SAND:	South African National Department
SANHANES-1:	South African National Health and Nutrition Examination Survey
UKZN:	University of KwaZulu-Natal
WHO:	World Health Organisation
WRCF:	World Cancer Research Fund

CHAPTER 1: INTRODUCTION, THE PROBLEM AND ITS SETTING

1.1 Introduction and importance of the study

The International Agency for Research on Cancer has recently indicated that processed meat is carcinogenic [International Agency for Research on Cancer (IARC) 2015a]. Processed meat is any meat that has been salted, cured, fermented or smoked to enhance the flavour. Examples include bacon, beef patties, biltong, ham, hotdogs, polony and sausages (Kassier, 2016). In addition to being carcinogenic, the consumption of processed meats is associated with an increased occurrence of coronary heart disease and diabetes mellitus (Micha *et al.*, 2010). This could be due to the fact that processed meat is high in fat and sodium and a high intake of salt and fat can lead to obesity, diabetes, heart disease and stroke [World Health Organization (WHO), 2015a]. Processed meat is a major source of dietary sodium (refer to Table 1.1). Sodium Chloride (salt) is required in meat for flavour, texture and preservation (Desmond, 2006).

Table 1.1: Nutritional Composition of selected meat and processed meat per 100 g

Food Item	Protein (g)	Fat (g)	Sodium (mg)
Vienna's, russians or frankfurters (incl. Salami)	22.9	34.4	1860
Cold Meat (ham, cooked/canned, 19% fat)	16.1	18.8	1365
Bacon (fried with fat)	30.5	49.2	1596
Beef (fillet, grilled)	26.0	17.2	61
Chicken with skin (roasted, light meat)	29.0	10.9	75
Fried fish (battered, low fat fish, fried in sunflower oil)	18.7	11.6	85

Source: Langenhoven *et al.*, (1991a)

In South Africa, there has been a shift towards a more westernized diet which has led to an increase in the consumption of processed meat (Ronquet-Ross *et al.*, 2015). This is a cause for concern as the Food and Agricultural Organization Statistical Database (FAOSTAT) Food Balance Sheets data has shown that there has been an increase in the consumption of processed meats by 43% amongst South Africans between 1994 and 2009 (Ronquet-Ross *et al.*, 2015). However, despite the significant increase in consumption of processed meats among South Africans, there are no guidelines regarding their consumption in the South African Food Based Dietary Guidelines (Vorster *et al.*, 2013).

Table 1.2 shows that there are many factors involved in the process of buying and consuming a food item (Ramya & Mohammed, 2016)

Table 1.2: Various factors that influence purchasing and consumption of food

Culture	Social	Personal	Psychological	Economical
Culture	Family	Age	Motivation	Personal income
Subculture	Reference	Income	Perception	Family income
Social class	Role and status	Occupation Lifestyle Personality	Learning Beliefs and attitude	Income expectations Liquid assets Government policy

However, a study conducted by Temple *et al.* (2011), found that South African women were mostly influenced by price when making food purchases, followed by taste and health. The Consumer Price Index (CPI) showed that a kilogram (kg) of polony costs R39.70 while a whole chicken costs R42.72/kg (National Agricultural Marketing Council, 2015). The Pietermaritzburg Agency for Community of Social Action (PACSA) Annual Report 2015, reported that a polony sandwich is a staple for school lunches. In addition, a study conducted among university students in the Eastern Cape concluded that the consumption of meat was positively related to the student's monthly allowance. However, the study also showed that the amount of money used for food purchases negatively related to meat consumption as students preferred buying other foods (Hosu *et al.*, 2015). Previous studies (Kassier & Veldman, 2013) have documented the prevalence of food insecurity among students

at the University of KwaZulu-Natal (UKZN). A study conducted by Van den Berg & Raubenheimer (2015) found that students at the University of the Free State did not have the necessary cooking skills. As a result, they did not know how to prepare healthy and affordable meals. Another study conducted on students at UKZN documented a high fat diet which included processed meats. It also showed a low intake of healthy meat alternatives such as beans and soya (Kassier & Veldman, 2013). Regardless of the South African Food Based Dietary Guidelines to ‘eat dry beans, split peas, lentils and soya regularly’ (Vorster *et al* 2013), meat alternatives are the lowest food group consumed by South Africans (Steyn *et al.*, 2006).

1.2 Statement of the problem

The aim of the study was to investigate the consumption of processed meat, meat and meat alternatives and related factors affecting their purchases and consumption amongst undergraduate students at UKZN, Pietermaritzburg Campus.

It is important to investigate the consumption of processed meats as well as other meat and protein sources being consumed by students at UKZN due to the presence of food insecurity and affordability of processed meat. In addition to the consumption, the reasons for purchasing processed meat as well the availability and use of cooking facilities also requires investigation. In addition, the nutrition knowledge of students will be assessed. Knowledge regarding the protein, salt, fat content of processed meats and healthier, more affordable meats and meat alternatives will be assessed in terms of the salt and fat content of processed meats, meats, and healthier, more affordable meat alternatives. This will help to gain a better understanding regarding processed meat consumption and other more affordable protein sources among undergraduate UKZN students on the Pietermaritzburg Campus. In addition, it will help to determine if awareness among the student community of UKZN needs to be raised regarding the health risks associated with the consumption of processed meats as well as health benefits related to consuming healthier meat alternatives such as legumes and eggs.

1.3 Type of study

A cross sectional descriptive study was conducted.

1.4 Objectives and null hypotheses

1.4.1 Objectives

For the study, the following objectives were set:

- To investigate the consumption of processed meat, meat and healthier, more affordable meat alternatives such as legumes.
- To investigate the factors influencing the consumption and purchase of processed meat, meat and healthier, more affordable meat alternatives
- To investigate the nutrition knowledge of students regarding processed meat, meat and healthier, more affordable meat alternatives

1.4.2 Null hypotheses

For the purpose of the study, the following hypotheses were set:

- There will be no significant difference in the frequency of consuming processed meat compared to meat and healthier, more affordable meat alternatives such as legumes (H_{01}).
- Price will not be the determining factor when it comes to the purchase of processed meat, meat and meat alternatives such as legumes (H_{02}).
- Students will not have a lack of knowledge regarding the nutrient composition of processed meat, meat and meat alternatives (H_{03}).

1.5 Study Parameters

1.5.1 Inclusion Criteria

The following inclusion criteria were set:

- Undergraduate students registered for study at the University of KwaZulu-Natal, Pietermaritzburg campus in the academic year
- All races
- Both genders

1.5.2 Exclusion Criteria

The following exclusion criteria were set:

- Students not registered for study at the University of KwaZulu-Natal, Pietermaritzburg campus in the academic year
- Postgraduate students
- Students who do not consume processed meat and pork

1.6 Assumptions

For the purpose of the study, the following assumptions were made:

- The participants were truthful in their response to the self-administered questionnaire.

1.7 Definition of Terms

Braaiing: To grill over an open fire (English Oxford Living Dictionaries, 2017).

Carcinogen: An agent or substance that tends to produce cancer (Dictionary.com, 2017).

Carcinogenic: having the properties of causing cancer (Dictionary.com, 2017).

Meat Alternatives: A product that is similar to meat in terms of aesthetic characteristics and other characteristics (Science Daily, 2017).

Processed meat: Meat that has been transformed through processes such as curing, fermentation, smoking and salting. This is to enhance the flavour of or preserve the meat. (IARC, 2015b)

Red Meat: Red meat refers all mammalian muscle meat. This includes beef, lamb, mutton, horse, goat. (IARC, 2015b)

1.8 Summary

This cross-sectional, descriptive study investigated the consumption, nutrition knowledge and factors affecting the purchase of processed meats, meat and healthier, more affordable meat alternatives of undergraduate students at UKZN, Pietermaritzburg campus.

1.9 Dissertation Overview

This dissertation consists of six chapters. Chapter 1 outlines the importance of the study, study aim, study objectives, hypotheses and study parameters. The next chapter (Chapter 2) provides a review of the literature relevant to processed meat, and the health risks associated with its consumption. Chapter 3 focuses on the research instruments and materials used in the study, including the study design, compilation of the research questionnaire, sampling, piloting reliability, validity, development of the research instruments and ethics approval. Chapter 4 presents the results while Chapter 5 discusses the results based mainly on the literature reported in Chapter 2. In Chapter 6, the conclusions and recommendations for future research are provided based mainly on the study findings.

CHAPTER 2: REVIEW OF RELATED LITERATURE

2.1 Introduction

In 2015, the IARC classified red meat as probably carcinogenic to humans (Group 2A). This was based on limited evidence that the consumption is associated with colorectal cancer, and a strong mechanistic evidence for a carcinogenic effect. Associations were also noted for pancreatic and prostate cancer. On the other hand, processed meat was classified as carcinogenic to humans (Group 1) based on sufficient evidence that the consumption is associated with colorectal cancer (IARC, 2015a). The National Institute of Health (2016) conducted a prospective study showing that red and processed meat consumption is associated with colorectal cancer as well as lung cancer, with red meat showing an increased risk for the development of oesophageal and liver cancer.

Red meat is classified as all 'mammalian muscle meat' such as beef, veal, pork, lamb, mutton, goat and horse (IARC, 2015b), while processed meat is classified as meat that has been salted, cured, fermented, smoked or subject to any other processes that transform the flavour and increases the preservation. Table 2.1 provides examples of processed meat. Processed meat can contain any red meat as well as poultry, offal or sometimes meat blood (IARC, 2015b). In addition, processed meat is also high in fat and salt (WHO, 2015a).

Table 2.1: Classification of red meat and processed meat

Red Meat	Processed meat including salting, curing and smoking
Beef	Biltong
Goat	Braaivleis (smoking occurs when cooking meat over a charcoal or wood fire when the dripping of fat and meat juices onto the fire causes flames and smoke)
Lamb	
Mutton	
Pork	Canned meat
Horse	Corned beef
Veal	Frankfurters

Table 2.1 (continued): Classification of red meat and processed meat

Red Meat	Processed meat including salting, curing and smoking
	Ham
	Hot dogs
	Meat based preparation and sauces made from meat drippings
	Salami
	Sausages
	Smoked chicken

Source: Food and Agricultural Organization of the United States (FAO) (2007); South African National Department (SAND) (2012); Kassier (2016)

2.2 Relationship between processed meat consumption and development of cancer

Cancer is one of the leading causes of death globally, with colorectal and stomach cancer accounting for 774000 and 754000 deaths in 2015 respectively (WHO, 2017a).

Asian adults have the highest risk for development of cancer, followed by Coloured adults, white adults and the lowest risk being reported for Black adults (see Table 2.2). According to the National Institute for Occupational Health (NIOH) (2012), colon cancer was the sixth highest cancer diagnosed in women and the fourth highest in men. In 2014, cancer contributed to 7% of all deaths in South Africa (WHO, 2014).

A number of studies have suggested that processed meat consumption is associated with an increased risk for colorectal, colon and rectal cancer. It appears that an increase in red and processed meat consumption almost linearly increases the risk for the development of colorectal cancer up to 140g/day for processed or red meat consumption (Chan *et al.*, 2011). It is reported that for every 50g portion of processed meat consumed on a daily basis, the risk of developing colorectal cancer can be increased by 18% (IARC, 2015a). Table 2.3 below illustrates the weight and household measurements of various processed meats.

Table 2.2: The percentage of cancer diagnosed and lifetime risk for developing cancer among South Africans

	Percentage of diagnosed colon cancer per ethnicity	Estimated lifetime risk per ethnicity
All Men	4,98	1/81
Asian	11.61	1/53
Black	4.07	1/229
Coloured	5.87	1/46
White	5.04	1/33
All Women	4.14	1/135
Asian	6.82	1/98
Black	2.67	1/330
Coloured	5.67	1/86
White	5.09	1/51

Source: National Institute for Occupational Health (NIOH), 2012.

Table 2.3: Household measurement and weight of processed meat.

Type of Processed Meat	Household Measurement	Weight (g)
Hamburger patties – beef	75mm diameter x 40mm	50
Vienna's	100mm x 22mm diameter	35
Frankfurter	168mm x 21mm diameter	60
Salami	Slice 54mm diameter x 5mm	12
Biltong	125 ml sliced	50
Sausages	90mm x 30 mm diameter	55

Table 2.3 (continued): Household measurement and weight of processed meat.

Type of Processed Meat	Household Measurement	Weight (g)
Boerewors	165mm x 25mm diameter	90
Polony	Slice 100mm diameter x 5mm	60
Bacon	1 rasher	10

Source: Langenhoven *et al.*, (1991b)

2.3. The association between the consumption of processed meat, mechanisms responsible for this relationship and the development of colon cancer

Processed and red meats contain chemicals that form when heated or processed. During cooking, heterocyclic aromatic amines (HCAs) and polycyclic aromatic hydrocarbons (PAHs) are produced from these foods (IARC, 2015b). The latter are formed at a high temperature when cooking methods such as grilling, cooking over a direct flame ('braaing') and pan frying. When the amino acids and creatine are exposed to high temperatures, HCAs are formed. Meat that is cooked at higher than 300⁰F (149⁰C) or for a prolonged period of time form more HCAs (National Cancer Institute, 2015).

PAHs are formed during smoking of meat or during cooking over an open fire. When the meat fat drops into the fire, this causes flames. PAHs are found in these flames and stick to the meat (National Cancer Institute, 2015).

During curing, sodium nitrate is added to meat (American Meat Institute (AMI), 2017). When nitrates and nitrites are added to meat, this forms N-nitroso compounds (NOCs). Processing results in the formation of carcinogenic compounds, NOCs and PAHs. These are known or alleged carcinogens (IARC, 2015b). The heme iron found in red meat also promotes the formation of NOCs when broken down in the gut (Dubrow *et al.*, 2011). NOC's have been found to damage the lining of the intestine. This in turn causes cells to replicate in order to repair the lining. This replication can

increase the risk of errors in the cell's DNA, hence the increase in risk for the development of cancer [Cancer Association of South Africa (CANSA), 2017].

The acceptable daily intake of nitrite is 0-3.7mg/kg body weight (WHO, 2002). The current South African legislation permits that between 160-200 mg / kg of total nitrates may be added during the processing of meats [Department of Health (DOH), 2016a].

2.4 Composition of processed meat, meat and meal alternatives for protein, fat and sodium

Table 2.4 below shows the protein, fat and sodium content of meats consumed by South Africans per 100g.

Table 2.4: Selected nutritional composition of various South African meats per 100g

Food Item	Protein (g)	Fat (g)	Sodium (mg)
Beef (fillet, grilled)	26.0	17.2	61
Boerewors (beef or pork)	13.8	26.3	805
Mutton (lion chop, grilled, with fat)	25.2	23.1	77
Pork (lion chop, grilled, with fat)	23.6	27.2	66
Chicken with skin (roasted, light meat)	29.0	10.9	75
Chicken without skin (roasted, light meat)	30.9	4.5	77
Fried fish (battered, low fat fish, fried in sunflower oil)	18.7	11.6	85
Fish: steamed, grilled or braided (low fat)	23.2	1.3	105
Tinned fish (pilchards in tomato sauce)	18.8	5.4	370
Vienna's, russians or frankfurters (incl. Salami)	22.9	34.4	1860
Cold Meat (ham, cooked/canned, 19% fat)	16.1	18.8	1365

Table 2.4 (continued): Selected nutritional composition of various South African meats per 100g

Food Item	Protein (g)	Fat (g)	Sodium (mg)
Bacon (fried with fat)	30.5	49.2	1596
Organ meat (liver, chicken, cooked)	24.4	5.5	51
Eggs: boiled or poached	12.6	10.3	126
Eggs: scrambled, fried, omelettes (fried in sunflower oil)	12.5	15.2	124
Baked beans, sugar beans, dried beans (baked beans in tomato sauce)	4.6	0.5	397
Soya mince	4	1.1	0.415
Fried fish (battered, low fat fish, fried in sunflower oil)	18.7	11.6	85
Fish: steamed, grilled or braid (low fat)	23.2	1.3	105
Lentils, split peas (split peas cooked)	8.3	0.4	2
Peanut butter (smooth)	24.9	50.0	478
Pizza (with cheese, tomato, olives)	9.0	11.8	570
Pies, sausage rolls (commercial meat pie – flaky pastry)	18.0	29.3	429
Kentucky fried chicken (chicken, fried, batter dipped)	22.5	17.4	292
Nando's (1/4 chicken leg/thigh)	27.7	10.5	360

Table 2.4 (continued): Selected nutritional composition of various South African meats per 100g

Food Item	Protein (g)	Fat (g)	Sodium (mg)
Chicken Lickin, chicken king	22.5	17.4	292
Bunny chow	11.6	6.8	277.8
Hot dogs	9,4	13,5	721,5
Beef burgers	18,2	12,6	239,7
Chicken burgers	13,5	13,2	771,4

Source: Langenhoven *et al.* (1991a), Langenhoven *et al.*(1991b), Nando's (2017), Fat Secret South Africa (2017)

Table 2.4 shows that viennas, frankfurters, russians and bacon have the highest fat content per 100g after peanut butter. Viennas, frankfurters, russians and bacon also have the highest sodium content per 100g. The high fat content of processed meats is related to the high quantity of fatty tissue added to enhance the taste, flavour and softness of the processed meat (Heinz & Hautzinger, 2007). Consumers indicated that the higher the fat content, the higher the preference for processed meats due to the tenderness of the product (Font-i-Furnols & Guerrero, 2014). The high salt content is as a result of the addition of sodium during processing. This is done to enhance taste, help preserve the meat and give it a desirable colour (AMI, 2017).

When it comes to meat alternatives, Table 2.4 shows that split peas, lentils, beans and soya had the lowest fat and lowest sodium content per 100g. This is supported by Venter *et al.*, (2013) who reported that legumes provide good-quality protein and are low in fat and sodium. In addition, legumes provide many health benefits and help to protect against non-communicable diseases (NCD's) (Venter *et al.*, 2013).

2.5 Health effects of processed meat and meat alternatives

Globally, NCDs account for 70% of all deaths on an annual basis. Cardiovascular disease (CVD) accounts for the majority of deaths, followed by cancer, respiratory disease and diabetes. There are various causes as to why processed meat consumption is a risk factor for the above-mentioned diseases that can be categorised into two groups, namely modifiable behavioural and metabolic. Modifiable behavioural factors include excess salt consumption which attributes to 4.1 million deaths. This is the second highest modifiable behavioural risk factor after tobacco use and before alcohol and inactivity. Metabolic risk factors include raised blood pressure, obesity, hyperglycaemia and hyperlipidaemia (WHO, 2017b).

In South Africa, NCD's account for 43% of all deaths. This is divided into CVD (18%), cancer (7%), respiratory diseases (3%), diabetes (6%) and other NCDs (10%) (WHO, 2014). In 2016, two thirds (about 67%) and one third (about 33%) of women and men were classified as overweight or obese, respectively. Just under half of the men (44%) and women (46%) aged 15 and older had hypertension (South Africa Demographic and Health Survey, 2016).

Studies have shown that the consumption of processed meat puts consumers at risk for high blood pressure, stroke and cardiovascular disease due to the high sodium content (Bibbins-Domingo *et al.*, 2010; Smith-Spangler *et al.*, 2010). This could be due to the high salt and fat content (see Table 2.4) (WHO, 2015a). A meta-analysis done by Chen *et al.*, (2013) demonstrated that 100g per day increments of total meat consumption increased the risk of stroke by 10% while a 100g per day increment in red meat consumption increased the risk of stroke by 13%. Consumption of each 50g per day increment of processed meat increased the risk of stroke by 11% (Chen *et al.*, 2013). However, a study conducted by Micha *et al.*, (2013) suggests that sodium, heme iron or L-carnitine found in processed meat may be the components that increase the risk for developing CVD. In addition to cardiovascular disease and cancer, a high consumption of meat and processed meat can increase the risk for developing type 2 diabetes (Männistö *et al.*, 2010).

Meat alternatives like legumes and lentils are high in fibre, low in fat and a good source of protein (Venter *et al.*, 2013). Legumes are known to have an inverse relationship with the development of cardiovascular disease. Studies have shown that soy protein intake (25 - 26.9g) in adults resulted in lower low-density lipoprotein and total cholesterol levels (Venter *et al.*, 2013; Harland & Haffner, 2008). In addition, legumes may reduce the risk of type 2 diabetes due to their low glycaemic indices, high fibre and low-fat content (Venter & Van Eyssen, 2001; Thompson *et al.*, 2012). Although the evidence linking legume consumption and a decreased risk for the development of cancer are limited, legumes could be probable in reducing the risk of developing cancer due to their nutritional content (Venter *et al.*, 2013).

2.6. Guidelines regarding processed meat consumption

The current Food Based Dietary Guidelines for South Africa (FBDGSA) are as follows:

- Enjoy a variety of food
- Be active!
- Make starchy foods part of most meals
- Eat dry beans, split peas, lentils and soya regularly
- Eat plenty of vegetables and fruit every day
- Have milk, maas or yoghurt every day
- Fish, chicken, lean meat and eggs can be eaten daily
- Drinks lots of clean, safe water
- Use fats sparingly. Choose vegetable oils, rather than hard fats
- Use sugar and foods high in sugar sparingly
- Use salt and food high in salt sparingly (Vorster *et al.*, 2013).

As it can be seen from the above guidelines, there are currently no direct current guidelines regarding the consumption of processed meat. However, the World Cancer Research Fund (WCRF) (2017) and the American Institute for Cancer (AICR) (2017) recommends to 'limit consumption of red meats (such as beef, pork and lamb) and avoid processed meats'. The WCRF/ AICR recommend a consumption of less than 500g of red meat per week. This is similar to FBDGSA that recommend a consumption of less than 560g/week of red meat consumption (Vorster *et al.*, 2013).

The National Health Service (NHS) (2015) in England recommends reducing the consumption to 70g of red or processed meat per day if currently consuming more than 90g.

2.7 Guidelines regarding sodium intake

According to the WHO (2015b), normal blood pressure is defined as 120mmHg systolic pressure (when the heart beats) and 80mmHg diastolic pressure (when the heart relaxes). When the systolic pressure is above 140mmHg and the diastolic pressure is above 90mmHg, blood pressure is classified as high. To decrease the risk of developing hypertension it is recommended that the intake of salt (sodium chloride) should be reduced to less than 5 g per day (WHO, 2015b).

According to the Heart and Stroke Foundation of South Africa (2016a), South Africans consume approximately 40 g of salt per day. The majority of the salt consumed is found in processed foods. The South African hypertension guidelines recommend a daily consumption of less than 6g of salt per day (Seedat *et al.*, 2014). The FBDGSA regarding salt is 'use salt and foods high in salt sparingly' (Vorster *et al.*, 2013). While the WHO (2012) recommends a maximum daily intake of 5g of salt (2 g of sodium).

Table 2.4 shows that 100g of processed meat such as vienna's, frankfurters, cold meat or bacon are just under the recommended daily allowance of sodium per day (2g). This is cause for concern as 150g of these processed meats will exceed the recommendation. While meat alternatives such as lentils, split peas and soya mince containing 2mg and 0.4mg respectively compared to the current 2000mg (2g) sodium recommendation (Langenhoven *et al.*,1991a); Langenhoven *et al.*, 1991b; Fat Secret South Africa, 2017)

2.7.1 Regulations regarding the reduction of sodium in certain foodstuffs

To reduce the sodium intake of South Africans, legislation regarding the consumption of sodium was introduced to decrease the amount of sodium added to foods (Peters *et al.*, 2017). Table 2.5 shows the maximum amount of sodium allowed in processed meats per 100 g.

Table 2.5: Maximum amount of sodium allowed in processed meat

Product	Sodium per 100 g	Sodium per 100 g
	<i>Date effective by: 31</i>	<i>Date effective by: 30 June</i>
	<i>March 2017</i>	<i>2019</i>
Vienna's, polonies	1300 mg	1150 mg
Nuggets	1300 mg	1150 mg
Bacon	1300 mg	1150 mg
Hams	1300 mg	1150 mg
	<i>Date effective by: 30</i>	<i>Date effective by: 30 June</i>
	<i>June 2016</i>	<i>2019</i>
Burger Patties	850 mg	650 mg
Salami	850 mg	650mg
Pork Sausages, uncured chicken vienna's and polonies	850 mg	650 mg

Source: South African Bureau of Standards Division (2011), DOH (2016b)

According to Table 2.4, vienna's, cold meats and bacon would have had to reduce the sodium content by 31 March 2017 in order to meet regulations.

2.7.2 Regulations relating to labelling of salt and fat

According to Koen (2015), nutrition labelling is a 'valuable and relatively low cost' method to try decrease the prevalence of NCDs in South Africa. Table 2.6 illustrates the relevant nutrition labelling for processed meat, meat and meat alternatives as was published in the Government Gazette No. 32695:429 (DOH, 2014).

Table 2.6: Labelling regulations in terms of protein, fat and salt

Nutrient	Claim	'Not less than'
Protein	High in	10 g per 100 g
Fat	Low	3 g per 100 g
Sodium	Low	120 mg Na per 100 g (3 g salt per 100 g)

Source: DOH (2014)

2.8 Guidelines regarding fat intake

In South Africa, the following guidelines regarding the consumption of fat are presented in Table 2.7 in accordance to FBDGSA.

Table 2.7: South African recommendations regarding fat intake

Fat	Guideline (% of total energy)	Guideline based on 8400KJ diet (g)
Total Fat	<30	68
Saturated fatty acids	<10	23
Trans fatty acids	<1	2
Monounsaturated Fatty Acids	Approx. 10	27

Source: Vorster *et al* (2013)

Peanut butter has the highest amount of fat per 100 g, followed by bacon, viennas and pies (see Table 2.4). Again, more than 150 g of peanut butter, bacon and viennas will exceed the current guideline based on a 8400 kj diet. The lowest amount of fat content per 100 g are meat alternatives such as lentils and split peas (0.4 g), baked beans (0.5 g) and soya mince (1.1 g).

2.9 Consumption patterns and purchasing patterns of processed meat and meat alternatives

Food intake is influenced by “geography, season, education, demography, disposable income, government and other support services, urbanisation, globalisation, marketing, religion, culture, ethnicity, social networks, time and the consumer” (Kearney, 2010).

Globally, there has been an increase in meat consumption with the greatest increase being seen in developing countries (Kearney, 2010). With an increase in disposable income, the purchasing of meat has increased too (Global Agricultural Information Network, 2015).

From 1994 to 2014, there has been an increase in the consumption of poultry meat by nearly 80%, while red meat consumption has increased by 19%. This trend can be attributed to the increase in economic growth in South Africa. The increase in poultry may be due to the inexpensive and ‘ubiquitous’ nature of poultry and has been shown to be the most important protein source of many South Africans. However, trends in the consumption of processed meat are not referred to (Global Agricultural Information Network, 2015).

A study investigating the consumption of fast food among 17-year-old Africans in Soweto reported that the ‘quarter’ is the most popular ‘fast food’ purchased. This consists of a quarter loaf of white bread, fried chips, processed cheese, egg and processed meat (Polony, Vienna’s, Russians, white liver or *mangola*) (Feeley *et al.*, 2009). A study conducted by Van Zyl *et al.* (2010) on young adults in Johannesburg reported that 27.9% of participants had fast food two to three times a week and 21% of participants had fast food once a week. This consisted of predominately burgers, pizza and fried chicken. However, if a healthier meal was available, 78% of participants have chosen that. In terms of socio-economic status, 65% of the participants were from a lower socio-economic group with nearly half (42%) of the participants earning less than R5000 per month and spent more than R200 on fast food a month. A cross-sectional study in South Africa showed that socio-economic status is an important factor in fast and street food consumption. Street food intake is

the greatest in the medium socio-economic and lowest in the higher socio-economic groups. This could be due to the affordable price as well as convenience of street foods (Steyn *et al.*, 2011). Another study conducted on students at UKZN documented a high fat diet which included processed meats. It also showed a low intake of healthy meat alternatives such as beans and soya (Kassier & Veldman, 2013). There was a 50% increase in processed meats consumption from 1999 to 2012 and a reduction in legumes and beans by 33% in South Africa (Ronquest-Ross *et al.*, 2015).

Legumes are one of the lowest food groups consumed in South Africa with only 15.23% of South Africans reporting consumption (Steyn *et al.*, 2006). In a cross-sectional study conducted by Labadarious *et al.* (2011), participants who were older and were of a lower socio-economic status consumed more legumes than younger or higher socio-economic status participants.

According to the Pietermaritzburg Agency for Community Social Action (PACSA) Annual Report (2015), a typical lunch for children in Pietermaritzburg would include a polony sandwich (Smith & Abrahams, 2016). In the lower income group, five of the top 20 meats consumed are processed (polony, vienna's, russians, canned meat and dried meat). Polony and vienna's are consumed on a daily basis by 20-26% of the lower income group with affordability being an important factor. Middle income groups ate less processed meat and fresher meat than the lower income group, while the higher income group ate the least amount of processed meat than the low and middle-income groups (Schönfeldt *et al.*, 2015).

A study conducted in Malaysia showed that when consumers purchase meat they consider freshness, Halaal assurance, price, and relationship with the retailer and the environment of the shop (Chamhuri & Batt, 2013). According to SANHANES-1 (Shisana *et al.*, 2013), women are the main shoppers in the family and price is the first factor they consider when purchasing food. This was followed by taste, health considerations, how long the food remained fresh, nutrient content, convenience, hygiene and lastly how easy the food is to prepare. The main reasons for choosing food in general were taste, mood, price and appearance, with health, hunger and convenience being the least important factors. However, when choosing fast food, taste (52.5%), convenience (58.2%) and time constraints (58.9%) were the main

factors (Van Zyl *et al.*, 2010). Another study showed that the most important factor when purchasing food was price (Ronquest-Ross *et al.*, 2015). University students in Belgium reported that they were influenced by taste, time, convenience and self-discipline. Their friends, peers and lack of parental control at university also influenced their eating behaviour. The physical environment (availability, accessibility, price and appeal of food), media and advertising also played a role in their eating behaviour (Deliens *et al.*, 2014). A study conducted on Korean students showed that those who lived in rented houses consumed the most processed foods compared to the students who lived at home, lodging houses and living in dormitories. This was due to the low prices and being easy to cook because they had to cook for themselves and budget for food expenses (Kim *et al.*, 2015).

Table 2.8 illustrates the price of various meats, processed meats and meat alternatives in South Africa in the year 2017.

Table 2.8: Price changes from January 2017 to April 2017 and price percentage change of processed meat, meat and meat alternatives

Food Item	Unit	Price Jan 2017 (R)	Price April 2017 (R)	Percentage Change (%)
Beef brisket	1kg	72.42	79.68	10.02
Beef chuck	1kg	73.67	81.20	10.22
Chicken portions	1kg	56.04	56.15	0.20
Whole chicken	1kg	43.69	44.03	0.78
Chicken giblets	1kg	30.89	30.38	-1.65
Tinned fish (excl. tuna)	155g	10.62	10.55	-0.66
Polony	1kg	42.04	43.37	3.16
Bacon	1kg	128.19	127.72	-0.37

Table 2.8 (continued): Price changes from January 2017 to April 2017 and percentage change of processed meat, meat and meat alternatives

Food Item	Unit	Price	Price	Percentage
		Jan 2017 (R)	April 2017 (R)	Change (%)
Eggs	½ dozen	14.73	15.07	2.31
Beans Dried	1kg	37.44	39.58	5.72
Baked Beans	410g	9.34	9.34	0
Peanut Butter	250g	19.84	19.87	0,15

Source: National Agricultural Marketing Council (NAMC) 2015

As seen in table 2.8 polony is still one of the cheapest ‘meats’ available per kilogram in South Africa after chicken giblets. Polony is only slightly more expensive than the healthier alternative, beans. As price and convenience are some of the main factors in making decisions regarding food choices, it is possible that there is a relationship between the increase in processed meat consumption and the affordability and convenience of processed meat when compared to more affordable alternatives such chicken giblets and beans which still require cooking (NAMC, 2015; Ronquest-Ross *et al.*, 2015; Kim *et al.*, 2015; Van Zyl *et al.*, 2010).

2.10 Food security

Food security is defined as having physical social and economic access to sufficient, safe and nutritious food that meets their dietary requirements and preferences to live a healthy life. Therefore, food insecurity is the lack thereof (FAO, 2003).

Food security is largely dependent on household income. Due to significant unemployment levels in South Africa, food security is largely reliant on social grants (Faber & Drimie, 2016). In a study conducted by Kassier & Veldman (2013) among UKZN students, it was found that more than half (53.1%) of the participants were moderately food insecure and 12.5% were considered food insecure. A study

conducted by Temple *et al.* (2011) in the Western Cape concluded that a healthy diet is unaffordable by the majority of the population due to healthier foods generally being more expensive than commonly purchased foods. In addition, more affordable foods are usually energy dense. The study by Temple & Steyn (2011), highlighted the need for education for people in developing countries such as South Africa on a more affordable and healthy diet.

Table 2.8 also provides evidence of the prices of processed meat, meat and meat alternatives. With processed meat, still being one of the most affordable options, it can be postulated that the more the prices of meat increases, the greater the consumption of processed meat will become (NAMC, 2015; Shisana *et al.*, 2013).

2.11 Nutrition knowledge and behavioural change

Nutrition education can be defined as a combination of strategies to enable healthier food choices and behaviours (Contento, 2010). The SANHANES-1 indicated that there was an association between socio-economic status and nutrition knowledge among South Africans (Shisana *et al.* 2013).

Various studies have found a positive relationship between nutrition knowledge and changes in food behaviour (Shahril *et al.*, 2013; Shisana *et al.*, 2013; Spronk *et al.*, 2013; Ha & Caine-Bish, 2011; Ha & Caine-Bish, 2009; Wardle *et al.*, 2000). Therefore, it can be deduced that the promotion of nutrition education can result in students adapting healthier eating habits and increasing the consumption of meat alternatives.

2.12 Conclusion

Processed meat has been classified as carcinogenic, as well as being high in fat and salt. Therefore, processed meat increases the risk of developing colorectal cancer, hypertension, cardiovascular disease and diabetes, while, meat alternative such as legumes are low in fat and salt and are seen as protective against the risk of developing noncommunicable diseases. Due to the literature reviewed it can be seen that price and convenience are the predominant factors affecting food choices. The high consumption of processed meat in South Africa can be attributed to the

affordability of processed meat when compared to non-processed meat. However, there are no local guidelines directed at the consumption of processed meats and the health risks associated with a high consumption. However, nutrition education may be an effective measure to change eating behaviour targeted towards including more meat alternatives and less processed meats.

Chapter 3 will discuss the materials and methods used for data collection in this study.

CHAPTER 3: STUDY METHODOLOGY

3.1 Introduction

This chapter provides a description and explanation of the study design, study population and sample selection. The methods, materials and data collection procedures used are described as well. In addition, the efforts made to increase the validity and reliability of the study are described. Lastly, the ethical considerations for the study are explained.

3.2 Study design

A cross sectional descriptive study was chosen due to the relationship between exposure and outcome at a single time and the fact that the study was purely descriptive (Health Knowledge, 2017).

Cross sectional studies are advantageous due to the fact that they are not time consuming, data is collected at a single point in time and numerous outcomes and exposures can be studied. However, the study design measures prevalence rather than incidence (Health Knowledge, 2017). It also only provides a 'snapshot' of the sample population at one point in time, thus results may vary at different points in time (Bland, 2015; Levin, 2006).

3.3 Study population and sample selection

3.3.1 Study population

The study population included 250 undergraduate students registered for study on the Pietermaritzburg campus of UKZN in the academic year that met the study inclusion criteria (section 1.5.1).

3.3.2 Sample selection

Sample selection was done by convenience sampling. This involves prospective participants that are conveniently available at the time of data collection (Research

Methodology, 2016). This was chosen as it is the least time-consuming and least expensive, as well as the easiest sampling method. However, convenience sampling may lead to inherent bias. This means that the sample chosen may not be a true representative of the population being studied. Therefore, a generalization to the study population cannot be made (Bornstein *et al.*, 2013; Lærd Dissertation, 2012).

3.4 Study methods and materials

3.4.1 Measuring instruments

A self-administered questionnaire, based on available literature as well as expert input from the study supervisor, was developed to investigate the consumption of processed meat, meat and meat alternatives and related factors affecting their purchase and consumption amongst UKZN students, Pietermaritzburg campus.

The questionnaire consisted of 21 questions which were divided into four sections (See Appendix A). The majority of the questions were close-ended. The questionnaire was developed to be user friendly in terms of the time it took to answer, as well as addressing the research objectives.

Section A of the questionnaire was developed to document the socio-demographic variables of the study sample. Section B consisted of questions used to gauge the socio-economic status of participants as well as determine how participants spent their money, and the availability of cooking facilities and cooking skills. Section C consisted of a non-quantified food frequency questionnaire as well as factors affecting food purchases decisions. Section C of the questionnaire was an adapted version of a non-quantified food frequency questionnaire was used to determine the frequency of consumption of processed meat, meat and meat alternatives. This was chosen as food frequency questions are easy to administer, affordable, quick to complete, can be self-administered and is suitable for large surveys. However, food frequency questions are dependent on the participant's memory. Therefore, errors may occur when participants over- or under-estimate frequency (Wong *et al.*, 2012; Australian Child and Adolescent Obesity Research Network, 2010). The last section consisted of a nutrition knowledge questionnaire which investigated participants' knowledge regarding the fat, salt and protein content of foods in the non-quantified

food frequency questionnaire. The data in Section D was coded in accordance with the nutrient composition the South African Medical Research Council Food Composition Tables (Langenhoven *et al.*, 1991a).

According to the DOH (2014), a food that can be classified as high in protein if it contains at least 10 g of protein per 100 g. AMI (2017) classifies 'good' source of protein as 5 g of protein per 100g edible food. For the purpose of the study, low in protein was classified as less than 0-5 g of protein per 100 g and medium in protein as 5-10 g of protein per 100 g. Using the South African Medical Research Council food composition table, the following processed meats, meat and meat alternatives were classified to be into high, medium or low in protein (Langenhoven *et al.*, 1991a).

Table 3.1: Classification of meat processed meat, meat and meat alternatives according to protein content per 100 g.

Food Item	Protein (g)	Answer	Corresponding Code
Beef (fillet, grilled)	26.0	High	1
Boerewors (beef or pork)	13.8	High	1
Mutton (lion chop, grilled, with fat)	25.2	High	1
Pork (lion chop, grilled, with fat)	23.6	High	1
Chicken with skin (roasted, light meat)	29.0	High	1
Chicken without skin (roasted, light meat)	30.9	High	1
Fried fish (battered, low fat fish, fried in sunflower oil)	18.7	High	1
Fish: steamed, grilled or braided (low fat)	23.2	High	1
Tinned fish (Pilchards in tomato sauce)	18.8	High	1

Table 3.1 (continued): Classification of meat processed meat, meat and meat alternatives according to protein content per 100 g.

Food Item	Protein (g)	Answer	Corresponding Code
Vienna's, Russians or frankfurters (incl. Salami)	22.9	High	1
Cold Meat (Ham, cooked/canned, 19% fat)	16.1	High	1
Bacon (fried with fat)	30.5	High	1
Organ Meat (Liver, chicken, cooked)	24.4	High	1
Eggs: boiled or poached	12.6	High	1
Eggs: scrambled, fried, omelettes (fried in sunflower oil)	12.5	High	1
Baked beans, sugar beans, dried beans (baked beans in tomato sauce)	4.6	Low	3
Soya mince	4	Low	3
Lentils, split peas (Split Peas cooked)	8.3	Medium	2
Peanut Butter	24.9	High	1
Pizza	9.0	Medium	2
Pies, sausage rolls (commercial meat pie – flaky pastry)	18.0	High	1
Kentucky Fried Chicken	22.5	High	1
Nando's	27.7	High	1
Chicken Lickin, Chicken King	22.5	High	1
Bunny Chow	11.6	High	1

Table 3.1 (continued): Classification of meat processed meat, meat and meat alternatives according to protein content per 100 g.

Food Item	Protein (g)	Answer	Corresponding Code
Hot dogs	9.4	Medium	2
Beef burgers	18.2	High	1
Chicken burgers	13.5	High	1

Using the guidelines provided by the Heart and Stroke Foundation of South Africa (2016b) and the DOH (2014), the sodium content of food can be classified into the following 3 groups:

Table 3.2: Classification of sodium level (content) per 100 g of processed meat, meat and meat alternatives

Per 100 g	Low	Medium	High
Sodium	120mg or less	120-600mg	600mg or more

Based on the above classification, processed meat, meat and meat alternatives were classified as follows:

Table 3.3: Classification of processed meat, meat and meat alternatives according to sodium content per 100 g

Food Item	Sodium (mg)	Answer	Corresponding Code
Beef (fillet, grilled)	61	Low	3
Boerewors (beef or pork)	805	High	1
Mutton (lion chop, grilled, with fat)	77	Low	3
Pork (lion chop, grilled, with fat)	66	Low	3

Table 3.3 (continued): Classification of processed meat, meat and meat alternatives according to sodium content per 100 g

Food Item	Sodium (mg)	Answer	Corresponding Code
Chicken with skin (roasted, light meat)	75	Low	3
Chicken without skin (roasted, light meat)	77	Low	3
Fried fish (battered, low fat fish, fried in sunflower oil)	85	Low	3
Fish: steamed, grilled or braid (low fat)	105	Low	3
Tinned fish (Pilchards in tomato sauce)	370	Medium	2
Vienna's, Russians or frankfurters (incl. Salami)	1860	High	1
Cold Meat (Ham, cooked/canned, 19% fat)	1365	High	1
Bacon (fried with fat)	1596	High	1
Organ Meat (Liver, chicken, cooked)	51	Low	3
Eggs: boiled or poached	126	Medium	2
Eggs: scrambled, fried, omelettes (fried in sunflower oil)	124	Medium	2
Baked beans, sugar beans, dried beans (baked beans in tomato sauce)	397	Medium	2

Table 3.3 (continued): Classification of processed meat, meat and meat alternatives according to sodium content per 100g

Food Item	Sodium (mg)	Answer	Corresponding Code
Soya mince	0,4	Low	1
Lentils, split peas (Split Peas cooked)	2	Low	1
Peanut Butter	478	Medium	2
Pizza	570	Medium	2
Pies, sausage rolls (commercial meat pie – flaky pastry	429	Medium	2
Kentucky Fried Chicken	292	Medium	2
Nando's	360	Medium	2
Chicken Lickin, Chicken King	292	Medium	2
Bunny Chow	278	Medium	2
Hot dogs	722	High	3
Beef burgers	240	Medium	2
Chicken burgers	771	High	3

In terms of classifying processed meat, meat and meat alternatives, the guidelines provided by the DOH (2014) were used. Food can be classified as low in fat if it contains 3 g or less of fat per 100 g. According to the Food Standards Agency (2010), a fat content of greater than 20 g per 100 g of food is considered high. For the purpose of this study, a medium fat content was classified as between 3-20 g.

Table 3.4: Classification of fat content per 100 g in processed meat, meat and meat alternatives

Per 100 g	Low	Medium	High
Fat	3 g or less	3-20 g	20 g or more

Based on the above classification, processed meat, meat and meat alternatives were classified as follows:

Table 3.5: Classification of processed meat, meat and meat alternatives according to fat content per 100g

Food Item	Fat (g)	Answer	Corresponding Code
Beef (fillet, grilled)	17.2	Medium	2
Boerewors (beef or pork)	26.3	High	1
Mutton (lion chop, grilled, with fat)	23.1	High	1
Pork (lion chop, grilled, with fat)	27.2	High	1
Chicken with skin (roasted, light meat)	10.9	Medium	2
Chicken without skin (roasted, light meat)	4.5	Medium	2
Fried fish (battered, low fat fish, fried in sunflower oil)	11.6	Medium	2
Fish: steamed, grilled or braided (low fat)	1.3	Low	3
Tinned fish (Pilchards in tomato sauce)	5.4	Medium	2
Vienna's, Russians or frankfurters (incl. Salami)	34.4	High	1
Cold Meat (Ham, cooked/canned, 19% fat)	18.8	Medium	2
Bacon (fried with fat)	49.2	High	1

Table 3.5 (continued): Classification of processed meat, meat and meat alternatives according to fat content per 100 g

Food Item	Fat (g)	Answer	Corresponding Code
Organ Meat (Liver, chicken, cooked)	5.5	Medium	2
Eggs: boiled or poached	10.3	Medium	2
Eggs: scrambled, fried, omelettes (fried in sunflower oil)	15.2	Medium	2
Baked beans, sugar beans, dried beans (baked beans in tomato sauce)	0.5	Low	3
Soya mince	1.1	Low	3
Lentils, split peas (Split Peas cooked)	0.4	Low	3
Peanut Butter	50.0	High	1
Pizza	11.8	Medium	2
Pies, sausage rolls (commercial meat pie – flaky pastry)	29.3	High	1
Kentucky Fried Chicken	17.4	Medium	2
Nando's	10.5	Medium	2
Chicken Lickin, Chicken King	17.4	Medium	2
Bunny Chow	6.8	Low	1
Hot dogs	13.5	Medium	2
Beef burgers	12.6	Medium	2
Chicken burgers	13.2	Medium	2

According to WHO (2017c), fast foods, processed foods and fried foods are not considered as being part of a healthy diet. Foods high in salt and fat are also classified as ‘unhealthy’ (Vorster *et al.*, 2013). Hence, the following processed meat, meat and meat alternatives were classified using a combination of both sources.

Table 3.6: Classification of processed meats, meat and meat alternatives according to probable effect on health

Food Item	Answer	Corresponding Code
Beef (fillet, grilled)	Healthy	1
Boerewors (beef or pork)	Unhealthy	2
Mutton (lion chop, grilled, with fat)	Unhealthy	2
Pork (lion chop, grilled, with fat)	Unhealthy	2
Chicken with skin (roasted, light meat)	Healthy	1
Chicken without skin (roasted, light meat)	Healthy	1
Fried fish (battered, low fat fish, fried in sunflower oil)	Healthy	1
Fish: steamed, grilled or braid (low fat)	Healthy	1
Tinned fish (Pilchards in tomato sauce)	Healthy	1
Vienna’s, Russians or frankfurters (incl. Salami)	Unhealthy	2
Cold Meat (Ham, cooked/canned, 19% fat)	Unhealthy	2
Bacon (fried with fat)	Unhealthy	2
Organ Meat (Liver, chicken, cooked)	Healthy	1
Eggs: boiled or poached	Healthy	1
Eggs: scrambled, fried, omelettes (fried in sunflower oil)	Healthy	1

Table 3.6 (continued): Classification of processed meats, meat and meat alternatives according to probable effect on health

Food Item	Answer	Corresponding Code
Baked beans, sugar beans, dried beans (baked beans in tomato sauce)	Healthy	1
Soya mince	Healthy	1
Lentils, split peas (Split Peas cooked)	Healthy	1
Lentils, split peas (Split Peas cooked)	Healthy	1
Pizza	Unhealthy	2
Pies, sausage rolls (commercial meat pie – flaky pastry)	Unhealthy	2
Kentucky Fried Chicken	Unhealthy	2
Nando's	Unhealthy	2
Chicken Lickin, Chicken King	Unhealthy	2
Bunny Chow	Unhealthy	2
Hot dogs	Unhealthy	2
Beef burgers	Unhealthy	2
Chicken burgers	Unhealthy	2

3.4.2 Data Collection

Prospective participants were recruited by means of convenience sampling on the Pietermaritzburg campus of UKZN. Six trained post-graduate dietetic students were used as Research Assistants to recruit prospective eligible participants to complete the self-administered questionnaire. Participants were provided with a clipboard if found to be eligible and willing to participate. Data was not collected in a central venue but on campus (i.e. in a corridor or in a common space).

3.5 Pilot Study

A pilot study was conducted on 5% of the study sample (n=13) in accordance to the guidelines proposed by Viechtbauer *et al.*, (2015). A pilot study was conducted to test the questionnaire for clarity of questions, assess if the questionnaire was easy to use as a self-administered questionnaire and to determine any problems that may occur in the administration thereof (Van Teijlingen & Hundley, 2001). No areas of concern were noted during the pilot study. As a result, no changes to the research instrument were necessary before data collection commenced.

3.6 Variables included in the study, data capturing and statistical analysis

The data collected, captured and analysed using the IBM Statistical Package for the Social Sciences (SPSS) version 24. The relationship between the variables and the study objectives were analysed using descriptive and inferential statistics.

Table 3.7: Variables included in the study, data capturing and statistical analysis

Objectives	Variables required for the analysis	Statistical tests that were conducted
Socio-demographic	<ul style="list-style-type: none">• Gender• Age• Race• College• Year of study• Residence during term	<ul style="list-style-type: none">• Frequency distribution
Factors influencing consumption and purchase	<ul style="list-style-type: none">• Financial aid or bursary• Allowance• Finance received• Source of additional finance• Monthly expenditure	<ul style="list-style-type: none">• Frequency distributions

Table3.7 (continued): Variables included in the study, data capturing and statistical analysis

Objectives	Variables required for the analysis	Statistical tests that were conducted
Factors influencing consumption and purchase (continued)	<ul style="list-style-type: none"> • Cooking facilities • Use of cooking facilities • Cooking skills • Frequency of cooking • Preparation of meals if a healthy and affordable cookbook was available • Factors relating to food purchases 	
Consumption of processed meat and healthier, more affordable sources	<ul style="list-style-type: none"> • Frequency of consumption of food types 	<ul style="list-style-type: none"> • Frequency distribution
Nutrition knowledge	<ul style="list-style-type: none"> • Foods high or low in protein • Foods high or low in salt • Foods high or low in fat • Healthy sources of protein 	<ul style="list-style-type: none"> • Frequency distribution

3.7 Data quality control

3.7.1 Reliability

Reliability refers to the consistency and repeatability of the study as well as the degree in which the study is void of measurement error (Babbie & Mouton, 2008; Katzenellenbogen & Joubert, 2007; Simply Psychology, 2013). The internal reliability of a study can be determined using the Cronbach's alpha (α). If the reliability coefficient is closer to one, then it would be more reliable when compared to the coefficient being closer to zero (Tavakol & Dennick, 2011).

To increase reliability, a pilot test was conducted to ensure that the questionnaire was not ambiguous. In this study, reliability was ensured by using trained dietetic students as field workers that were able to assist participants when completing the self-administered questionnaire. The reliability of the questionnaire was ensured by developing a comprehensive theoretical framework on the concepts to include in the research instrument in accordance with the available literature. Reliability was also ensured by developing the questionnaire based on relevant published literature as well as expert input provided by the study supervisors (Mchiza *et al.*, 2015; Block *et al.*, 1990).

3.7.2 Validity

Validity refers to the accuracy, meaningfulness, consistency and relevance of the study. Validity ensures that the research instruments measures what it claims to measure, as well as accurately reflecting the theory (Simply Psychology, 2013; Babbie & Mouton, 2008; Katzenellenbogen & Joubert, 2007). Construct, concept and face validity were achieved by ensuring that the questionnaire could provide answers to the study objectives that were outlined. Pilot testing, a thorough theoretical framework and expert input from the study supervisor ensured construct, content and face validity of the research instrument used in this study.

3.8 Reduction of bias

Bias is defined as 'systematic error introduced into sampling or testing by selecting or encouraging one outcome or answer over others' (Merriam-Webster, 2017). Potential biases that could occur in this study included selection bias, recall bias and participation bias. Selection bias may occur when participants are selected by personal preference and not at random. Recall bias occurs when information is falsely reported such as under- or over-estimating food frequency. Participation bias occurs when not all the participants agree to participate or when records are missing. (Shuttleworth, 2009; Tripepi *et al.*, 2008; Silman & Macfarlane, 2002).

Bias was reduced by approaching students that met the inclusion criteria (See 1.5.1). In addition, research assistants were trained to provide assistance to participants

while completing the research questionnaire without influencing participant's responses. The questionnaire was reviewed by an expert to ensure clarity. The participants were not rushed in answering the questionnaire. It is assumed that participants answered honestly, therefore, assuming response bias was reduced.

3.9 Ethical Consideration

Ethical approval was obtained from the Humanities and Social Sciences Research Ethics Committee of the University of KwaZulu-Natal, reference number HSS/0130/017M (Appendix C). Eligible participants, who were willing to participate, had to read and sign an informed consent form before participating in the study (Appendix B). Participation in the study was voluntary and participants could withdraw from the study at any time without negative consequences. Participant anonymity and confidentiality was ensured by the allocation of a code to each data set.

3.10 Conclusion

A cross-sectional descriptive study was conducted to determine the consumption of processed meat, meat and meat alternatives and related factors affecting their purchase and consumption amongst undergraduate students at UKZN, Pietermaritzburg campus. Prospective participants were selected by means of convenience sampling. A self-administered questionnaire (Appendix A) was developed. This consisted of socio-demographic questions, socio-economic questions, a section that was in the form of an adapted non-quantified food frequency questionnaire and lastly, a nutrition knowledge questionnaire section. Reliability and validity of the data were ensured as well as the reduction of bias. Ethics approval to conduct this study was obtained from the Humanities and Social Sciences Ethics Research Committee at UKZN.

Chapter 4 will present the results in accordance to the study objectives that were presented in chapter 1.

CHAPTER 4: RESULTS

4.1 Introduction

In this chapter the results of the study are reported in accordance to the study objectives that were stated in chapter one. The data was analysed using SPSS version 24.

4.2 Results

4.2.1 Characteristics of study sample

Table 4.1 presents the socio-demographic characteristics of the study sample.

Table 4.1: Socio-demographic characteristics of study sample (N=189)

Variable	Standard deviation / % (n)
Gender:	
• Female	45% (n=85)
• Male	55% (n=105)
Age (years):	
Mean \pm std. deviation	20.5 \pm 2.2
Race	
• Black	72% (n=136)
• White	4.2% (n=8)
• Coloured	5.3% (n=10)
• Indian	18.5% (n=35)

Table 4.1 (continued): Socio-demographic characteristics of study sample (N=189)

Variable	Standard deviation / % (n)
College	
• Humanities	29.6% (n=56)
• Agriculture, Engineering and Science	34.3% (n=65)
• Law and Management Studies	32.8% (n=62)
• Health Sciences	2.6% (n=5)
• Missing	0.5% (n=1)
Years registered as an undergraduate student	
• 1	25.4%(n=48)
• 2	25.9% (n=49)
• 3	30.2% (n=57)
• 4	15.3% (n=29)
• >4	2.6% (n=5)
• Missing	0.5% (n=1)
Residence during term time	
• Off campus, with family	37.6% (n=71)
• Off campus, with friends/other students	25.9% (n=49)
• Off campus, alone	9.5% (n=18)
• Student residence	27.0% (n=51)

Table 4.1 shows that more participants were male. The mean age of the participants is 20.52 ± 2.17 . The majority of the participants were black, and majority of students were from the Agriculture, Engineering and Science College followed closely by Law and Management College. 30.2% of the participants were in their third year of study.

Over a third (37.6%) of participants lived at home with their family followed by living in student accommodation (27.0%).

4.2.2 Socio-economic characteristics

Table 4.2 presents the socio-economic characteristics of the participants. More than half of the participants were on a financial aid or a bursary (54%) and received additional financial assistance (50.8%). The most common (19.6%) allowance received was R500 – R1000 followed by R1000-R1500 (15.3%). More than a third (38.6%) of the participants received financial assistance from parents.

Table 4.2: Socio-economic characteristics of study sample

Variable	% (n)
On financial aid/bursary	
• Yes	54.0% (n=102)
• No	44.4% (n=84)
• Missing	1.6% (n=3)
Receiving allowance or any other additional financial assistance	
• Yes	50.8% (n=96)
• No	48.1% (n=91)
• Missing	1.1% (n=2)
Allowance received per month	
• R0-100	2.6% (n=5)
• R100-500	11.1% (n=21)
• R500-1000	19.6% (n=37)

Table 4.2 (continued): Socio-economic characteristics of study sample

Variable	% (n)
Allowance received per month (continued)	
• R1000-1500	15.3% (n=29)
• R1500-2000	3.7% (n=7)
• R2000-2500	2.6% (n=5)
• >R2500	6.9% (n=13)
• Missing	38.1% (n=72)
Source of additional financial assistance	
• Parents	38.6% (n=73)
• Guardian	5.3% (n=10)
• Sibling	2.1% (n=4)
• Grandparents	1.6% (n=3)
• Friends	0.5% (n=1)
• Partner	0.5% (n=1)
• Part time work	7.9% (n=15)
• Other	5.8% (n=11)
• Missing	37.6% (n=71)
Sources of other income	
• UKZN	0.5%(n=1)
• Family (as a whole and unspecified)	1.1% (n=2)
• Business owner	0.5% (n=1)
• Child support grant	0.5% (n=1)

Table 4.2 (continued): Socio-economic characteristics of study sample

Variable	%(n)
Sources of other income (continued)	
• Bursary	1.1% (n=2)
• NSFAS	1.6% (n=3)

Table 4.3 shows rent was the highest expense amongst students followed by campus fees, money sent home and then food being the fourth highest expense.

Table 4.3: Amount of money spent per month by the study sample

Variable	Mean ± Std. deviation
Amount of money spent in Rands per month	
Student rent per month	2036.27 ± 569.48
Parties, alcohol or eating with friends	440.11 ± 414.69
Related to normal personal purchase of food	673.95 ± 544.38
Student travelling expenses per month	498.41 ± 573.97
Students purchase of clothes per month	512.77 ± 539.80
Student purchase of toiletries per month	222.98 ± 212.06
Varsities extras such as duplications	116.89 ± 127.03
Student's monthly savings	100.00
Money sent home	1500.00
Campus fees	2250.00 + 353.55

4.2.3 Cooking facilities and cooking skills

Table 4.3 depicts the cooking facilities available to participants, as well as how frequently the participants cook and how they rate their cooking skills. Table 4.3 also depicts the frequency of participants that would prepare healthy and affordable meals if the participants had a recipe book.

Table 4.4: Cooking facilities available and the frequency and cooking skills of participants

Variables	% (n)
Access to cooking facilities	
• No	4.8% (n=9)
• Yes	95.2% (n=180)
If no cooking facilities, would subject use it if they had	
• No	22.2% (n=2)
• Yes	44.4% (n=4)
• Missing	33.3% (n=3)
If cooking facilities available, does subject use them	
• No	3.9% (n=7)
• Yes	91.7% (n=165)
• Missing	4.4% (n=8)

Table 4.4 (continued): Cooking facilities available and the frequency and cooking skills of participants

Variables	% (n)
Rating of cooking skills	
• Excellent	18.5% (n=35)
• Good	40.7% (n=77)
• Average	31.7% (n=60)
• Bad	7.9% (n=15)
• Missing	1.1% (n=2)
Frequency of subject preparing food	
• Daily	18.0% (n=34)
• 5-6 times/week	10.1% (n=19)
• 3-4 times/week	27.0% (n=51)
• 1-2 times/week	39.2% (n=74)
• Never	5.3% (n=10)
• Missing	0.5% (n=1)

Table 4.4 (continued): Cooking facilities available and the frequency and cooking skills of participants

Variables	% (n)
Would participant prepare meals if they had a recipe book of healthy and affordable meals	
• No	13.8% (n=26)
• Yes	85.2% (n=161)
• Missing	1.1% (n=2)

Table 4.4 illustrates that majority of the participants had access to cooking facilities (95.2%). Only 44.4% of the participants who did not have cooking facilities would use them if they had. Most of the participants (91.7%) use the cooking facilities available to them. 40.7% of the participants rated their cooking skills as 'good', while 39.3% of participants only cook once or twice a week. Majority (85.3%) of participants would use a recipe book with healthy and affordable meals if they had one.

4.2.4 Food frequency

Table 4.5 represents the frequency of consumption of meat and meat alternatives by the participants in relation to the response options provided.

Table 4.5 shows that 37.0% of the participants ate beef one to three times a month followed by 20.1% once a week. Just under a third never ate boerewors or ate it once a month (31.7%) and one to three times a month (29.6%). Just under half (42%) never ate or ate mutton less than a month. Pork was never eaten or eaten less than a month by more than half of the participants (53.4%). Chicken with skin was split between never or eating less than once a month (28.6%) and two to four times a month (28.6). More participants ate chicken without skin compared to chicken with skin two to four times a month (36.0%). Fried fish and fish steamed or grilled were mostly never eaten or eaten less than a month by 48.7% and 56.1% of the

Table 4.5: Frequency of consumption of meat, processed meat and meat alternatives

	Never/ < once a month	1-3 times a month	Once a week	2-4 times a week	Once a day	2-3 times a day	4-5 times a day	>6 times a day	Missing
Meat, fish and chicken									
Beef	18.5% (n=35)	37.0% (n=70)	20.1% (n=38)	19.0% (n=36)	3.2% (n=6)	0% (n=0)	0.5% (n=1)	0% (n=0)	1.6% (n=3)
Boerewors	31.7% (n=60)	29.6% (n=56)	19.6% (n=37)	12.7% (n=24)	1.6% (n=3)	2.1% (n=4)	0% (n=0)	0% (n=0)	2.6% (n=5)
Pork	53.4% (n=101)	23.8% (n=45)	12.7% (n=24)	4.2% (n=8)	0% (n=0)	1.6% (n=3)	0% (n=0)	0% (n=0)	4.2% (n=8)
Chicken without skin	22.8% (n=43)	12.2% (n=23)	17.5% (n=33)	36.0% (n=68)	3.7% (n=7)	1.6% (n=3)	1.1% (n=2)	0.5% (n=1)	4.8% (n=9)
Fish: steamed, grilled or braaied	56.1% (n=106)	22.8% (n=43)	9.0% (n=17)	8.5% (n=16)	2.1% (n=4)	0.5% (n=1)	0% (n=0)	0% (n=0)	1.1% (n=2)

Table 4.5 (continued): Frequency of consumption of meat, processed meat and meat alternatives

	Never/ <once a month	1-3 times a month	Once a week	2-4 times a week	Once a day	2-3 times a day	4-5 times a day	>6 times a day	Missing
Tinned Fish (tuna, pilchards, sardines, salmon)	38.6% (n=73)	24.9% (n=47)	18.5% (n=35)	12.2% (n=23)	2.1% (n=4)	1.6% (n=3)	1.1% (n=2)	0% (n=0)	1.1% (n=2)
Cold meat (polony, ham, salami)	22.8% (n=43)	21.7% (n=41)	12.2% (n=23)	21.7% (n=41)	11.1% (n=21)	6.3% (n=12)	1.1% (n=2)	0.5% (n=1)	2.6% (n=5)
Organ meat (liver, kidney, tripe)	47.6% (n=90)	25.4% (n=48)	11.6% (n=22)	8.5% (n=16)	2.6% (n=5)	1.6% (n=3)	0% (n=0)	0% (n=0)	2.6% (n=5)
Eggs: scrambled, fried, omelettes	18% (n=34)	14.3% (n=27)	12.7% (n=24)	30.2% (n=57)	12.7% (n=24)	6.9% (n=13)	2.1% (n=4)	1.6% (n=3)	1.6% (n=3)
Legumes									
Baked beans, sugar beans, dried beans	17.5% (n=33)	21.7% (n=41)	27.5% (n=52)	26.5% (n=50)	2.1% (n=4)	1.6% (n=3)	0.5% (n=1)	1.6% (n=3)	1.1% (n=2)
Lentils, split peas	58.2% (n=110)	18.5% (n=35)	8.5% (n=16)	9% (n=17)	1.6% (n=3)	0.5% (n=1)	0.5% (n=1)	0% (n=0)	3.2% (n=6)

Table 4.5 (continued): Frequency of consumption of meat, processed meat and meat alternatives

	Never/ <once a month	1-3 times a month	Once a week	2-4 times a week	Once a day	2-3 times a day	4-5 times a day	>6 times a day	Missing
Nuts									
Peanut butter	43.9%	16.4%	8.5%	16.4%	4.8%	4.8%	2.1%	1.6%	1.6%
	(n=83)	(n=31)	(n=16)	(n=31)	(n=9)	(n=9)	(n=4)	(n=3)	(n=3)
Fast food and take-aways									
Pizza	28.6%	45.5%	10.6%	10.1%	1.1%	1.1%	2.1%	0%	1.1%
	(n=54)	(n=86)	(n=20)	(n=19)	(n=2)	(n=2)	(n=4)	(n=0)	(n=2)
Pies and sausage rolls	26.5%	42.3%	12.7%	11.1%	3.2%	0.5%	0.5%	0%	3.2%
	(n=50)	(n=80)	(n=24)	(n=21)	(n=6)	(n=1)	(n=1)	(n=0)	(n=6)
Kentucky Fried Chicken	38.1%	42.9%	11.1%	5.3%	1.1%	0%	0.5%	0%	1.1%
	(n=72)	(n=81)	(n=21)	(n=10)	(n=2)	(n=0)	(n=1)	(n=0)	(n=2)

Table 4.5 (continued): Frequency of consumption of meat, processed meat and meat alternatives

	Never/ <once a month	1-3 times a month	Once a week	2-4 times a week	Once a day	2-3 times a day	4-5 times a day	>6 times a day	Missing
Nando's	48.7% (n=92)	35.4% (n=67)	9.0% (n=17)	3.2% (n=6)	1.1% (n=2)	0% (n=0)	0.5% (n=1)	0% (n=0)	2.1% (n=4)
Chicken Lickin, Chicken King	63.5% (n=120)	25.9% (n=49)	4.8% (n=9)	2.6% (n=5)	1.1% (n=2)	0% (n=0)	0.5% (n=1)	0% (n=0)	1.6% (n=3)
Bunny Chow	64.9% (n=122)	20.6% (n=39)	6.3% (n=12)	4.2% (n=8)	1.1% (n=2)	0% (n=0)	0% (n=0)	0% (n=0)	2.1% (n=4)
Hot dogs	48.7% (n=92)	27.5% (n=52)	16.4% (n=31)	2.6% (n=5)	2.6% (n=5)	0% (n=0)	0% (n=0)	0% (n=0)	2.1% (n=4)

Table 4.5 (continued): Frequency of consumption of meat, processed meat and meat alternatives

	Never/ <once a month	1-3 times a month	Once a week	2-4 times a week	Once a day	2-3 times a day	4-5 times a day	>6 times a day	Missing
Beef burgers: McDonalds, Steers, Wimpy, Spur etc	34.4% (n=65)	41.3% (n=78)	11.6% (n=22)	5.3% (n=10)	1.6% (n=3)	3.7% (n=7)	0.5% (n=1)	0.5% (n=1)	1.1% (n=2)
Chicken Burgers	38.6% (n=73)	40.7% (n=77)	12.2% (n=23)	5.3% (n=10)	1.6% (n=3)	0% (n=0)	0.5% (n=1)	0.5% (n=1)	0.5 (n=1)

participants respectively. Vienna's and cold meats consumption was more spread out with 21.7% eating these processed meats two to four times a week. This was the second highest frequency for both after 'never or less than a month' with 28% and 22.8% respectively. Bacon and organ meat both had just under half of participants (44.4% and 47.6% respectively) eating it never or less than once a month. Scrambled egg, fried eggs or omelettes were eaten by 30.2% of the participants two to four times a week which was more than boiled or poached eggs with only 23.3%. Consumption of beans was spread with 21.7% eating one to three times a month, 27.5% eating once a week and 26.5% eating two to four times a week. Soya mince and peanut butter were eaten by just under half the participants (48.1% and 43.9% respectively) less than once a month or never while split peas were eaten just over half the participants (58.2) less than once a month or never. With regards to the fast food and takeaways, the majority were eaten never or less than a month and one to three times a month. Nando's (48.7%), Chicken Lickin (63.5%), bunny chow (64.6%), hot dogs (48.7%) were the leading frequency for consuming never or less than once a month. Pizza (45.5%), pies (42.3%), KFC (42.9%), beef burgers (41.3%) and chicken burgers (40.7%) were consumed one to three times a month by most of the participants.

4.2.5 Factors affecting food purchasing

Table 4.6 depicts the factors affecting the participants' food purchasing in relation to the response options provided. Price was considered the most likely factor by 35.4% of the participants followed closely by taste with 34.9%. Convenience was considered most likely by 18.5%, closely followed by nutrition and health (18.0%). Availability was considered the most likely by the least participants with only 15.9%. Nearly a quarter (24.9%) of the participants chose not to answer this question.

Table 4.6: Factors affecting the participants' food purchasing decisions

Variable	% (n)
Price	
• Most likely	35.4% (n=67)
• Likely	9.5% (n=18)
• Average	14.3% (n=27)
• Less Likely	5.3% (n=10)
• Least likely	10.1% (n=19)
• Missing	25.4% (n=48)
Nutrition/Health	
• Most likely	18.0% (n=34)
• Likely	16.9% (n=32)
Nutrition/Health (continued)	
• Average	16.4% (n=31)
• Less Likely	11.6% (n=22)
• Least likely	12.2% (n=23)
• Missing	24.9% (n=47)
Availability	
• Most likely	15.9% (n=30)
• Likely	15.9% (n=30)
• Average	15.9% (n=30)
• Less Likely	10.6% (n=20)

Table 4.6 (continued): Factors affecting the participants' food purchasing decisions

Variable	% (n)
• Least likely	16.9% (n=32)
• Missing	24.9% (n=47)
Taste	
• Most likely	34.9% (n=66)
• Likely	12.2% (n=23)
• Average	12.7% (n=24)
• Less Likely	8.5% (n=16)
• Least likely	6.9% (n=13)
• Missing	24.9% (n=47)
Convenience	
• Most likely	18.5% (n=35)
• Likely	12.2% (n=23)
• Average	16.4% (n=31)
• Less Likely	11.6% (n=22)
• Least likely	16.4% (n=31)
• Missing	24.9 (n=47)

4.2.6 Nutrition knowledge

Table 4.7 depicts the participants' knowledge of protein the content of meat, processed meat and meat alternatives in relation to the response options provided in the questionnaire.

Table 4.7: Participants' knowledge regarding the protein content of meat, processed meat and meat alternatives

Food item	High	Medium	Low	Not sure	Missing
Meat, fish and chicken					
Beef	61.9% (n=117)	23.8% (n=45)	7.9% (n=15)	6.3% (n=12)	0% (n=0)
Boerewors	31.2% (n=59)	33.9% (n=64)	23.8% (n=45)	11.1% (n=21)	0% (n=0)
Mutton	38.6% (n=73)	33.9% (n=64)	14.8% (n=28)	12.2% (n=23)	0.5% (n=1)
Pork	34.4% (n=65)	32.3% (n=61)	13.8% (n=26)	15.3% (n=29)	4.2% (n=8)
Chicken with skin	51.3% (n=97)	29.1% (n=55)	8.5% (n=16)	9% (n=17)	2.1% (n=4)
Chicken without skin	36% (n=68)	34.4% (n=65)	18% (n=34)	10.1% (n=19)	1.6% (n=3)
Fried fish in any fat or oil with or without batter or crumbs	43.9% (n=83)	30.2% (n=57)	13.2% (n=25)	10.6% (n=20)	2.1% (n=4)

Table 4.7 (continued): Participants' knowledge regarding the protein content of meat, processed meat and meat alternatives

Food item	High	Medium	Low	Not sure	Missing
Fish: steamed, grilled or braaied	55.6% (n=105)	16.4% (n=31)	11.6% (n=22)	12.2% (n=23)	4.2% (n=8)
Tinned Fish (tuna, pilchards, sardines, salmon)	45.5% (n=86)	26.5% (n=50)	7.9% (n=15)	18.5% (n=35)	1.6% (n=3)
Vienna's, Russians or Frankfurters	14.3% (n=27)	27% (n=51)	36.5% (n=69)	20.6% (n=39)	1.6% (n=3)
Cold meat (polony, ham, salami)	18% (n=34)	33.3% (n=63)	28% (n=53)	20.1% (n=38)	0.5% (n=1)
Bacon	24.9% (n=47)	29.6% (n=56)	18.5% (n=35)	21.7% (n=41)	5.3% (n=10)
Organ meat (liver, kidney, tripe)	46% (n=87)	24.3% (n=46)	11.6% (n=22)	16.4% (n=31)	1.6% (n=3)
Eggs: boiled or poached	76.2% (n=144)	12.2% (n=23)	6.3% (n=12)	5.3% (n=10)	0% (n=0)

Table 4.7 (continued): Participants' knowledge regarding the protein content of meat, processed meat and meat alternatives

Food item	High	Medium	Low	Not sure	Missing
Eggs: scrambled, fried, omelettes	49.2% (n=93)	28.6% (n=54)	14.3% (n=27)	7.9% (n=15)	0% (n=0)
Legumes					
Baked beans, sugar beans, dried beans	49.7% (n=94)	19.6% (n=37)	13.8% (n=26)	14.3% (n=27)	2.6% (n=5)
Fast food and takeaways					
Pizza	4.2% (n=8)	15.9% (n=30)	52.9% (n=100)	24.9% (n=47)	2.1% (n=4)
Pies and sausage rolls	7.4% (n=14)	14.3% (n=27)	49.7% (n=94)	24.3% (n=46)	4.2% (n=8)
Kentucky Fried Chicken	12.7% (n=24)	24.3% (n=46)	42.3% (n=80)	15.3% (n=29)	5.3% (n=10)
Nando's	14.8% (n=28)	30.7% (n=58)	34.9% (n=66)	17.5% (n=33)	2.1% (n=4)

Table 4.7 (continued): Participants' knowledge regarding the protein content of meat, processed meat and meat alternatives

Food item	High	Medium	Low	Not sure	Missing
Chicken Lickin, Chicken King	13.8% (n=26)	23.8% (n=45)	40.2% (n=76)	18% (n=34)	3.7% (n=7)
Bunny Chow	6.3% (n=12)	19.0% (n=36)	45.0% (n=85)	27.5% (n=52)	2.1% (n=4)
Hot dogs	7.9% (n=15)	18.0% (n=34)	48.1% (n=91)	21.1% (n=40)	4.8% (n=9)
Beef burgers: McDonalds, Steers, Wimpy, Spur etc	13.2% (n=25)	22.2% (n=42)	40.2% (n=76)	22.8% (n=43)	1.6% (n=3)
Chicken Burgers	16.4% (n=31)	30.7% (n=58)	32.8% (n=62)	19.0% (n=36)	1.1% (n=2)

The answers regarding beef, mutton, pork, chicken with skin, chicken without, fried fish, fish (steamed, grilled, braaied), tinned fish, organ meat and eggs were answered the most correctly by the participants. Just under a third (31.2%) of participants got the answers correct regarding boerewors. With regards to processed meat (vienna's, cold meat and bacon were answered incorrectly by most of the participants with only 14.3%, 24.9% and 24.9% respectively answering correctly. Only 13.8% of the participants answered the protein content of baked beans correctly. All the answers regarding fast foods and takeaways were answered incorrectly by majority of the participants showing poor nutrition knowledge regarding protein content.

Table 4.8 depicts the participants' knowledge of salt content of meat, processed meat and meat alternatives in relation to the response options provided in the questions.

Table 4.8 shows that most of the participants answered incorrectly with regards to the salt content of meat, processed meat and meat alternatives. However, most participants were correct with regards to boerewors (47.1%), steamed, grilled or braid fish, viennas (43.4%), cold meat (41.8%), bacon (45.5%) and hot dogs (34.4%). These participants' knowledge was mostly poor except where processed meats were concerned.

Table 4.9 presents the participants' knowledge of the fat content of meat, processed meat and meat alternatives in relation to the response options provided in the questionnaire.

Table 4.8: Participants' knowledge regarding the salt content of meat, processed meat and meat alternatives

Food item	High	Medium	Low	Not sure	Missing
Meat, fish and chicken					
Beef	21.2% (n=40)	42.9% (n=81)	24.3% (n=46)	9.5% (n=18)	2.1% (n=4)
Boerewors	47.1% (n=89)	31.2% (n=59)	7.4% (n=14)	12.7% (n=24)	1.6% (n=3)
Mutton	14.3% (n=27)	41.8% (n=79)	24.3% (n=46)	16.9% (n=32)	2.6% (n=5)
Pork	24.9% (n=47)	36.5% (n=69)	15.3% (n=29)	20.6% (n=39)	2.6% (n=5)
Chicken with skin	19.0% (n=36)	32.8% (n=62)	25.4% (n=48)	19.0% (n=36)	3.7% (n=7)
Chicken without skin	6.3% (n=12)	31.2% (n=59)	41.3% (n=78)	17.5% (n=33)	3.7% (n=7)
Fried fish in any fat or oil with or without batter or crumbs	33.3% (n=63)	30.2% (n=57)	18.5% (n=35)	15.9% (n=30)	2.1% (n=4)

Table 4.8 (continued): Participants' knowledge regarding the salt content of meat, processed meat and meat alternatives

Food item	High	Medium	Low	Not sure	Missing
Fish: steamed, grilled or braaied	23.8% (n=45)	27.0% (n=51)	31.2% (n=59)	14.8% (n=28)	3.2% (n=6)
Tinned Fish (tuna, pilchards, sardines, salmon)	32.8% (n=62)	31.7% (n=60)	16.4% (n=31)	14.8% (n=48)	4.2% (n=8)
Vienna's, Russians or Frankfurters	43.4% (n=82)	27.5% (n=52)	11.1% (n=21)	14.3% (n=27)	3.7% (n=7)
Cold meat (polony, ham, salami)	41.8% (n=79)	23.8% (n=45)	17.5% (n=33)	13.8% (n=26)	3.2% (n=6)
Bacon	45.5% (n=86)	20.6% (n=39)	7.4% (n=14)	19.0% (n=36)	7.4% (n=14)
Organ meat (liver, kidney, tripe)	10.1% (n=19)	36.0% (n=68)	33.9% (n=64)	16.9% (n=32)	3.2% (n=6)
Eggs: boiled or poached	4.8% (n=9)	21.2% (n=40)	57.1% (n=108)	13.2% (n=25)	3.7% (n=7)

Table 4.8 (continued): Participants' knowledge regarding the salt content of meat, processed meat and meat alternatives

Food item	High	Medium	Low	Not sure	Missing
Eggs: scrambled, fried, omelettes	12.7% (n=24)	33.3% (n=63)	35.4% (n=67)	14.3% (n=27)	4.2% (n=8)
Legumes					
Baked beans, sugar beans, dried beans	7.9% (n=15)	24.9% (n=47)	45.5% (n=86)	18.0% (n=34)	3.7% (n=7)
Fast food and takeaways					
Pizza	44.4% (n=84)	25.4% (n=48)	13.2% (n=25)	13.8% (n=26)	3.2% (n=6)
Pies and sausage rolls	47.1% (n=89)	30.2% (n=57)	6.9% (n=13)	12.2% (n=23)	3.7% (n=7)
Kentucky Fried Chicken	63.5% (n=120)	16.4% (n=31)	8.5% (n=16)	8.5% (n=16)	3.2% (n=6)
Nando's	48.7% (n=92)	28.6% (n=54)	8.5% (n=16)	10.6% (n=20)	3.7% (n=7)

Table 4.8 (continued): Participants' knowledge regarding the salt content of meat, processed meat and meat alternatives

Food item	High	Medium	Low	Not sure	Missing
Chicken Lickin, Chicken King	60.8% (n=115)	21.2% (n=40)	4.2% (n=8)	11.1% (n=21)	2.6% (n=5)
Bunny Chow	39.2% (n=74)	24.9% (n=47)	11.6% (n=22)	20.1% (n=38)	4.2% (n=8)
Hot dogs	34.4% (n=65)	33.3% (n=63)	12.2% (n=23)	18.0% (n=34)	2.1% (n=4)
Beef burgers: McDonalds, Steers, Wimpy, Spur etc.	44.4% (n=84)	30.2% (n=57)	9.0% (n=17)	14.3% (n=27)	2.1% (n=4)
Chicken Burgers	30.7% (n=58)	40.7% (n=77)	7.9% (n=15)	16.9% (n=32)	3.7% (n=7)

Table 4.9: Participants' knowledge regarding the fat content of meat, processed meat and meat alternatives

Food item	High	Medium	Low	Not sure	Missing
Meat, fish and chicken					
Beef	40.2% (n=76)	47.1% (n=89)	7.9% (n=15)	4.2% (n=8)	0.5% (n=1)
Boerewors	68.3% (n=129)	24.3% (n=46)	2.6% (n=5)	3.7% (n=7)	1.1% (n=2)
Mutton	49.2% (n=93)	35.4% (n=67)	6.3% (n=12)	7.9% (n=15)	1.1% (n=2)
Pork	69.3% (n=131)	18.0% (n=34)	3.7% (n=7)	7.9% (n=15)	1.1% (n=2)
Chicken with skin	63.5% (n=120)	23.3% (n=44)	9.0% (n=17)	2.6% (n=5)	1.6% (n=3)
Chicken without skin	12.2% (n=23)	39.7% (n=75)	43.4% (n=82)	3.2% (n=6)	1.6% (n=3)
Fried fish in any fat or oil with or without batter or crumbs	50.8% (n=96)	27.0% (n=51)	13.8% (n=26)	5.8% (n=11)	2.6% (n=5)

Table 4.9 (continued): Participants' knowledge regarding the fat content of meat, processed meat and meat alternatives

Food item	High	Medium	Low	Not sure	Missing
Fish: steamed, grilled or braaied	13.8% (n=26)	32.3% (n=61)	46.0% (n=87)	5.8% (n=11)	2.1% (n=4)
Tinned Fish (tuna, pilchards, sardines, salmon)	20.6% (n=39)	41.3% (n=78)	30.2% (n=57)	6.9% (n=13)	1.1% (n=2)
Vienna's, Russians or Frankfurters	41.3% (n=78)	30.7% (n=58)	19.0% (n=36)	6.9% (n=13)	2.1% (n=4)
Cold meat (polony, ham, salami)	26.5% (n=50)	38.1% (n=72)	21.7% (n=41)	7.9% (n=15)	5.8% (n=11)
Bacon	56.6% (n=107)	22.8% (n=43)	7.9% (n=15)	10.1% (n=19)	2.6% (n=5)
Organ meat (liver, kidney, tripe)	27.0% (n=51)	30.2% (n=57)	29.1% (n=55)	10.1% (n=19)	3.7% (n=7)
Eggs: boiled or poached	9.5% (n=18)	23.3% (n=44)	59.8% (n=113)	4.2% (n=8)	3.2% (n=6)

Table 4.9 (continued): Participants' knowledge regarding the fat content of meat, processed meat and meat alternatives

Food item	High	Medium	Low	Not sure	Missing
Eggs: scrambled, fried, omelettes	38.6% (n=73)	32.3% (n=61)	21.7% (n=41)	5.3% (n=10)	2.1% (n=4)
Legumes					
Baked beans, sugar beans, dried beans	10.1% (n=19)	19.0% (n=36)	56.6% (n=107)	12.2% (n=23)	2.1% (n=4)
Fast food and takeaways					
Pizza	58.2% (n=110)	24.9% (n=47)	7.9% (n=15)	6.9% (n=13)	2.1% (n=4)
Pies and sausage rolls	60.8% (n=115)	22.8% (n=43)	7.4% (n=14)	7.4% (n=14)	1.6% (n=3)
Kentucky Fried Chicken	81.5% (n=154)	8.5% (n=16)	2.6% (n=5)	4.2% (n=8)	3.2% (n=6)
Nando's	64.0% (n=121)	20.6% (n=39)	9.0% (n=17)	5.8% (n=11)	0.5% (n=1)

Table 4.9 (continued): Participants' knowledge regarding the fat content of meat, processed meat and meat alternatives

Food item	High	Medium	Low	Not sure	Missing
Chicken Lickin, Chicken King	78.3% (n=148)	13.8% (n=26)	2.6% (n=5)	4.8% (n=9)	0.5% (n=1)
Bunny Chow	53.4% (n=101)	27.5% (n=52)	7.4% (n=14)	10.1% (n=19)	1.6% (n=3)
Hot dogs	40.7% (n=77)	31.2% (n=59)	15.3% (n=29)	10.6% (n=20)	2.1% (n=4)
Beef burgers: McDonalds, Steers, Wimpy, Spur etc	66.8% (n=126)	21.2% (n=40)	6.3% (n=12)	4.8% (n=9)	1.1% (n=2)
Chicken Burgers	49.2% (n=93)	33.9% (n=64)	8.5% (n=16)	7.4% (n=14)	1.1% (n=2)

Table 4.9 shows the participant's knowledge regarding the fat content of meat, meat alternatives and processed meats. With regard to beef, 47.1% of participants were correct. Boerewors, mutton and pork were answered correctly by 68.3%, 49.2% and 69.3% participants respectively. The question about chicken with skin and without skin were answered incorrectly by majority of participants. Half (50.8%) of the participants answered fried fish fat content correctly and 46% and 41.3% correct answers for steamed, grilled and braaiied fish and tinned fish respectively. The majority answered processed meats incorrectly except for bacon with 56.6% answered correctly. Both categories of eggs were answered incorrectly by more than half of the participants. More than half of the participants (56.6%) answered the fat content of beans correctly. The majority answered fast foods and takeaways incorrectly.

Table 4.10 depicts the participants' knowledge of the protein content of meat, processed meat and meat alternatives in relation to the response options provided in the questionnaire.

The nutrition knowledge of the study participants with regard to healthy and unhealthy food was better than that regarding the actual specific nutrient content. The majority of the answers were answered correctly by majority of the participants. The exceptions were mutton, pork, chicken with skin, fried fish and eggs (scrambled, fried or omelettes).

Table 4.10: Participants' knowledge regarding the probable health effects of meat, processed meat and meat alternatives

Food item	Healthy	Unhealthy	Not sure	Missing
Meat, fish and chicken				
Beef	69.8% (n=132)	17.5% (n=33)	11.6% (n=22)	1.1% (n=2)
Boerewors	27.5% (n=52)	51.3% (n=97)	19.6% (n=37)	1.6% (n=3)
Mutton	58.2% (n=110)	22.2% (n=42)	18% (n=34)	1.6% (n=3)
Pork	42.3% (n=80)	38.6% (n=73)	17.5% (n=33)	1.6% (n=3)
Chicken with skin	25.4% (n=48)	63.5% (n=120)	9% (n=17)	2.1% (n=4)
Chicken without skin	80.4% (n=152)	7.4% (n=14)	10.1% (n=19)	2.1% (n=4)
Fried fish in any fat or oil with or without batter or crumbs	32.8% (n=62)	54.5% (n=103)	11.6% (n=22)	1.1% (n=2)

Table 4.10 (continued): Participants' knowledge regarding the probable health effects of meat, processed meat and meat alternatives

Food item	Healthy	Unhealthy	Not sure	Missing
Fish: steamed, grilled or braaied	74.6% (n=141)	12.2% (n=23)	10.1% (n=19)	3.2% (n=6)
Tinned Fish (tuna, pilchards, sardines, salmon)	61.9% (n=117)	22.8% (n=43)	14.3% (n=27)	1.1% (n=2)
Vienna's, Russians or Frankfurters	20.1% (n=38)	61.9% (n=117)	14.8% (n=28)	2.6% (n=5)
Cold meat (polony, ham, salami)	31.7% (n=60)	49.2% (n=93)	16.9% (n=32)	2.1% (n=4)
Bacon	30.2% (n=57)	51.9% (n=98)	15.9% (n=30)	2.1% (n=4)
Organ meat (liver, kidney, tripe)	61.9% (n=117)	20.6% (n=39)	15.3% (n=29)	2.1% (n=4)
Eggs: boiled or poached	88.4% (n=167)	3.7% (n=7)	6.3% (n=12)	1.6% (n=3)

Table 4.10 (continued): Participants' knowledge regarding the probable health effects of meat, processed meat and meat alternatives

Food item	Healthy	Unhealthy	Not sure	Missing
Eggs: scrambled, fried, omelettes	38.6% (n=73)	47.6% (n=90)	11.6% (n=22)	2.1% (n=4)
Legumes				
Baked beans, sugar beans, dried beans	75.1% (n=142)	11.1% (n=21)	12.2% (n=23)	1.6% (n=3)
Fast food and takeaways				
Pizza	6.3% (n=12)	79.9% (n=151)	11.6% (n=22)	2.1% (n=4)
Pies and sausage rolls	9% (n=17)	78.8% (n=149)	10.1% (n=19)	2.1% (n=4)
Kentucky Fried Chicken	6.9% (N=13)	84.1% (n=159)	7.4% (n=14)	1.6% (n=3)
Nando's	18.5% (n=35)	70.9% (n=134)	9% (n=17)	1.6% (n=3)

Table 4.10 (continued): Participants' knowledge regarding the probable health effects of meat, processed meat and meat alternatives

Food item	Healthy	Unhealthy	Not sure	Missing
Chicken Lickin, Chicken King	7.9% (n=15)	82.5% (n=156)	7.9% (n=15)	1.6% (n=3)
Bunny Chow	9.5% (n=18)	74.1% (n=140)	14.3% (n=27)	2.1% (n=4)
Hot dogs	10.6% (n=20)	75.1% (n=142)	12.2% (n=23)	2.1% (n=4)
Beef burgers: McDonalds, Steers, Wimpy, Spur etc	10.1% (n=19)	78.8% (n=149)	10.1% (n=19)	1.1% (n=2)
Chicken Burgers	19.6% (n=37)	67.2% (n=127)	12.2% (n=23)	1.1% (n=2)

4.3 Summary

Overall, the results depict that the majority of students at UKZN, Pietermaritzburg Campus are receiving financial aid or a bursary or some form of financial assistance. The majority of the students also have cooking facilities available to them. The food frequency was spread out, however processed meats and takeaways were mostly consumed never or less than a month or once to three times a month. The participants do not have adequate nutrition knowledge with regard to the protein, sodium and fat content of meat, processed meat and meat alternatives. However, the knowledge regarding overall probable health effects of meat, processed meat and meat alternatives was better than the other nutrition knowledge sections.

In chapter 5, the results will be discussed in relation to the study objectives and related literature.

CHAPTER 5: DISCUSSION

5.1 Introduction

In 2015, the IARC stated that processed meat was carcinogenic and red meat as probably carcinogenic (IARC, 2015a). In addition to being carcinogenic, processed meat is also associated with heart disease and diabetes (Micha *et al.*, 2010). This is even more concerning as the consumption of processed meat has increased due to a move towards a more Westernized diet by South Africans (Ronquet-Ross *et al.*, 2015). Therefore, the aim of this study was to investigate the consumption of processed meat, meat and meat alternatives and the related factors affecting the purchasing and consumption of these meats amongst undergraduate students at University of KwaZulu-Natal. In addition, the study also investigated the nutrition knowledge the students have concerning meat, processed meat and meat alternatives.

5.2 Characteristics of study sample

The majority of the study sample was male (55%) and 45% female. The mean age was 20.5 years with a minimum age of 17 and maximum age being 30. The majority of the study sample was black students (72%). This is representative of the UKZN population of 69% black students (Department of Higher Education and Training, 2015). The study sample was spread out between the colleges such as Humanities, Agriculture, Engineering and Science and Law and Management Studies. The majority of the study sample was also between first and third year students. Majority of the study sample lived off campus with either family or friends. Very few lived alone off campus. Only 27.0% of the study sample actually lived in student residence on campus. The high number of students living off-campus could be due the students who lived on campus went back to their rooms between lectures instead of waiting on campus like most students who lived off campus would.

More than half of the study sample was on financial aid or a bursary. More than half were also receiving other allowances or assistance. The allowance received varied,

but most of the study sample received between R1000 to R1500. This was mostly received from parents. Most of the money was spent on rent, which is to be expected. An average of R673.95 per month was spent on food. This equates to approximately R22.47 per day which is R7.49 per meal. This was slightly higher compared to a study done by Kassier & Veldman (2013) on university students who reported spending R487.90 per month on food. However, this could be due to inflation as the study was done four years ago. The amount of money students have to spend on food will affect the type of meat, processed meat or meat alternatives that they will buy and consume.

Nearly all the participants had access to cooking facilities and rated their cooking skills between averages to excellent. However, only 18% cooked every day and 10.1% cooked 5-6 times a week. Since the majority of the students surveyed lived off campus, it can be speculated that someone else does the cooking in the household such as a parent or partner or they take turns cooking meals. The majority said they would cook healthy and affordable foods if they had a recipe book containing healthy meals. However, if majority are not cooking on a daily basis then it can be speculated that they would give the book to the person doing the most cooking in the household.

5.3 Observed trends regarding food frequency of the study sample

Eggs were the most frequent food and were consumed once a day (boiled or poached) and was consumed by 14.8% participants. Scrambled eggs, fried eggs or omelettes were consumed by 12.7% participants per day. The third most frequently consumed was cold meat (polony, ham and salami). This was consumed by 11.1% of participants every day. Therefore, it is evident that a meat alternative (eggs) was consumed most frequently per day, then processed meats (cold meat) and then meat, chicken and fish. This could be due to affordability of these meat alternatives and processed meat (shown in Table 2.8) as well as the easy access and cooking it requires as suggested by Kim *et al.* (2015).

Regardless of price, lentils and split peas were never consumed or consumed once a month by the majority of the participants (58.2%). This reiterates the study done by Steyn *et al.* (2006) that legumes were one of the lowest food group consumed by South African. This could be perhaps students do not have the time or knowledge to

cook lentils and split peas. Lentils and split peas are a healthy meat alternative that can help to protect against non-communicable diseases. Lentils and split peas are a good-quality protein and are low in fat and sodium unlike many of the processed meats (Venter *et al.*, 2013). Since the students are eating processed meat more frequently than lentils and split peas, it could have a negative impact on their health as they are consuming more sodium and fat. Therefore, leading to more non-communicable disease.

The frequency of consumption of fast food ranged from 4.8% to 16.4% consumption once a week and 2.6% to 11.1% consumption two to four times a week. This proved contradictory to a study done by Van Zyl *et al.* (2010) who stated that fast food was consumed by 21% of participants once a week and 27.9% of the participants two to three times a week. These study results were lower than the study done by Van *et al.* (2010). This can be speculated that the students do not have enough money to buy fast food as majority only have approximately R22.47 per day to spend on food. Therefore, processed meats were the least consumed and meat alternatives were the most consumed by the participants.

5.4 Observed trends regarding food purchasing factors

Similar to studies done by Shisana *et al.* (2013) and Ronquest-Ross *et al.* (2015), the most likely factor the study sample considered was price. According to Van Zyl *et al.* (2010), the main factor in purchasing food was taste. However, in this current study, taste was the second most likely factor to be considered. Price could likely be the most likely factor to be considered due to more than half of the students being on financial aid or bursaries and spending an average of R673.95 a month on food.

5.5 Observed trends regarding nutrition knowledge in meat, processed meat and meat alternatives

The nutrition knowledge of the study participants was generally poor which is contrary to a study done by Kassier & Veldman (2013). It can be deduced that due to many students being on financial aid that a connection could be suggested between low nutrition knowledge of the student and low socio-economic status as suggested by Shisana *et al.* (2013). The students' knowledge regarding 'healthy' and

'unhealthy' meat, processed meat and meat alternatives was better than the knowledge regarding the salt, fat and protein content. As the participants were university student students, it can be speculated that they would have had some general knowledge regarding healthy foods, but maybe not the specific nutrients found in food. It can be speculated that even with better knowledge, the consumption and purchasing of meat, processed meat and meat alternatives will not change. This could be due to majority of the students are not the ones cooking daily and that price is one of the main purchasing factors.

5.6 Summary

The average age of the study sample (N=189) was 20.5 years. The majority of the study sample was males. The racial breakdown was majority black participants, followed by Indian, coloured and white participants to try represent the racial breakdown of the students at the university. This chapter discussed the results that were obtained through this study regarding the consumption and knowledge of meat, processed meat and meat alternatives as well as the factors considered in the purchasing of meat, processed meat and meat alternatives. The results displayed that lentils, split peas and soya mince (meat alternatives) were majority 'never or once a month' consumed by participants. Eggs and cold meat (processed meat) were eaten by more students once a day than the meat. Subsequently, the university students considered price as a main factor when purchasing food. The nutrition knowledge of students was poor as majority of the participants got the answers wrong in all four sections of the nutrition knowledge section.

In chapter 6, the conclusion, strengths and limitations of the study will be discussed as well as the recommendations for nutrition practice and further research.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The aim of the study was to investigate the consumption of processed meats as well as other meat sources and alternatives being consumed by students at UKZN. In addition, purchasing factors and the nutrition knowledge regarding protein, salt and fat content of processed meat, meat and meat alternatives will be analysed.

6.2 Conclusion

Due to the consumption of processed meat being classified as carcinogenic and red meat as probably carcinogenic (IARC, 2015), it is important to research the consumption patterns of the undergraduate students at UKZN, as well as their purchasing patterns and knowledge.

This cross-sectional study aimed to determine the consumption of processed meat, meat and meat alternatives and related factors affecting their purchases and consumption amongst undergraduate students at the University of KwaZulu-Natal, Pietermaritzburg campus. Therefore, a self-administered questionnaire assessing the food frequency and knowledge about processed meat, meat and meat alternatives. The questionnaire also assessed the factor for the purchasing of products. The questionnaire was developed using current literature and the expert input from the study supervisor.

Results generated from this current study indicated that the participants consumed cold meat and eggs the most frequently every day compared to other meat sources. Legumes and fast food had majority of the participants stating they eat it 'never or less than once a month. Price was the main factor that was considered when purchasing food. Taste was the second most likely factor. The nutrition knowledge of the protein, fat and salt content of meat, processed meat and meat alternatives was poor, as well as the results from categorizing meat as healthy or unhealthy. The results

from this study are similar to other published studies (Ronquest-Ross *et al.*, 2015, Shisana *et al.*, 2013 and Steyn *et al.*, 2006).

This current study forms a reference point for the need of nutrition education to be carried out to undergraduate students at UKZN.

6.3 Recommendation for nutrition practice

Distributing recipe books containing healthy and affordable meals to the students at UKZN may prove to be beneficial in ensuring meat alternatives such as legumes are consumed more frequently. In addition, dietetic students could hold education sessions to other students to inform them about the health risks associated with the consumption of meats and processed meats.

6.4 Strengths of study

The questionnaire was designed based on relevant literature as well as expert input by the study supervisor to determine the consumption, purchasing factors and knowledge of meat, processed meat and meat alternatives specifically aimed at the students at UKZN. Convenience sampling was used in this study.

6.5 Limitations of the study

The sample size (N=189) was small in relation to the number of students at UKZN, therefore reducing the statistical power of the study. Only students at Pietermaritzburg campus were selected, therefore the results of the current study cannot be extrapolated to the other campuses at UKZN. Another limitation was that not all participants answered all the questions in the questionnaire.

6.6 Recommendations for future research

It is recommended that the sample size be increased by expanding the sample size to the other UKZN campuses as well as other forms of tertiary education in PMB and surrounding areas.

The questionnaire should undergo a test-retest method to increase the reliability and validity of the results.

Measuring body composition of the study sample in future studies could be used to investigate the relationship between consumption of meat, processed meat and meat alternatives and their nutrition knowledge amongst students at UKZN.

Finally, the study null hypotheses (H_{01-03}) can be rejected.

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APPENDIX A
SURVEY QUESTIONNAIRE

Code			
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Consumption of processed meat, meat alternatives and related factors affecting their purchase and consumption among students, University of KwaZulu-Natal, Pietermaritzburg Campus

Dear participant,
 Kindly complete the following questionnaire as honestly as possible. There is no right or wrong answer. Please tick next to the appropriate answer. The results of this questionnaire will not, in any way be traceable to you in person.

Section A: Socio-Demographic information:

1. Gender:

1. Female	<input type="checkbox"/>
2. Male	<input type="checkbox"/>

2. Age (in years) _____

3. Race

1. Black	<input type="checkbox"/>
2. White	<input type="checkbox"/>
3. Coloured	<input type="checkbox"/>
4. Indian	<input type="checkbox"/>
5. Asian	<input type="checkbox"/>
6. Other (please specify) _____	<input type="checkbox"/>

4. College:

1. Humanities	<input type="checkbox"/>
2. Agriculture, Engineering and Science	<input type="checkbox"/>
3. Law and Management Studies	<input type="checkbox"/>
4. Health Sciences	<input type="checkbox"/>

5. Academic Year:

1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	>4 <input type="checkbox"/>
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6. Place of residence during term time:

- 1. Off campus, with family
- 2. Off campus, with friends/other students
- 3. Off campus, alone
- 4. Student residence

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

Section B: Socio-Economic

7. Are you on financial aid or receive a bursary:

- 1. Yes
- 2. No

8. Do you receive an allowance or any additional financial assistance:

- 1. Yes
- 2. No

If yes, how much per month?

- 1 R0-100
- 2 R100-500
- 3 R500-1000
- 4 R1000-1500
- 5 R1500-2000
- 6 R2000-2500
- 7 More than R2500

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

If yes, where does the additional financial assistance come from?

- 1 Parents
- 2 Guardian
- 3 Sibling
- 4 Grandparents
- 5 Friends
- 6 Partner
- 7 Work
- 8 Other (please specify)

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

9. How do you spend your available money on a monthly basis? Please allocate an estimated amount in the boxes below:

- 1. Rent
- 2. Social
- 3. Food
- 4. Travelling
- 5. Clothes
- 6. Toiletries
- 7. Varsity extras

8. Other (please specify)

10. Do you have access to cooking facilities where you live?

- 1. No
- 2. Yes

11. If No to question 10, would you cook if you had cooking facilities?

- 1. No
- 2. Yes

12. If yes to question 10, do you use the cooking facilities?

- 1. No
- 2. Yes

13. How would you rate your cooking skills?

- 1. Excellent
- 2. Good
- 3. Average
- 4. Bad

14. How often do you prepare food?

1. Daily	<input type="checkbox"/>
2. 5-6 times a week	<input type="checkbox"/>
3. 3-4 times a week	<input type="checkbox"/>
4. 1-2 times a week	<input type="checkbox"/>
5. Never	<input type="checkbox"/>

15. Would you prepare meals if you had a recipe book for healthy and affordable meals?

1. No	<input type="checkbox"/>
2. Yes	<input type="checkbox"/>

Section C: Food Frequency

16. How often do you eat the following foods (Mark with an X in the appropriate box)

Food item	Never/ less than once a month	1-3 times a month	Once a week	2-4 times a week	Once a day	2-3 times a day	4-5 times a day	More than 6 times a day
Meat, fish and chicken								
Beef								
Boerewors								
Mutton								
Pork								
Chicken with skin								
Chicken without skin								
Fried fish in any fat or oil with or without batter or crumbs								
Fish: steamed, grilled or braaied								
Tinned Fish (tuna, pilchards, sardines, salmon)								
Vienna's, Russians or Frankfurters								
Cold meat (polony, ham, salami)								
Bacon								
Organ meat (liver, kidney, tripe)								

Food item	Never/ less than once a month	1-3 times a month	Once a week	2-4 times a week	Once a day	2-3 times a day	4-5 times a day	More than 6 times a day
Eggs: boiled or poached								
Eggs: scrambled, fried, omelettes								
Legumes								
Baked beans, sugar beans, dried beans								
Soya mince								
Lentils, split peas								
Nuts								
Peanut butter								
Fast food and takeaways								
Pizza								
Pies and sausage rolls								
Kentucky Fried Chicken								
Nando's								
Chicken Lickin, Chicken King								
Bunny Chow								
Hot dogs								
Beef burgers: McDonalds, Steers, Wimpy, Spur etc								
Chicken Burgers								

17. Rank the deciding factors in order when purchasing food? (1= most likely to consider, 5= least likely to consider)

Price	
Nutrition/Health	
Availability	
Taste	
Convenience	

Section D: Nutrition Knowledge

18. Do you think these foods are high or low in protein? (tick one box per food)

Food item	High	Medium	Low	Not sure
Beef				
Boerewors				
Mutton				
Pork				
Chicken with skin				
Chicken without skin				
Fried fish				
Fish: Grilled, steamed or braaied				
Tinned Fish (tuna, pilchards, sardines, salmon)				
Vienna's/Russians/Frankfurters				
Cold meat (polony, ham, salami)				
Bacon				
Organ meat (liver, kidney, tripe)				
Eggs: boiled or poached				
Eggs: scrambled, fried, omelette				
Legumes (baked beans, sugar beans, dried beans, soya mince, lentils, split peas)				
Pizza				
Pies and sausage rolls				
Kentucky Fried Chicken				
Nando's				
Chicken Lickin, Chicken King				
Bunny Chow				
Hot dogs				
Beef burgers: McDonalds, Steers, Wimpy, Spur etc				
Chicken Burgers				

19. Do you think these foods are high or low in salt? (tick on box per food)

Food item	High	Medium	Low	Not sure
Beef				
Boerewors				
Mutton				
Pork				
Chicken with skin				
Chicken without skin				

Food item	High	Medium	Low	Not sure
Fried fish				
Fish: Grilled, steamed or braaied				
Tinned Fish (tuna, pilchards, sardines, salmon)				
Vienna's/Russians/Frankfurters				
Cold meat (polony, ham, salami)				
Bacon				
Organ meat (liver, kidney, tripe)				
Eggs: boiled or poached				
Eggs: scrambled, fried, omelette				
Legumes (baked beans, sugar beans, dried beans, soya mince, lentils, split peas)				
Pizza				
Pies and sausage rolls				
Kentucky Fried Chicken				
Nando's				
Chicken Lickin, Chicken King				
Bunny Chow				
Hot dogs				
Beef burgers: McDonalds, Steers, Wimpys, Spur etc				
Chicken Burgers				

20. Do you think these foods are high or low in fat? (tick one box per food)

Food item	High	Medium	Low	Not sure
Beef				
Boerewors				
Mutton				
Pork				
Chicken with skin				
Chicken without skin				
Fried fish				
Fish: Grilled, steamed or braaied				
Tinned Fish (tuna, pilchards, sardines, salmon)				
Vienna's/Russians/Frankfurters				
Cold meat (polony, ham, salami)				
Bacon				
Organ meat (liver, kidney, tripe)				
Eggs: boiled or poached				
Eggs: scrambled, fried, omelette				

Food item	High	Medium	Low	Not sure
Legumes (baked beans, sugar beans, dried beans, soya mince, lentils, split peas)				
Pizza				
Pies and sausage rolls				
Kentucky Fried Chicken				
Nando's				
Chicken Lickin, Chicken King				
Bunny Chow				
Hot dogs				
Beef burgers: McDonalds, Steers, Wimpy, Spur etc				
Chicken Burgers				

21. Do you think these are healthy sources of protein? (tick one per box)

Food item	High	Medium	Low	Not sure
Beef				
Boerewors				
Mutton				
Pork				
Chicken with skin				
Chicken without skin				
Fried fish				
Fish: Grilled, steamed or braaied				
Tinned Fish (tuna, pilchards, sardines, salmon)				
Vienna's/Russians/Frankfurters				
Cold meat (polony, ham, salami)				
Bacon				
Organ meat (liver, kidney, tripe)				
Eggs: boiled or poached				
Eggs: scrambled, fried, omelette				
Legumes (baked beans, sugar beans, dried beans, soya mince, lentils, split peas)				
Pizza				
Pies and sausage rolls				
Kentucky Fried Chicken				
Nando's				
Chicken Lickin, Chicken King				
Bunny Chow				
Hot dogs				
Beef burgers: McDonalds, Steers, Wimpy, Spur etc.				
Chicken Burgers				

APPENDIX B

PARTICIPANT INFORMATION AND INFORMED CONSENT FORM

Study title:

Consumption of processed meat and meat alternatives and related factors affecting their purchase and consumption among students, University of KwaZulu-Natal, Pietermaritzburg Campus

Dear Student,

You are hereby invited to participate in a study investigating the consumption of processed meat in Pietermaritzburg campus of University of KwaZulu-Natal. This study is being conducted by an MSc Dietetics student from Dietetics and Human Nutrition, School of Agricultural, Earth and Environmental Sciences. The aims and procedure that will be followed are as follows:

Study Aims:

1. To investigate the consumption of processed meat and other protein sources among students.
2. To determine the factors influencing these purchases.
3. To determine the nutritional knowledge of students regarding processed meat and other protein sources.

Study Procedures:

1. Participants will be asked to complete a self-administered questionnaire.

Risk:

There will be no physical or emotional risks involved in this study. The data will be treated as anonymous. No personal details will be required that could trace a particular questionnaire back to an individual. Each participant will be allocated a code for data capturing purposes. If you have any concerns, please contact the researcher, study supervisor or ethics committee as per the following contact details:

<p>Researcher Megan Birkett Email: birkettmegan@gmail.com</p>	<p>Human and Social Science Research Ethics Committee (HSSREC) Mrs Mariette Snyman</p>
<p>Study supervisor Dr Suna Kassier Tel: (033) 260-5453 Email: kassiers@ukzn.ac.za</p>	<p>Tel: (031) 260-8350 Fax: (031) 260-3093 Email: snymanm@ukzn.ac.za</p>

Benefits:

There are no direct benefits related to participation in this study. However, by participating, you will be making a contribution that may benefit others from the study. As a token of appreciation, you will receive a booklet entitled “Healthy Eating on a Limited Budget: A Student’s Guide”.

Duration:

The self-administered questionnaire will take approximately 15 minutes to complete should you wish to participate.

Findings:

The results from the study will be used towards the completion of a MSc in Dietetics. After the study is complete, participants can access the study finding by logging on to the University of KwaZulu-Natal’s website, and following the link the website of Dietetics and Human Nutrition which falls under the College of Agriculture, Engineering and Science, School of Agricultural, Earth and Environmental Sciences. This study has been granted gatekeepers permission by the Registrar, Academic Affairs and ethics approval by the Human and Social Science Research Ethics Committee (contact details above).

Confidentiality:

The results of this study will only be used for the purpose of the study and will be available to members of the public through a journal publication and/or conference presentation. No reference will be made to individual participants as each participant’s data set will be allocated a code.

Voluntary participation:

Participation of this study is voluntary, and you have the right to withdraw at any time without any adverse outcomes or discrimination.

Should you be willing to participate, please consent by signing the informed consent form below:

INFORMED CONSENT TO PARTICIPATE IN THE STUDY

I, _____ declare that the purpose of the study and methods that will be used for data collection have been explained to me by the researchers/fieldworkers. I fully understand the study aim and what is required from me. In addition, I have been given the opportunity to ask questions. I understand that my participation is voluntary, and I may exit from the study at any point should I wish to do so. I am aware that I can contact the researcher at any time should I require clarification regarding the study or its purpose, as well as my rights as a participant.

I hereby consent to voluntary participation in the above-mentioned study.

Participant signature: _____

Date: _____

Witness: _____

Date: _____

APPENDIX C: Ethics Approval



**UNIVERSITY OF
KWAZULU-NATAL**
INYUVESI
YAKWAZULU-NATALI

13 February 2017

Ms Megan Ann Birkett 212542947
School of Agricultural, Earth and Environmental Sciences
Pietermaritzburg Campus

Dear Ms Birkett

Protocol Reference Number: HSS/0130/017M
Project title: Consumption of processed meat, meat alternatives and related factors affecting their purchases and consumption among students, University of KwaZulu-Natal, Pietermaritzburg Campus

Full Approval – Expedited Application

In response to your application received 26 January 2017, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully



Dr Shonuka Singh (Chair)
Humanities & Social Sciences Research Ethics Committee

/pm

cc Supervisor: Dr Suna Kassier & Professor Frederick Veldman
cc Academic Leader Research: Professor Onesimo Mutanga
cc School Administrator: Ms Marsha Manjoo

Humanities & Social Sciences Research Ethics Committee
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