Food intake, socio-economic factors and health status of free-living, white residents living in an elderly residential facility in Morningside, Durban

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Dissertation submitted in fulfilment of the requirements of the degree of Master of Applied Science in Food and Nutrition in the Department of Food and Nutrition: Consumer Science, Faculty of Applied Sciences at the Durban University of Technology.

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Supervisor: Professor Carin Napier

DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature of any degree.

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STATEMENT 1

This dissertation is being submitted in fulfilment of the requirements of the degree of Master of Technology.

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The dissertation is the result of my own independent work/investigation, except where otherwise stated. Other sources are acknowledged by giving explicit references. A bibliography is appended. I did not make myself guilty of any plagiarism.

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I, Shenaye Dale Bodin and Professor Carin Napier, do hereby declare that in respect of the following dissertation: Food intake, socio-economic factors and health status of free-living, white residents living in an elderly residential facility in Morningside, Durban; as far as we know and can ascertain: no other similar dissertation exists.
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21-07-2020

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APPROVAL

I hereby approve the submission of the following dissertation:

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ABSTRACT

Food intake patterns, socio-economic factors, health and nutritional status of free-living, white residents living in an elderly residential facility in Morningside, Durban.

RATIONALE AND OBJECTIVE

The objective of the study was to conduct an analysis of elderly people living in Morningside, Durban, KwaZulu-Natal, South Africa. The research focused on the socio-economic status, the dietary intake, the nutritional status and the health status of this community.

METHODOLOGY

The sample comprised 150 (125 women and 25 men) randomly selected white residents, residing in an elderly care facility located within ward 27 of Durban. The methods used for assessment included a socio-demographic questionnaire which determined their socio-economic status. A 24-Hour recall questionnaire and a food frequency questionnaire were used to determine dietary intake, while anthropometric measurements were conducted to determine their nutritional status. A health questionnaire was used to determine the health status of the participants. Trained field workers and nurses assisted in the data collection and food consumption data was captured and analysed by a qualified dietician using the Food Finder version 3.0 computer software program. Descriptive statistics (frequencies, means, standard deviations and confidence intervals) were determined with the assistance of a bio-statistician. Socio-demographic and health data were captured onto an Excel ® spreadsheet by the researcher. These questionnaires were analysed using the Statistical Package for Social Sciences (SPSS) for Windows version 17, 0 software program.

RESULTS

The results indicated that most participants were not financially secure. Many of the participants were widowed and lived alone. A number of the participants relied on their pensions (31.3%, n=32) and very few had a job or any other source of income (6.7%, n=10). Most of the participants said that there was always enough money for food (80.0%, n=120).

The BMI results showed that 39.3% (n=59) of the participants were obese. This was mostly observed in the women, where 40.8% (n=51) were obese. This can be linked to the high consumption of a carbohydrate-based diet and a lack of dietary diversity as well as possible lack of physical exercise; 35.3% (n=53) of men and women were of normal weight.

The nutrient analysis of the 24-Hour recall showed that there was a nutrient deficiency in energy, dietary fibre, calcium, iodine, phosphorus, magnesium and vitamin D. The total fat intake was slightly higher than the recommended intake by the WHO (15-30.0%), with men obtaining 32.4% and women obtaining 32.6% of energy from fat. Carbohydrates and dietary fibre contributed 48.1% for men and 49.3% for women of the daily energy needs for the group, slightly below the recommended 55-75.0%. The protein contribution to total energy intake was above the recommendation of 10-15.0% for both men and women. The men had an intake of 19.5% and the women had an intake of 17.9%. This shows that the average person ate a balanced diet in terms of macronutrients intake. Carbohydrates were the main source of food with the average amount consumed within the group being 152.7 g per day. This was above the recommended amount for this age group, which is 100 g per day. The most consumed sources of carbohydrates were bread or rolls, breakfast cereals, rice, potatoes and pasta. This could be due to the fact the residents received free bread from the facility every week. This bread was donated by a local bakery.

These results indicated that the participants consumed a variety of foods but not in sufficient amounts needed to meet the daily recommended requirements. The fruit and vegetable consumption was high, with a mean intake of 219.7 g per person, but this is less than the amount needed to meet the recommendations for this age group. Consumption of dairy products was high, with the per capita intake for one day being 303.2 g for the group. This means that the average person consumed 303.2 g of dairy products a day. The main sources of dairy products consumed were milk, cheese, margarine and yoghurt. These high amounts are required for this age group due to weakening bones and the risk of osteoporosis; however, this rate of dairy consumption did not meet the calcium requirements for this age group.

Health factors that were self-reported by the elderly included issues with the skeleton (47.3%, n=71), sensory organs (49.3%, n=74), and the heart or circulation (29.3%, n=44). Many reported suffering from other illnesses (42.6%, n=64) such as diabetes and high cholesterol.

CONCLUSION

The results show that the community did not face poverty, food insecurity or any adverse social factors such as lack of money or food choices. There was a relatively high number of obese participants (39.3%); therefore these participants were classified as malnourished. There needs to be a nutritional intervention aimed at changing the food-purchasing choices of the elderly, and placing emphasis on healthier food preparation and reducing the high level of carbohydrate intake as well as encouraging physical activity.

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LIST OF ABBREVIATIONS

ADL-	Activities of daily living
AI-	Adequate intake
AIDS-	Acquired immunodeficiency syndrome
ALM-	Appendicular lean mass
ARHI-	Age-related hearing impairment
BMI-	Body mass index
BP –	Blood pressure
Btech-	Bachelor of technology
Cdc-	Centre for disease control and prevention
Ceo-	Chief executive officer
CM-	Centimetres
CVD-	Cardiovascular disease
DAFF-	Department of agriculture, forestry & fisheries
DBP-	Diastolic blood pressure
DDS-	Dietary diversity score
DRIs -	Dietary reference intakes
DUT-	Durban University of Technology
EAR-	Estimated average requirement
EFR-	Estimated food record
EU-	European Union
Fao-	Food and agricultural organization
FBDG-	Food based dietary guidelines
FFQ-	Food frequency list questionnaire
FGDS-	Food group diversity score
FHIS-	Food and health innovations services
FVS-	Food variety score

GDP- Global domestic product

GEC- Global environmental changes

GI- Gastrointestinal

GM- Genetically modified

HANES- Health and nutrition examination survey

HCC- Hepato cellular carcinoma

HIV- Human immunodeficiency virus

IGT- Impaired glucose intolerance

INP- Integrated nutrition program

IoS- Institute of medicine

IS- Immune system

KG- Kilogram

kJ- Kilojoule

KZN- KwaZulu-Natal

LM- Lean mass

M²- Metre squared

MJ- Megajoule

MM- Millimetres

MNA- Mini nutritional assessment

NAR- Nutrient adequacy ratio

NCD- Non-communicable diseases

NGO- Non-governmental organization

NICUS- Nutrition information centre of the University of Stellenbosch

NSSA- Nutrition society of South Africa

PAL- Physical activity level

PEM- Protein energy malnutrition

PPS- Portable physician scale

RDA-	Recommended daily allowance
RDI-	Recommended dietary intake
RSA-	Republic of South Africa
SBP-	Systolic blood pressure
SD-	Standard deviation
SPSS-	Statistical package for social sciences
SSA-	Sub-Saharan Africa
STATSSA-	Statistics South Africa
TB-	Tuberculosis
UK-	United Kingdom
UL-	Tolerable upper intake level
UN-	United Nations
UNGPP-	United Nations' global population pyramid
UNICEF-	United Nations international children's emergency fund
UNPD-	United Nations population division
UNPF-	United Nations population fund
WC-	Waist circumference
WFR-	Weighed food record
Who-	World health organization
WHR-	Waist-to-hip ratio

LIST OF SYMBOLS

&- And

% - Percent

n – Number

g – Grams

Kg – Kilograms

kJ – Kilojoule

> - Greater than

< - Less than

≥ - Greater than or equal to

≤ - Less than or equal to

mg – Milligram

MJ- Megajoule

Z – Z value

P – Percentage

R – Rand

SD – Standard deviation

cm – Centimetre

m2 – Metre squared

µg – Microgram

± - Plus-minus sign

®- Registered

$ - US Dollar

♂- Male

♀- Female

LIST OF DEFINITIONS

Word/phrase	Definition
Adaptive immunity:	The body's way of overcoming infection (Alberts, Johnson, Lewis, Raff, Roberts and Walter 2002).
Antigen specific immunity:	Specific toxins that are produced to fight immunity (Leng and Goldstein 2010).
Atherosclerosis:	Potentially fatal disease where there is a build-up of fats, cholesterol and other substances on the artery walls (NHS 2019).
Cardiovascular disease:	A general term for conditions affecting the heart or blood vessels (NHS 2018).
Cognitive:	The minds way of processing (McLeod 2015).
Dietary diversity:	The number of different individual food items and food groups consumed (Ruel 2002).
Elderly:	A person that is 60 years and older (WHO 2009).
Fertility:	Natural ability to produce offspring (Frank 2019).
Gastric atrophy:	A process of chronic inflammation of the gastric mucosa of the stomach (Zayouna 2018).
Global poverty line:	The percentage of the population living on less than $1.90 a day (World bank group 2018).
H. *Pylori:*	A type of bacteria. These germs can enter your body and live in your digestive tract (Khatri 2018).
Health status:	The impact of disease on a patient as reported by the patient (Rumsfeld 2002).
Helminthiasis:	Is any macroparasitic disease of humans in which a part of the body is infected with parasitic worms, known as helminths (Mkhize-Kwitshana, Tadokera and Mabaso 2017).
Herpes zoster:	Also known as shingles, is a painful rash, usually unilateral, caused by the varicella zoster virus (Wareham and Breuer 2007).
Humoral immunity:	Is the immunity formed by circulating antibodies. It is part of adaptive immunity, where a specific immune response to a foreign material is generated (Panawala 2017)
Malnutrition:	The condition of not being adequately nourished due to the lack of one or more nutrients, which is undernutrition or an excess of nutrients which is overnutrition (Hickson 2006).
Mortality:	Death (Bonneux 2002).
Neurodegenerative disorders:	An umbrella term for a range of conditions which primarily affect the neurons in the human brain (Berman and Bayati 2018).
Non-communicable diseases:	A medical condition or disease which cannot be passed from person to person. These may be diseases of long duration and slow progression, or they may result in more rapid death such as a sudden stroke (WHO 2018).
Nutritional status:	The physiological state of an individual, caused by the connection between nutrient intake and requirements, as well as the body's ability to digest, absorb and utilise these nutrients (FAO 2007).
Osteoporosis:	A condition where bones become weak and brittle
Per capita:	Per average person (Banton 2010)
Poverty:	A person not being able to afford basic human rights such as clean water, nutrition, health care, education, clothing and shelter (SA-DAFF 2011).
Reliability:	The degree to which the research method produces stable and consistent results (Mouton and Babbie 2001).

Renal resistance to vasopressin:	The kidneys resistance to an anti-diuretic hormone (vasopressin) (Whitney and Rolfes 2016).
Socio-demographic:	Conditions of how people live, their well-being, activities in which they partake in, demographic characteristics and cultural factors which influence behaviour and social and economic change (Banda 2003).
Socio-economic:	Society related economic factors, such as, income, education and occupation and more (Adler and Newman 2002)
Sphygmomanometer:	The device used to measure blood pressure (WHO 1995).
Stadiometer:	The device used to measure height (WHO 1995).
Standard deviation:	A quantity expressing by how much the members of a group differ from the mean value for the group (Barde and Barde 2012).
Tuberculosis:	A chronic disease caused by a bacteria, which spreads from person to person through air. It usually affects the lungs but can also affect other parts of the body, such as brain, intestines, kidneys, or the spine (Zaman 2011)
Validity:	The degree of accuracy for a measurement (Mouton and Babbie 2001).

CHAPTER 1: THE PROBLEM AND ITS SETTING

1.1 INTRODUCTION

The World Health Organization (WHO) (2009) defined the term 'elderly' as a person that was 60 years and older. Globally, ageing populations were becoming the norm rather than the exception. This was a positive outcome as it showed the successes of dealing with childhood disease and maternal mortality and helping women achieve control over fertility (WHO 2012). Whitney and Rolfes (2008) stated that as an individual became older, a number of factors such as basic nutrition, genetics, physical activity and controlling everyday stress played an important role in achieving their overall psychological wellbeing.

Between 1950 and 1955, the annual growth rate for people aged 60 years and older was 1.7%, which was quite similar to the overall growth rate of the population as a whole, which was 1.8%. Between 2005 and 2010 this changed as the annual population growth rate for people aged 60 years and above rose to 2.6% and this was more than double the annual growth rate for the total population which was 1.2% (Favela, Castro, Franco-Marina, Sánchez-García, Juárez-Cedillo, Bermudez, Mora-Altamirano, Rodriguez and García-Peña 2013).

Malnutrition among the elderly was predominant in hospitals and long-term care facilities, compared to community-dwelling older adults. It was expected that in the United States the elderly population would double to approximately 72 million people by 2030. Addressing the more complex needs of the older adult, including meeting nutritional needs, represented an important public health issue given the changing demographics (Maher, Student Nurse and Eliadi 2011).

The rise in the elderly population had both positive and negative outcomes. Some of these negative outcomes were directly linked to ageing and were mainly physiological, economical and physical factors. These outcomes could accelerate the onset of chronic diseases and tissue oxidants, decrease dietary anti-oxidants and physical activity and reduce food consumption, especially when it came to fruits and vegetables. This would then reduce the ability of an elderly individual to maintain good health and lower the supply of anti-oxidants resulting in disease, which increased the nutritional stress on an ageing person. All of the above was very often linked to income (Watson and Preedy 2013).

Furthermore, the major negative outcomes relating to the welfare of an elderly person were to do with nourishment, hygiene and health, which could lead to financial insecurity by underlining the fact that in 2005, 20% of the population survived below the Global Poverty Line of US$ 1.25 per day. Poverty was a big problem among the ageing population. This could be due to receiving a lower income or inadequate pension allowance, poor health and undernourishment (United Nations Population Fund 2012).

He, Muenchrath and Kowal (2012) stated that in order to rectify the outcomes faced by the elderly population, an understanding of the differences in the health of older populations across and within countries was important for the development of health care services, social support systems and health policies for all individuals.

1.2 DEFINITIONS OF NORMATIVE DIMENSIONS IN FOOD SECURITY

1.2.1 FOOD SECURITY

Food security was closely linked to the poverty levels in a country. The two went hand-in-hand and to some extent influenced one another (SA-DAFF 2011).

According to SA-DAFF (2011), when looking at food security it was very important to consider the plight of poverty in the country. Poverty referred to a person not being able to afford basic human rights such as clean water, nutrition, health care, education, clothing and shelter.

1.2.2 THE RIGHT TO FOOD

The right to food is a universal right. It is not only the right to a minimum amount of specific nutrients. It is also the right to all nutritional elements that are needed in order to live a healthy and active life and having the means to access them (United Nations (UN) 2010). The right to food is a human right which protects a person's entitlement to access food and to feed themselves (Ziegler, Golay, Mahon and Way 2011). Food has to be available, accessible and adequate. Availability means that food should be available through natural resources, for example, the production of food or access through other resources such as fishing, hunting or gathering. Accessibility means having economic access, meaning that food should be affordable, and a person should be able to afford nutritious food without it affecting other basic needs such as school fees, medicine, rent and other expenses. The other side of accessibility is the physical side, meaning that food should be accessible to all, regardless of where the person lived. Food should be readily available. Adequacy means that the quantity of food needed to fulfil the basic nutritional needs of a person (United Nations (UN) 2010).

1.2.2.1 Common misunderstandings about the right to food

The United Nations found that many people had a lack of understanding when it came to the right to food. As per United Nations (UN) (2010), these misunderstandings are stated below:

- **The right to food is NOT the same as the right to be fed.**
  Many people are under the impression that the right to food is the right to receive food handouts from the government. This is a misunderstanding. The right to food is not the right to be fed; it is the right to feed oneself through food that is accessible, affordable and adequate. An individual is expected to meet their needs through the effort that is put in from that person's side. This is either through producing the food or buying the food.

- **The denial of the right to food is NOT due to a lack of food worldwide.**
  Some may believe that people are denied the right to basic food because there is not enough food in the world to feed everyone. The reason for hunger and malnutrition is not due to the lack of food worldwide but is rather due to the lack of access to available food. Reasons for not having access to food can be linked to poverty, social exclusion and discrimination. This is not only seen in developing countries but also in economically advanced countries. The longer-term solution is for countries to enforce the sustainable production of food to ensure that there is availability of food for future generations. Factors that need to be considered include population growth, climate change and the availability of natural resources.

- **The right to adequate food is NOT the same as the right to safe food.**
  There is more to the right to adequate food than just the right to safe food. The right to adequate food is sometimes misinterpreted as meaning that the standard of the food that is sold on the market should be safe for consumption. This is not a broad enough interpretation. The right to adequate food means that people need to have food that is readily available and easily accessible. Adequate refers to quantity, quality and appropriateness, taking into account cultural aspects as well as the physiology of the individual (for example, sex, age and health status).

1.3 BACKGROUND TO THE PROBLEM: A GLOBAL PERSPECTIVE

According to the WHO (2009), females made up the majority of the elderly population worldwide due to the fact that they tended to outlive males. It was expected that by 2025, the number of elderly women living in Africa would increase from 13 to 46 million.

The WHO (2008) also suggested that the high life expectancy was equivalent to the drop in the infertility rate percentage which guaranteed that the elderly population would increase from 11% of the world's population in 2006 (about 650 million) to 22% of the population (about 2 billion) in 2025. This was backed up by the following statistics: worldwide, for every second that passes, two people were celebrating their sixtieth birthday, which amounted to 58 million people annually. The estimation that one in nine people worldwide was at the age of 60 or older was estimated to increase to one in five people by 2025. In developing countries, the rate of ageing was growing at a much faster rate than in already developed countries. By 2050, just over 80% of the world's older people would be living in developing countries compared to 60% in 2005. Older people were a more vulnerable age group (WHO 2008). Figure 1.1 illustrates the expected increase in elderly people from 1950 to 2050.

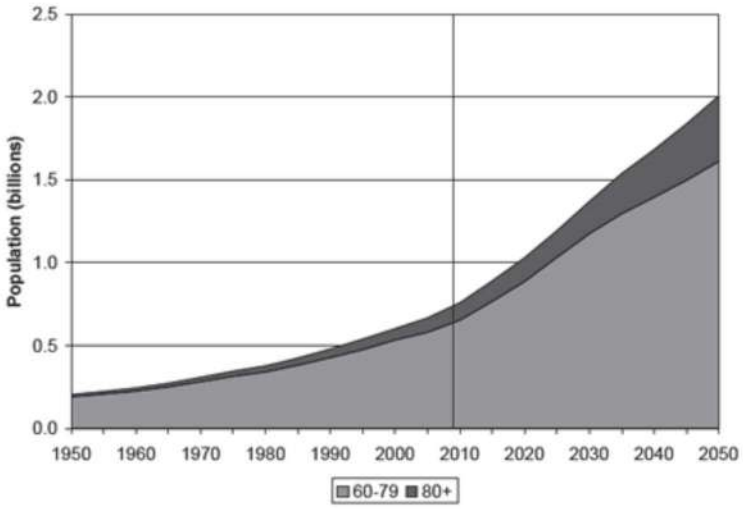

Figure 1.1. Expected increase in the ageing population (Goldman, McKay, Mojet and Kremer 2014).

He *et al.* (2012) believed that this could in fact be the case, stating that the major cause of the increasing elderly population was linked to the decrease in fertility, which was linked to increased life expectancy. The United Nations' Global Population Pyramid stated that the cause of the increasing numbers of the elderly population might be due to the decrease in fertility and mortality rates (Tyrovolas *et al.* 2011).

According to Ogden, Carroll, Curtin, McDowell, Tabak and Flegal (2006), the increased percentage of persons aged 80 years or over (3.8%) was seen to be twice as high as that of the population over 60 years of age (1.9%) at a global level. Food items that were high in micronutrients were costly and were thus often unattainable for the elderly and as a result of the lack of consumption of these micronutrients, deficiencies were commonly seen in the elderly (WHO 2010a), particularly deficiencies in vitamin D, thiamine, riboflavin, calcium, magnesium and selenium (Hoffman 2017).

According to the WHO (2010b), obesity was a common lifestyle disease that was seen worldwide. In developed countries, obesity was acknowledged as an epidemic in the last quarter of the twentieth century. In respect of global mortality, 5% was due to individuals who succumbed to the consequences of being overweight or obese (WHO 2010b). Obesity, along with inactivity, increased the chances of developing non-communicable diseases (NCDs) such as cardiovascular disease (CVD), cancer and type-2 diabetes. Early mortality during adulthood could be a result of this (WHO 2015a and Cetteanu and Jones (2014).

Wright and Aronne (2012) stated that obesity was directly linked to an excessive level of poor nutritional dietary intake as well as a decreased level of physical activity. Over time, when a persons' energy input exceeded the output of energy, this led to an increased number of fat cells in the body. Dependent on metabolic rate, this led to being overweight, and a more serious result of this was an obese or morbidly obese condition.

According to WHO (2010c), osteoporosis and fractures associated with osteoporosis were a major concern resulting in chronic illness, disability and death and caused high medical expenses which some people could not afford. It was anticipated that the number of annual hip fractures worldwide would likely rise from 1.7 million in 1990 to around 6.3 million by 2050 (WHO 2010c).

Research conducted by Clausen, Charlton, Gobotswang and Holmboe-Ottesen (2005) stated that when there were high risk factors present in an elderly person's life, for example, living alone, physical or mental disability, recent death of a spouse or friend, weight loss, consumption of multiple medications, poverty and high consumption of alcohol, nutritional problems relating to the elderly would be present. Receiving adequate nutrition during the earlier adult stages could add value to a person's health status, thereby reducing certain illness experienced during the elderly stages (Ferreira and Kowal 2006).

According to Roy, Stemple, Merrill and Thomas (2007), there was a significant increase in the occurrence of diseases in elderly populations due to the decline of their nutritional status. This decline was due to the many changes taking place in an elderly person's body, both physiological and pathological, which may be seen as fundamental to the ageing process. Some factors which could indirectly affect the healthy eating and nutritional status of the elderly person were social (isolation and depression), socio-economic and reduced quality of life due to concerns about money. This was particularly apparent in the retired elderly who had to live on small pensions or a low income. Another factor was socio-demographic, such as having limited skills when it came to preparing food and being apprehensive about accepting new foods due to cultural and religious status (Oliveira, Fogaça and Leandro-Merhi 2009).

1.4 BACKGROUND TO THE PROBLEM: THE AFRICAN PERSPECTIVE

According to the WHO and the Food and Agricultural Organization (2006), the rising number of aged persons might be the result of a number of factors which included life expectancy at birth, which had been reduced due to the on-going decline in fertility and the high mortality rate in infants, children and adults because of the struggle against the Human Immunodeficiency Virus (HIV), Acquired Immunodeficiency Syndrome (AIDS), tuberculosis and malaria. According to Oldewage-Theron, Salami, Zotor and Venter (2008), during the 1980s the life expectancy at birth for South Africans increased steadily but due to the ongoing effects of HIV and AIDS, it was reduced from 61.6% in the 1980s to 49.7% in 2006. Of this number, it was estimated that 2.9 million of the population were elderly, aged 60 years and above. The United Nations International Children's Emergency Fund (UNICEF) (2013) confirmed that HIV and AIDS had affected many families in Africa. More and more elderly people were forced to look after grandchildren who were left orphaned because of the death of their parents due to HIV and AIDS.

According to Charlton and Rose (2001), the elderly population was not seen as a significant group for nutrition services. Interventions for nutrition in African countries were not undertaken regularly and when undertaken were directed primarily toward infants, young children and pregnant and lactating women. This lack of intervention towards the elderly was the result of the paucity of information from research studies on conditions affecting the elderly. The limited research that had been conducted on this age group suggested that there were numerous nutrition problems affecting the elderly population. Due to the fact that the

ageing population in Africa was increasing, researchers found they needed to focus more attention on this group.

Nabalamba and Chikoko (2011) stated that the elderly population in Africa might encounter different challenges, due to ageing being associated with long-term physical and mental disability and numerous long-term chronic conditions. Africa had an inadequate health care system which was not able to overcome the ongoing health problems among the elderly.

Golaz, Nowick and Sajoux (2012) found that many of the elderly population living in Africa still did not receive an adequate old-age pension, compared to elderly living in countries in the northern hemisphere where the majority of the elderly population received a state pension. However, the pensions, or welfare payments that were paid to the South African elderly were not enough to maintain a decent standard of living. When their pensions were inadequate, the elderly, who could no longer work, relied on family for support and care. However, it was predicted that in the future the families would more than likely not have the resources to support their elderly dependants without sufficient public policy measures being introduced (Golaz, Nowick and Sajoux 2012).

Furthermore, it was recognised that in third world countries, pensions were an important measure to secure and improve the living conditions of the elderly and reduce the risk of poverty. Evidence showed that the risk of poverty found among the elderly was reduced in countries where there was an adequate pension or some other financial safety net to support the elderly population. Examples of these countries were Brazil, Chile and South Africa. However, in countries where the elderly did not receive old-age pensions or where only a select few received a pension, the elderly were affected by poverty (Faye 2010).

1.5 BACKGROUND TO THE PROBLEM: THE SOUTH AFRICAN PERSPECTIVE

In 2016 it was reported that elderly women made up 59.4% of the South African population aged 60 years and over. Of this number, 21.0% of the women were white (Statistics South Africa (STATSSA) 2016). According to the Nestlé nutrition institute (2010), the number of elderly people in South Africa was increasing and with this came an increase in malnutrition despite the advances made in medicine. Sixty-seven percent of the elderly in nursing homes were found to be malnourished or at risk of malnutrition.

According to Charlton, Ferreira and Du Plessis (2008), in comparison to other world regions, sub-Saharan African (SSA) countries were transitioning demographically at the slowest rate.

This might have been caused by the higher fertility and mortality rates linked to AIDS and other diseases commonly found in SSA.

STATSSA (2017) found that KwaZulu-Natal (KZN) had a population of 11,4 million people which was 19.7% of the Republic of South Africa's population. Of the overall population in RSA, 4.89 million (8.5%) were elderly. According to eThekweni Municipality (2011), 3041 elderly people resided in Ward 27 where the elderly residential facility was situated and 97.3% of them lived in formal housing. He *et al.* (2012) stated that the major cause of the increasing elderly population was the decrease in fertility, which was linked to increased life expectancy.

Dunger, Gomez-Olive, Kahn, Kimani-Murage, Klipstein-Grobusch, Norris, Pettifor and Tollman (2011) suggested that food insecurity was a major issue, particularly in South Africa. Due to the fact that it was a third world country which was still developing, there were many people living under adverse conditions. South Africa was rated as one of the highest for income inequality, with 35.0% of the population being food insecure.

Hunger and under-nutrition were both factors caused by inadequate food intake. Hunger was associated with not getting enough food, whereas under-nutrition was the inadequate intake of important nutrients needed to sustain health. Relatively few people could afford a variety of nutritious food (Altman, Hart and Jacobs 2009).

In the Health and Nutrition Examination Survey (NHANES) done in 2005 in America, it was found that 16.0% of people older than 65 years living in elderly communities consumed less than 4.18kJ per day. This statistic would mean that these people were at a high risk of undernutrition. The risk of undernutrition increased in the community-dwelling elderly who were sick, poor and homebound and thus had limited access to medical care (Evans 2005).

Labadarios *et al.* (2011) found that a balanced nutritional intake would sustain a healthy lifestyle; however, food insecurity created an unbalanced nutritional intake. Based on the findings from the 2004 Food and Agricultural Organization (FAO) study, more than 81 million people in developing countries like South Africa were considered undernourished.

1.6 RATIONALE AND MOTIVATION

According to Ahmed and Haboubi (2010), nutrition affected the ageing process and contributed significantly to the health status of the elderly population studied. An elderly person would suffer from malnutrition if their nutrient intake was inadequate. Deterioration in functional status, immune dysfunction, reduced bone mass, reduced muscle activity, anaemia, condensed cognitive abilities, poor wound healing and mortality were all attributes of malnutrition. The elderly experienced malnutrition as a result of a reduced appetite and concomitant energy expenditure, which was exacerbated by deterioration in biological and physiological functions, as well as pathological changes associated with ageing such as chronic diseases and psychological illness in general.

A major concern in the elderly population was poor nutritional status and malnutrition. Malnutrition and unintentional weight loss contributed to deterioration in health, reduced physical and cognitive function, increased utilisation of health care services, and increased mortality (Evans 2005). According to Hintz (2011), due to limited access to income, food security, shelter, health, family and community support, the elderly population was one of the most vulnerable age groups. Evans (2005) found that many health care practitioners ineffectively addressed the many factors that contributed to poor nutrition and malnutrition. A common misconception was that nutritional deficiencies were a normal part of ageing, and that any interventions had a minimal effect and were not necessary. Nutritional assessments and treatment to prevent malnutrition should be a compulsory part of care for all elderly persons, whether in the outpatient setting, acute care hospital or in old-age homes.

Nestlé (2008) suggested that poor nutrition among the elderly population could be significantly linked to psychological, physiological and economic factors which affected the elderly. Moreover, metabolic, oral and dental, physical, clinical, social and economic factors such as depression and financial stress played a significant role in contributing to under-nutrition in the elderly population.

According to the Food and Health Innovative Services (FHIS) (2012), malnutrition was linked to both under-nutrition and over-nutrition and there was major concern regarding the elderly population within the UK (United Kingdom) as older people did not consume enough nutrients to maintain good nutrition in old age. Being underweight could pose a greater risk to one's health than being overweight.

The WHO (2011) also wanted to focus on the health problems of the elderly and reduce the death or disability rate by developing and instituting creative ideas such as additional vaccinations or boosters that would be given throughout the individual's life, in order to promote a healthier immune system in old age. A balanced nutritional diet would sustain a healthy lifestyle but food insecurity created an unbalanced nutritional diet. In addition, food insecurity could be exaggerated by the weakening of the global economy.

1.7 RESEARCH OBJECTIVES

The aim of the study was to examine the relationship between the actual food intake and food group diversity and the nutritional and health status of the white elderly within an elderly residential facility in Durban. It was anticipated that the results of this study could be used to develop nutrition education material and advise the residents about healthy eating and how to maintain a healthy nutritional status.

1.7. 1 SPECIFIC OBJECTIVES:

The specific objectives that the researcher applied to the community in order to evaluate their nutritional status, health and food security, were as follows:

1. To determine the socio-demographic profile of the participants, by means of socio-demographic questionnaires.
2. To determine the anthropometric status of the elderly by calculating the Body Mass Index (BMI), measuring waist circumference and weight-for-height, in order to determine underweight, overweight and obesity
3. To determine the participants' dietary intake by completing 3 x 24-Hour Recall questionnaires.
4. To determine the variety of food intake of the participants, by completing a Food Frequency Questionnaire.
5. To determine the health and behavioural patterns of the participants by completing a health and behavioural questionnaire and measuring blood pressure. Questions were included to elicit self-reported information on the participants' health status, smoking habits, physical activity and use of medication.
6. To determine what the relationship was between the actual food intake and food group diversity and the nutritional status of the participants.

1.7.2 CONCEPTUAL FRAMEWORK OF THE STUDY

The framework below (Figure 1.2) details the various stages involved from the beginning until the end of the study.

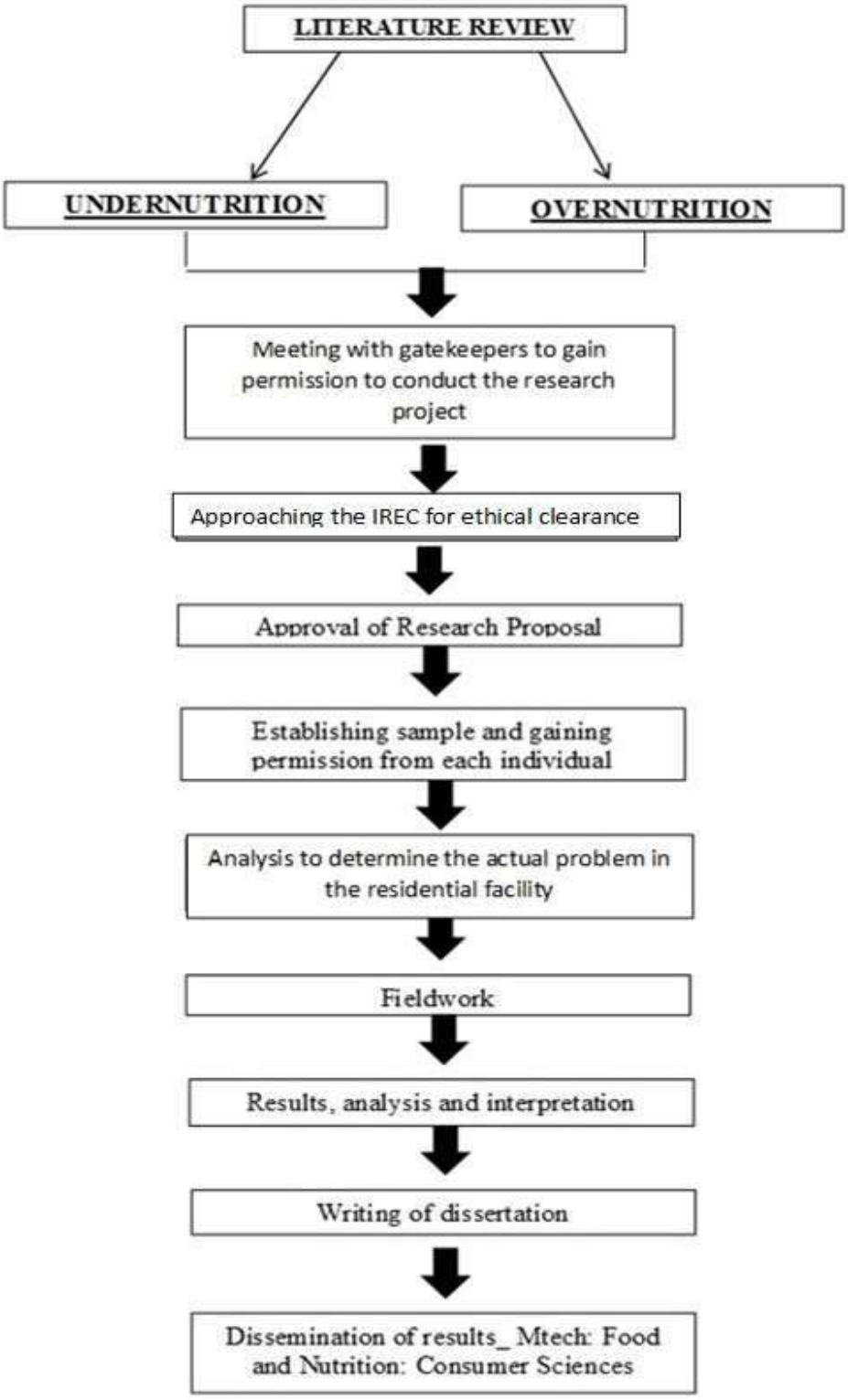

Figure 1.2: Framework of the study

1.8 THE STRUCTURE OF THE DISSERTATION

The structure of the dissertation is presented in Figure 1.3, which provides an outline of each chapter.

CHAPTER ONE: THE PROBLEM AND ITS SETTING

- INTRODUCTION
- DEFINITIONS OF NORMATIVE DIMENSIONS IN FOOD SECURITY
  - A) FOOD SECURITY
  - B) THE RIGHT TO FOOD
  - C) COMMON MISUNDERSTANDINGS ABOUT HAVING A RIGHT TO FOOD
- BACKGROUND TO THE PROBLEM: A GLOBAL PERSPECTIVE
- BACKGROUND TO THE PROBLEM: THE AFRICAN PERSPECTIVE
- BACKGROUND TO THE PROBLEM: THE SOUTH AFRICAN PERSPECTIVE
- RATIONALE AND MOTIVATION
- RESEARCH OBJECTIVE
- CONCEPTUAL FRAMEWORK OF THE STUDY
- STRUCTURE OF THE DISSERTATION
- CONCLUSION

CHAPTER TWO: LITERATURE REVIEW

- INTRODUCTION
- FACTORS THAT INFLUENCE THE AGEING PROCESS
- NUTRITION SECURITY
- FOOD SECURITY
- MALNUTRITION
- NUTRITIONAL REQUIREMENTS OF THE ELDERLY
- NUTRITION ASSESSMENT IN THE ELDERLY
- CONCLUSION

CHAPTER THREE: METHODOLOGY

- INTRODUCTION
- ETHICAL CONSIDERATION
- PLANNING AND ADMINISTRATION
- DEVELOPMENT STAGES OF THE STUDY
- RESEARCH DESIGN
- STUDY TYPE
- STUDY VARIABLES
- SAMPLE SIZE
- RESPONSIBILITY OF FIELD WORKERS
- ADMINISTRATION OF MEASURING INSTRUMENTS
- PROCEDURES FOR CONDUCTING ANTHROPOMETRIC MEASUREMENTS
- STATISTICAL ANALYSIS OF DATA
- DATA QUALITY CONTROL
- CONCLUSION

CHAPTER FOUR: RESULTS AND DISCUSSION

- INTRODUCTION
- RESULTS OF STUDY
- SUMMARY OF RESULTS
- CONCLUSION

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

- INTRODUCTION
- LIMITATIONS OF THE STUDY
- MAIN FINDINGS
- CONCLUSION
- RECOMMENDATIONS
- RECOMMENDATIONS FOR FUTURE RESEARCH

Figure 1.3: The structure of the dissertation

1.9 CONCLUSION

Based on the research, it is evident that the elderly population is growing rapidly and is one of the fastest growing sectors of the population. This is causing a change in the demographic structure and brings large challenges as this group is one of the most vulnerable groups. The dissertation consists of five chapters that are presented in Figure 1.3. The structure of the dissertation outlines the content of each chapter, namely: Chapter One - The problem and its setting, Chapter Two - Literature review, Chapter Three - Methodology, Chapter Four - Results and discussion and Chapter Five - Conclusion and recommendations. Chapter Two extensively outlines the factors that the elderly population encounter, as well as assessing the nutritional status of this population.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews the available literature and previous studies that apply to the study in order to provide a background to the issues that are facing the elderly. Figure 2.1 shows the risk factors for poor nutritional status in the elderly and each of the factors will be discussed in more detail in this chapter.

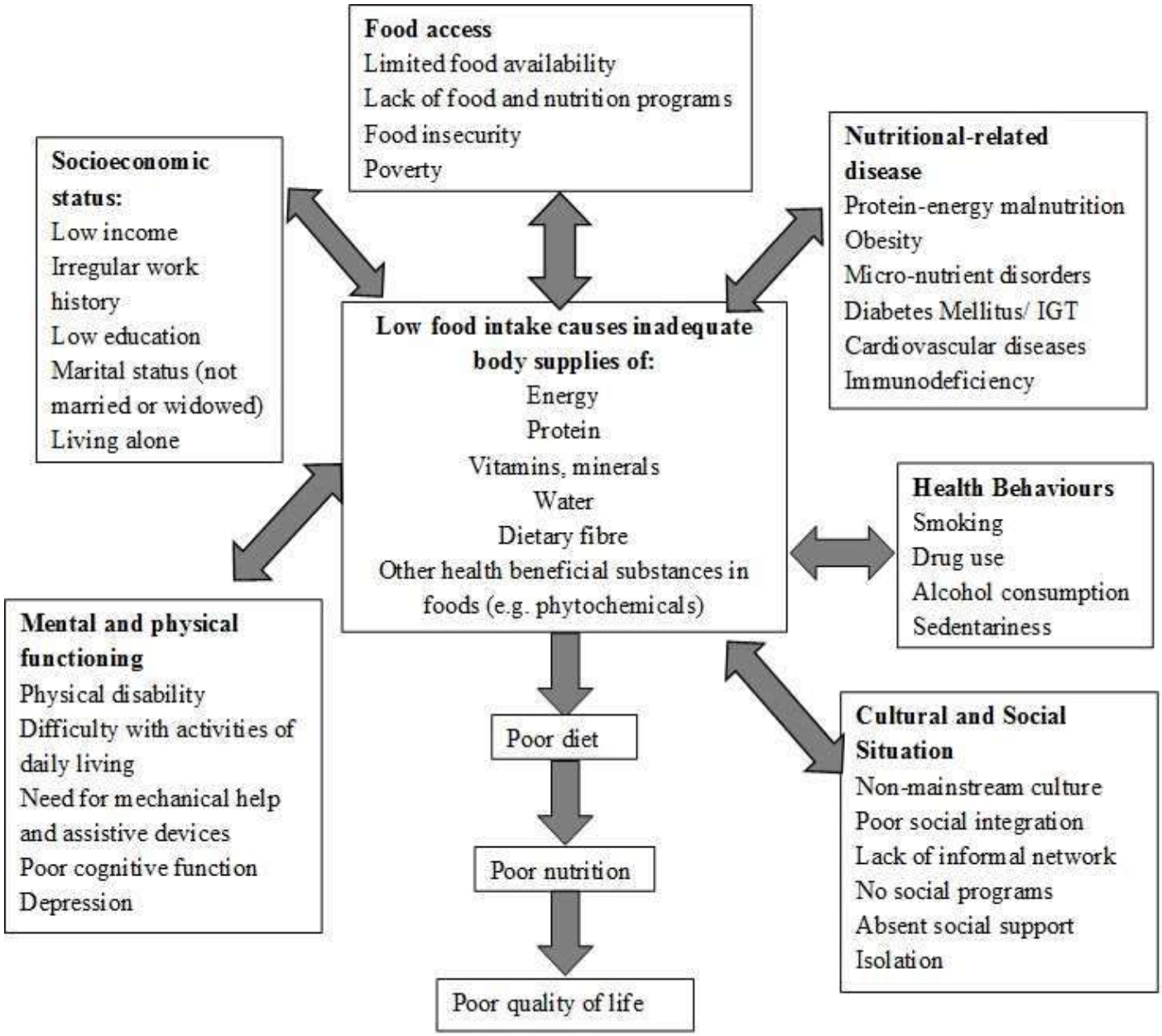

Figure 2.1: The adapted risk factors for poor nutritional status in the elderly (Wahlqvist and Lukito 1992; Bermudez and Dwyer 1999)

Gribble, Haub and Jacobsen (2010) stated that the elderly demographic was the fastest growing demographic globally. The growth rate of the elderly population was growing faster in developing countries due to the size of the overall population growth. Another way of looking at the overall growth of this age group was to look at the relationship between the size of the elderly group and the normal working-class population. This projected that between 2000 and 2030 the ratio of elderly to working-class population was expected to grow from 21.0% to 33.0% in the developed world and from 8.0% to 13.0% in the developing world.

Han, Tajar and Lean (2011) found that when looking at the mortality rates in the UK between 1982 and 2007, there was a significant increase in life expectancy, with an increase of over six years for men, pushing the average life expectancy to 77.2 years and an increase of over four years for women, pushing the average life expectancy to 81.5 years. This statistic was expected to continue increasing in the future and had led to an 'ageing population'.

WHO (2018b) stated the average global life expectancy increased between the years 2000 and 2016 by 5.5 years. This increase was the fastest since the 1960s. This increase was greatest in the African region, where life expectancy increased by 10.3 years. This was mainly due to the child survival rate and expanded access to antiretrovirals for the treatment of HIV. STATSSA (2018a) stated that in 2018 the life expectancy at birth was estimated at 61.1 years for males and 67.3 years for females.

The Food and Health Innovation Services (2012) stated that by 2025 the number of elderly was expected to be more than 1.2 billion with 840 million living in developing countries. Joubert & Bradshaw (2005) explained that an ageing population, or demographic ageing, meant that people from the age of 60 years and above made up the largest number of the total population due to lower levels of fertility and lower levels of mortality. The United Nations' Global Population Pyramid believed that the cause of the increasing number of the elderly could be associated with the decrease in fertility and mortality rates (Tyrovolas, Tountas, Polychronopoulos and Panagiotakos, 2011).

The elderly population was anomalous in that people ranged from fit, active and healthy to extremely frail (Hickson 2006). It was thought that with the rise in the elderly population worldwide, various problems regarding the quality of life of the older generation were to be expected. As the world's population was becoming more obese and there was a greater trend towards obesity, various health related diseases and deficiencies were seen in the elderly, which

were associated with the consequences of the transition in social and dietetic evolutions caused by economic progression (Charlton and Rose 2001; Charlton *et al.* 2008).

Thomas-Crusells, McElhaney and Aguado (2012) stated that infectious diseases were a major issue that the ageing population were facing, which increased the chances of morbidity, disability and mortality. Infectious diseases could be unseen and left untreated and included acute respiratory illnesses that brought on influenza and pneumonia, digestive tract infections, herpes zoster, malaria, tuberculosis, helminthiasis and HIV and AIDS; these were more prevalent in the developing countries.

An increase in the ageing population could have an effect on other related aspects such as retirement pensions, other social benefits and medical costs with an increased demand for health services because older people were more susceptible to chronic diseases, which tended to last for longer periods of time (United Nations 2010). This could be due to the ageing process impacting the innate and adaptive immune systems' ability to control viral infections. Adaptive immunity was necessary to overcome viral infections by creating antigen specific immunity, which brought on the development of protective immunologic memory. Ageing affected adaptive immunity, by bringing about both qualitative and quantitative changes in humoral immunity (Leng and Goldstein 2010).

Thomas-Crusells *et al.* (2012) also found that increased life expectancy was linked to the decrease in the percentage of fertility rates, which ensured that the population of 60 years and above would increase from 10.0 to 21.0% in 2050. FHIS (2012) explained that mortality rates had decreased globally due to progress in the fight against infectious diseases, improvements in hygiene and sanitation, and overall social development and higher living standards. Old age was not considered a disease; however, it was accompanied by non-communicable diseases such as CVDs, musculoskeletal diseases, diabetes mellitus and mental illness (Katta, Gopalakrishnan and Ganeshkumar 2015).

Figure 2.2 illustrates the predicted rise in the elderly population between developed and developing countries between 1950 and 2050.

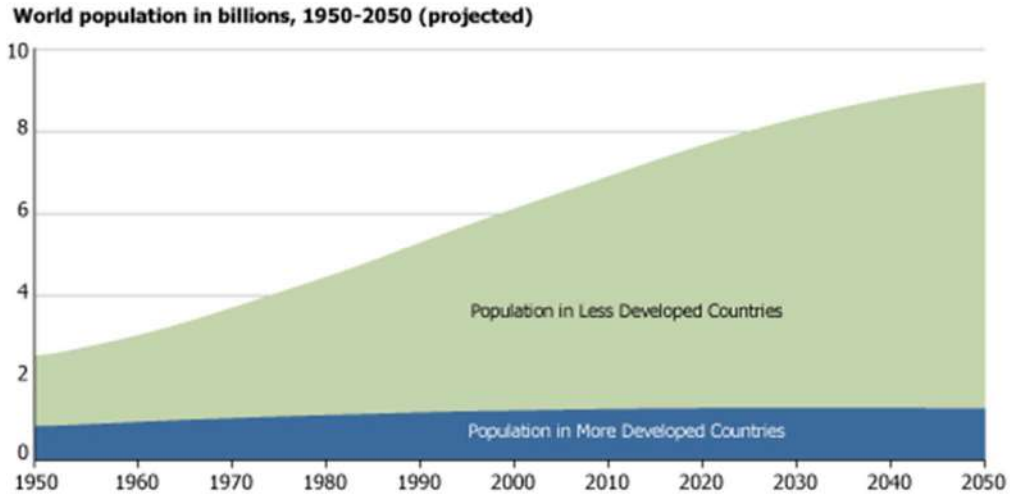

Figure 2.2: World population growth, between developed and developing countries (UN 2007).

2.2 FACTORS THAT INFLUENCE THE AGEING PROCESS

The ageing population group is susceptible to multi-morbidity, which is known to be the presence of two or more interlinked diseases, disabilities and conditions of the elderly. Some examples of these are polypharmacy, sensory deficits, incontinence, decreased energy, cognitive impairment, reduced social contribution and functional weakening, which is often referred to as a reduction in activities of daily living (ADL). A reduction in ADL was seen as a decrease in independence and could lead to an inferior quality of life and even death. All of this resulted in diminished physiological reserves (Parlevliet, Buurman, Pannekeet, Boeschoten, Brinke, Hamaker, Van Munster and De Rooji 2012).

Ahmed and Haroubi (2010) suggested that pathological alterations of ageing such as chronic disease and psychological illness all contributed to the complex cause of malnutrition in older people. Nutritional assessment was important to identify and treat patients at risk. Increased malnutrition in the elderly was linked to various related health issues such as reduced health status, reduced muscle function, reduced bone mass, a weakened immune system, anaemia, decreased cognitive function, poor wound healing and slow recovery from surgery, greater hospital re-admission rates and death. There was also a decrease in appetite and energy expenditure, which was also linked to reduced biological and physiological functions such as

decreased lean body mass, variations in cytokine and hormonal levels, variations in fluid electrolyte regulation, delayed gastric emptying and reduced senses of smell and taste.

2.2.1 THE AGEING PROCESS

WHO (2012) stated that populations around the world were ageing rapidly. This should be classed as a positive outcome and should be celebrated. This showed that childhood diseases, maternal mortality and helping mothers control fertility issues had been dealt with successfully.

Chou (2008) stated that there were several factors that might influence ageing, life span and the quality of life during this life stage, and which included gene reproduction, food, the accumulation of cellular damage and the ability to repair cells. The debilitating changes that came with ageing were the result of environmental influences that a person was exposed to over a lifetime. Once the body reached physical maturity, the progressive changes became greater than the rate of regeneration of anabolic cells, and the result of this was the loss of cells, which caused various levels of reduced efficiency and weakened organ function (De Magalhães, Budovsky, Lehmann, Costa, Li, Fraifeld and Church 2009).

Simkó, Gyurkó, Veres Nánási and Csermely (2009) confirmed that ageing was associated with some diseases, which included cancer, atherosclerosis, diabetes and neurodegenerative disorders such as Alzheimer's disease and Parkinson's disease because of the decline in cell function (Whitney and Rolfes 2016). According to Chuckrow (2010), deterioration was different from person to person and could be managed through three theoretically different impacts that had a different comparative influence in each person. These were physiological factors (changes due to the action of time), pathological factors (changes in the development of previous diseases or surgeries suffered throughout a person's life) and thirdly, changes influenced by individual lifestyle, the environment or by different risk factors, including polypharmacy. Poor nutrient intake contributed to reduced function, repair and production of cells because each cell in the body needed oxygen, vitamins, minerals, amino acids and sugar (Chuckrow 2010).

2.2.1.1 Physiological factors

Whitney and Rolfes (2016) suggested that the one disorder that was often seen as a person starts to age was gastric atrophy. This was responsible for the poor absorption of calcium, iron and Vitamin B12 and could lead to failure to release cobalamin from food or its lack of binding properties on proteins which led to some deficiencies, especially vitamin B12 (Whitney and

Rolfes 2016). Depreciation in physiological functions affected functional physical and cognitive ability in older people and caused depression (Doets, Groot, Di Bari, Visser, Bartali, Volpato, Topinkova, Gambassi and Salva 2011).

2.2.1.1.1 Sensory factors

Taste, smell, sight, hearing and touch were weakened based on the individual's own rate of weakening (Wellman and Kamp 2008). The relationships between loss of hearing, vision impairment and loss of coordination were some of the most common effects that the elderly experienced and could in turn lead to reduced food intake as a result of decreased appetite, food recognition and the ability to feed oneself, therefore leading to poor nutrition (De Magalhães *et al*. 2009). Taste and smell significantly influenced the elderly's selection and enjoyment of food. The elderly's ability to differentiate between subtle differences in taste was diminished, due to a reduced number of taste buds within the tongue (Wellman and Kamp 2008).

According to Fischer, Cruickshanks, Klein, Klein, Schubert and Wiley (2009), assessment and restoration of sensory deficits might lead to an improvement in functioning and well-being in the latter years. A considerable amount of the information that was used to function was captured through multiple senses and had to be centrally combined and incorporated to provide a coherent observation. These multiple senses included vision, hearing and olfactory senses. Cruickshanks, Nondahl, Dalton, Fischer, Klein, Klein, Nieto, Schubert and Tweed (2015) stated that impaired vision and hearing affected independence and the quality of life. Previous research had shown that hearing and vision impairments were linked to a decline in physical and social functioning in the older population.

A study done by Gopinath, Schneider, McMahon, Burlutsky, Leeder and Mitchell (2013) showed that in developing countries, visual impairment was the main cause of disease and was three times more prevalent than it was in developed countries. These impairments were brought on by refractive errors, cataracts, glaucoma and macular degeneration. Hearing loss was another cause of disability because if hearing loss was not treated, it could affect communication and also contributed to social isolation and loss of autonomy and was linked to anxiety, depression and cognitive decline.

Benova, Grundy, and Ploubidis (2015) stated that the ageing process could lead to hearing deficiencies which could be worsened by other factors such as noise experience and genetic conditions. The frequency of hearing deficiency was more prevalent among older men than older women and was linked to other health issues, such as poor nutrition and smoking. If left

untreated, this could lead to a decline in physical, mental and psychological functioning as well as mortality.

Hardin (2012) suggested that hearing loss varied according to age, sex, race and ethnicity. The process of hearing loss in women was thought to be linked to levels of oestrogen, vitamin B12 and red cell folate. Gopinath, Schneider, McMahon, Teber, Leeder and Mitchell (2012) stated that hearing loss was associated with old age and numerous signs of adverse well-being including reduced quality of life, social isolation and depressive symptoms (Lin, Thorpe, Gordon-Salant and Ferucci 2011).

2.2.1.1.2 Oral health status

Oral health meant more than good teeth, as it was a very important part of general health and was essential for the well-being of the elderly as it impacted on the digestive system (WHO 2007). Bad oral health in older years could be impacted by a few factors present during the younger years, such as bad dietary habits, smoking and use of other tobacco products, as well as alcohol use and stress. Good oral health allowed for effective chewing, helped with speech, assisted with social confidence and was linked to an improved cognitive functioning of the elderly (Andrade, Caldas and Kitoko 2008). It was more than likely that the elderly might take medication which caused a dry mouth, leading to tooth decay. Infections of the mouth were the main contributors towards poor dietary habits and moreover, ill-fitting dentures could reduce the elderly's quality of life by impeding their ability to chew (WHO 2007).

The WHO (2007) stated that the following factors could hinder nutrient intake of the elderly:

- Poor levels of nutrients could be linked to difficulty with eating.
- Social isolation could be as a result of poor oral appearance, bad breath and dental incapacity.
- Peptic ulcers and respiratory and cardiovascular illness were an implication of oral disease.
- Dental decay was the costliest diet-related disease in Africa**.**

2.2.1.1.3 Immunodeficiency

Langan (2008) suggested that during the ageing process, the immune system lost its ability to fight infections. This then increased the risk of becoming sick and could make immunisation less effective. Together with this, there was also a decline in the immune system's ability to

detect and correct defects of the cells and this resulted in an increase of cancers associated with ageing. The immune system became less tolerant towards the body's own cells later in life and together with this, an auto-immune disorder could develop where normal tissue was mistaken for non-self tissue and the immune cells attacked certain organs or tissues (Langan 2008)**.**

Delves (2008) stated that this might be as a result of changes in the immune system or problems like diabetes or arteriosclerosis, which led to reduced blood flow to some parts of the body such as the lower legs. Delves (2008) stated that the following were some ways in which the elderly immune system became less effective:

• The ability to distinguish self from non-self (that is, antigens) was reduced. Consequently, autoimmune disorders became more common.

• Macrophages (which ingest antigens) destroyed bacteria, cancer cells and other antigens more slowly. This slowdown was a common cause of cancer in the elderly.

• T cells (which remembered antigens they have encountered on previous occasions) responded less rapidly to the antigens.

• The white blood cells that could respond to new antigens were reduced. The consequence of this was that when there was a new antigen, the body was less able to remember it and defend itself against it.

• In response to the bacterial infections, there were smaller amounts of complementary proteins that did not produce as many of these proteins as younger people did.

• There were fewer antibodies that were produced in response to an antigen and the antibodies were less able to attach to the antigen. Because of this, there was risk of pneumonia related to influenza and infectious endocarditis, which resulted in death more often in the elderly.

2.2.1.1.4 Physical function

The WHO (2009) defined disability as a multi-layered singularity, which showed a link between a person’s health condition and the social and the environmental context in which he or she lived. Although disability was a general term for the diminishment of certain activities, disability might be caused by some impairments. An individual who had decreased functioning might have a problem carrying out daily activities. Tension in family life, social relationships, psychological well-being and level of independence could be the result of this. Measurements

for ADL were routinely used for the evaluation of older people's incapacity to carry out daily activities (functional disability), including basic ADL such as washing and buying, preparing and eating food (Ferdous, Cederholm, Razzaque, Wahlin and Kabir 2009; Parlevliet *et al.* 2012; Mithal, Bonjour, Boonen, Burckhardt, Degens, Fuleihan, Josse, Lips, Torres, Rizzoli, Yoshimura, Wahl, Cooper and Dawson-Hughes 2013). According to Rabaglietti, Ciairino, Candela, Magistro and Liubicich (2012), elderly people should be encouraged to partake in physical activity as it could enhance the biological and physiological state of an elderly person.

2.2.1.2 Biological factors

2.2.1.2.1 Gastrointestinal (GI) decline in elderly people

Wellman and Kamp (2008) suggested that during the ageing process, there was a significant decline in gastrointestinal function and the most common disorders experienced by the elderly were diverticulosis and ischemic bowel disease which tended to develop and therefore led to problems with constipation. One of the most common complaints among the elderly population was gastroesophageal reflux, also known as heartburn. This was caused by small changes in the digestive system that might increase their vulnerability to illness and malnutrition.

The ability of the elderly to consume food was influenced by gastric changes, therefore gastric mucosa often led to a reduced resistance to damage caused by cancer, ulcers and infections (Wellman and Kamp 2008). Inflammation and pain caused by gastritis was due to a delay in gastric emptying and discomfort and had a major effect on the bioavailability of nutrients, therefore this increased the risk of developing chronic disease such as osteoporosis (Wellman and Kamp 2008).

In people over the age of 75 years, the variety of gastric atrophy and *H.Pylori* had also been linked to reduced demonstration of gut appetite in proteins, in leptin and in ghrelin, which increased the instance that *H.Pylori* might be impacting on undernutrition in the older population. Gastric atrophy could also cause constipation because of the reduced production of the mucoprotein intrinsic factors and malabsorption of Vitamin B12 (Di-Mauro, Neu, Riezz, Raimondi, Martinelli, Francavilla and Indrion 2013).

Ahmed and Haboubi (2010) stated that the overall decrease in acid excretions predisposed the gut to small bowel bacterial overgrowth. Bacterial overgrowth had been known to be related to decreased body weight and the decreased intake of micronutrients. The liver depreciated in size and blood flow also declined with age; however, the microscopic changes were subtle.

Oesophageal motility might diminish the reduction of neurons in the mesenteric plexus in the elderly population (Ahmed and Haboubi 2010).

2.2.1.2.2 Biological changes of the digestive system in the elderly

Grassi, Petraccia, Mennuni, Fontana, Scarno, Sabetta and Fraioli (2011) found that in the ageing population, digestive functions changed in respect of motility, secretion, intraluminal digestion and absorption. Older individuals often had oropharyngeal muscle dysmotility and experienced difficulty in swallowing food. The changes in the digestive system indicated the workings of symptoms of gastrointestinal dysfunctions in the older population, such as dysphagia, gastroesophageal reflux disease, primary dyspepsia, irritable bowel syndrome, major constipation, maldigestion and decreased absorption of nutrients. The diseases that were most often seen in the elderly were atrophic gastritis, gastric ulcer, colon diverticulosis, malignant tumours, gallstones, chronic hepatitis, liver cirrhosis, hepatocellular carcinoma (HCC) and chronic pancreatitis (Grassi, Petraccia, Mennuni, Fontana, Scarno, Sabetta and Fraioli 2011).

2.2.1.2.3 Gastric emptying

Pilotto, Rotondo, Mario and Parma (2007) suggested that small bowel motility problems, gastric motility and emptying were common among the elderly population. There was a reduction in the forward-moving motion of the colon and this was linked to neurological and endocrine-paracrine changes in the colonic wall. A decrease in gastric secretions (such as acid and pepsin) and lack of the mucus-bicarbonate barrier were often specific to the elderly and could lead to gastric ulcers. Exocrine pancreatic secretion was often reduced as was the salt content of the bile.

2.2.1.2.4 Metabolic system

A person's metabolism controlled the chemical and physical changes that occurred within the body that aided in its ongoing growth and function (Wellman and Kamp 2008). According to Roy *et al.* (2007) after the age of 50 years, there were many metabolic and physiological changes that occurred in an individual. The metabolic rate reduced and in some cases it could drop to 30.0% over a lifetime. Bechtold, Palmer, Valtos, Iasiello and Sowers (2006) stated that metabolism joined the breakdown of complex organic constituents of the body in order to release energy for all the processes of the body, which included the building of complex substances where the material of the tissues and organs was formed. The decline in metabolism

of the elderly was caused by a change in body composition. There were changes in the body composition with age due to the decrease in the mass of lean tissue as the amount of fat increased. The reduced rate of metabolism in the elderly also reduced the use and efficiency of protein absorption in the body (Jan 2006).

2.2.1.3 Pathological factors

Old-age affected pathological factors which contributed to malnutrition. Table 2.1 below shows the different types of pathological factors that could be affected by ageing.

Table 2.1: Types of pathological factors (Ahmed and Haboubi 2010 and Hickson 2006).

Types of the pathological factors	Types of diseases
Medical factors	• Cardiac (chronic heart failure) • Respiratory disease (chronic obstructive pulmonary disease) • Gastrointestinal (malabsorption syndromes, dysphagia, *H-Pylori*, atrophic gastritis) • Endocrine disorders (diabetes thyrotoxicosis) • Neurological (stroke, Parkinson's disease, motor neuron disease) • Infection (pneumonia, urinary tract infection) • Malignancy • Physical disability (arthritis) • Alcoholism • Poor dentition • Drugs
Psychological factors	• Delirium • Dementia/ Alzheimer's disease • Depression • Anxiety • Alcoholism • Bereavement
Sociological factors	• Poverty • Isolation • Inability to shop for, prepare and cook meals

2.2.1.3.1 Diseases affecting the elderly

Lifestyle habits such as smoking, inadequate food intake and the absence of physical activity were major causes of the above illnesses. Other factors that contributed towards the illnesses were non-adaptable factors such as age and genetics (Whitney and Rolfes 2016). Diets high in

saturated fats and poor in carbohydrates, dietary fibre, fruit and vegetables were also seen as a cause of disease in the elderly (Magnusson 2008; Lucca *et al.* 2011).

2.2.1.3.2 Obesity

Nowson (2010) stated that the number of elderly people that were obese and overweight had increased over the years. Older people tended to suffer more with sarcopenia obesity, which resulted from excessive weight and reduced muscle mass. The effects of obesity and sarcopenia were physical disability, morbidity and mortality. Overweight or obesity was the result of not meeting the nutritional requirements due to prolonged consumption of higher energy/low nutrient density foods. This was especially the case in the elderly (Pearson and Biddle 2011).

BMI is the WHO (1995) gauge used to access underweight, overweight and obesity in adults. Ahmed and Haboubi (2010) suggested that obesity was also seen to be linked to diseases such as diabetes, hypertension and CVD. Often an older person with a higher BMI suffered from symptomatic osteoarthritis, enlarged grades of cataracts, mechanical urinary and bladder problems as well as sleep apnoea and other respiratory issues. Attention should be focused on promoting weight loss in overweight older people based on body weight alone, even though deliberate weight loss for overweight elderly people might be harmless and necessary. Weight loss diets, as well as exercise programmes should be combined to preserve muscle mass, as dieting on its own could result in loss of muscle and not only fat, and the elderly already had decreased skeletal muscle mass.

2.2.1.3.3 Cardiovascular disease

According to Tourlouki, Matala and Panagiotakos (2009), CVD was expected to be the main cause of disability and mortality in old age. In the European Union (EU), CVD caused about 21.0% of deaths and cost the EU economy around 169 billion a year. The WHO maintained that 30.0% of deaths worldwide were caused by CVD. There had been an increase in the effect of CVD on low and middle-income countries such as India and China. Not only did biological ability diminish with the ageing process, but also many encounters and behaviours throughout a person's life would dictate the risk of CVD. For example, a lack of exercise and physical activity in earlier years might have a negative effect on health status as that person grew older; also, loneliness and depression in older years might lead to decreased appetite and increase the chance of nutrient deficiency (Tourlouki, *et al.* 2009). In 2009 the estimated cost for treating cardiovascular disease in the United States was $ 475.3 billion, and for CHD it was $ 165.4 billion (American Heart Association 2009).

2.3 NUTRITION SECURITY

Alkire and Santos (2014) stated that just consuming food was not enough; every individual should constantly have access to a range of nutritious foods that contain protein, carbohydrates, fats, vitamins and minerals. Adding to this, easily accessible potable drinking water should also be available, as it was related to a sanitary environment. Acceptable health services that assist individuals with living a healthy active lifestyle by providing information, resources and skills for all the members of the household should be available. Adding to the above report, every person should have access to facilities to aid in the prevention, treatment and care of diseases which could affect the individual's nutritional status. There should also be a system in place worldwide to protect people during crisis situations such as natural disasters or political unrest. Nutritional security would be possible if all the above could be achieved in both developing and undeveloped countries (Alkire and Santos 2014).

Figure 2.3 shows the factors which lead to food and nutrition security (FNS). It also highlights the link between food security and nutrition security.

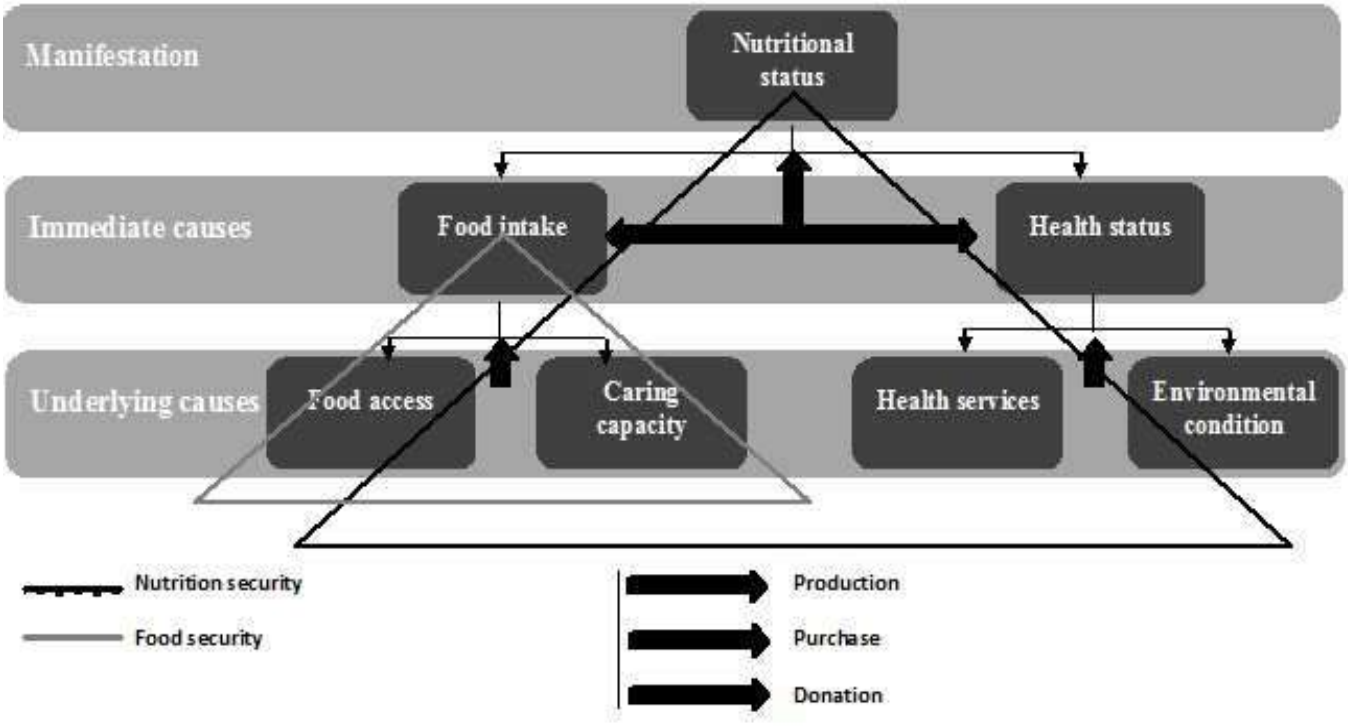

Figure 2.3: The conceptual framework of food and nutrition security at a household level (Gross 2002).

2.3.1 FOOD AND NUTRITION SECURITY

Ruel (2013) stated that nutritional security corresponded with food security. Being food secure was seen as having constant physical, social and economic access to adequate, harmless and nutritious food to complement dietary needs and food preferences for a healthy, active life. To have food security, a person needed to have access to the four pillars of food security, which were availability, accessibility, utilisation and stability. Nutritional security was present when an entire household had a substantial intake of energy, vitamins, proteins and minerals at all times. The framework of nutrition security focused more on the biological needs of the human body and the physiological requirements. Food security, on the other hand, focused more on the economic approach, meaning how food was made. This showed that food security was not adequate without nutritional security in order to maintain the healthy nutritional status of a household. Poor households, poor communities and poor nations were a major concern when looking at food security and nutritional security (Shetty 2009).

According to Misselhorn, Aggarwal, Ericksen, Gregory, Horn-Phathanothai, Ingram and Wiebe (2012), the world had not attained food security and nutritional security due to the fact that billions of people worldwide received inadequate nutrition and one billion people in this century still did not consume enough food, irrespective of the worldwide attempt to maximise food production over the past half century in order to provide for the world's demands. It was expected that the world would still be under severe pressure to meet food demands in the following 50 years due to global environmental changes related to climate, biodiversity, water availability, land usage, tropospheric ozone, other pollutants and a rise in sea levels. These changes would come about partially from the food system itself (Misselhorn, Aggarwal, Ericksen, Gregory, Horn-Phathanothai, Ingram and Wiebe 2012).

Godfray, Beddington, Crute, Haddad, Lawrence, Muir, Pretty, Robinson, Thomas and Toulmin (2010) suggested that the world was faced with a dilemma because although there had been growth in food production, which had led to a major reduction in the amount of people who were hungry, more than one in seven people in 2010 still did not have access to adequate protein and energy from the diet. On top of this, even more people suffered from some sort of micronutrient malnourishment. There would be a marked increase in the wealth and consequent higher buying power of the world's population due to the estimated global population increasing to nine billion by the middle of the century. Biesalski (2013) stated that there was a belief that the increased demand for processed foods such as meat, dairy and fish would place increased pressure on the food supply system. Food producers were facing increased struggles

in terms of land, water and energy and the need to limit the numerous negative effects that food production was placing on the environment. The increased demand for food put additional pressure on food production methods that were ecologically and socially sustainable. Suppliers also needed to guarantee that the poorest people in this world were no longer hungry. This involved differences in the way food was made, stored, processed, distributed and accessed as drastic as those changes that took place during the 18th and 19th centuries in the Industrial and Agricultural Revolutions and the 20th Century Green Revolution (Biesalski 2013).

2.4 FOOD SECURITY

Strickhouser, Wright and Donley (2014) stated that the term 'hunger' had been replaced with the term 'food insecurity' due to the fact that hunger was seen as a physiological condition which defined the physical pain and discomfort a person encounters. However, food security was a social, cultural or economic state which made it easier to conceptualise and measure. Also, food insecurity referred to a much broader and often more general problem than could be described as 'hunger'. Unlike hunger, food insecurity was not temporary. When a person was in a state of hunger, this suggested a much greater extent of need, or a more serious condition than stating that people had problems with accessing food (Strickhouser, Wright and Donley 2014). Sherry *et al.* (2007) stated that hunger was quite possibly a consequence of food insecurity amongst the elderly, especially when hunger was ongoing as it resulted in undernutrition.

Wolfe, Frongillo and Valois (2003) stated that food insecurity and hunger coincided and the two were not only unpleasant, but food insecurity and hunger added to the many nutritional and non-nutritional concerns which could exacerbate poor health and nutritional status especially in vulnerable groups such as the elderly (McGuire and Beerman 2013).

Lambrou and Nelson (2010) stated that there had been an increased stress on global food markets from increasing populations, longer term changing aspects such as climate change and increasing food requirements due to ongoing changes in dietary patterns. There were also other issues, such as industrial land usage where pollution caused soil degradation and once the soil was polluted, agricultural practices could not be carried out and this led to food insecurity. When land usage was changed from agricultural use to urban use, it resulted in most of the population in developing countries being forced to rely on commercial trade, which was the main source of food and this made the population vulnerable to the effects of food price increases (Stage, Stage and McGranahan 2009).

Seligman, Laraia and Kushel (2009) stated that households that were food insecure were not able to afford a balanced meal, worried about inadequate food supply, ran out of food, cut meal sizes and skipped meals. Severe levels of food insecurity caused people to go hungry and even not eat for the entire day because there was limited money to buy food. Income insecurity caused by a lack of employment could lead to household food insecurity (Altman, Hart and Jacobs 2009). Charlton (2000) found that most South African pensioners, whether residing in urban or non-urban areas, used their social pensions to contribute to a large portion of the household budget

Maxwell, Watkins, Wheeler and Collin (2003) suggested that even though poverty and low income were linked to food insecurity, suitable household income was not enough to ensure food security. Ivers and Cullen (2011) stated that when the household suffered from food insecurity, it embraced structures to cope with the shortage of food and this could either be by changing the diet by using cheaper food instead of food that was preferred, or by households resorting to short-term strategies to increase the food supply such as borrowing, buying on credit, begging or eating wild-grown foods or seed stock but this was only done in extreme cases. According to Bremner (2012) these coping strategies reflected the levels of severity of food insecurity. The severity was only determined by the frequency with which the coping strategies were used, which would specify the degree of food insecurity per household.

According to Seligman *et al.* (2009), households that were food insecure were forced to reduce their food budget, food intake and food variety. The negative impact of reducing dietary variety was the increased consumption of energy-dense foods. These foods consisted of refined grains, added sugar and added saturated/trans fats, which tended to be of poor nutritional value and were less expensive, kilojoule-for-kilojoule, than other foods. People in food insecure households tended to eat less fruit, vegetables, dairy products as well as micronutrient rich food, including the B complex vitamins, magnesium, iron, zinc and calcium. These restrictions were linked to the individual developing chronic diseases of lifestyle including hypertension, hyperlipidaemia and diabetes mellitus (Dewbre 2010).

Labadarios, Mchiza, Steyn, Gericke, Maunder, Davids and Parker (2011) stated that food insecurity was a clinically related problem which led to the progress and ill management of diet-related chronic diseases and poor access to health care. When looking at the FAO report on the circumstances of food insecurity from 2004, it was evident that more than 814 million people from developing countries were undernourished. These included Brazil, Nigeria,

Lesotho, Swaziland, Ghana, Lebanon, India, Jamaica, Kuwait and many other countries. Of this number, 240 million people were from sub-Saharan Africa, specifically South Africa, Lesotho, Ghana, Mozambique and other countries. Bremner (2012) suggested that this meant that one in every four people in sub-Saharan Africa had insufficient food intake and this had a negative effect on a healthy, active lifestyle. Bhargava, Lee, Jain, Johnson and Brown (2012) found that the incidence of food insecurity in elderly households had been linked to poor food availability, decreased nutrient consumption, poor self-reported health status, overweight and obesity, physical and psychological health problems, advanced cardiovascular disease and poor diabetes self-management. Bremner (2012) stated that when elderly people were faced with food insecurity, diseases might be worsened and there was a decline in resistance to infection leading to prolonged hospitalisation and as a result of this, there would be an increase in individual care-giving and healthcare costs and national healthcare expenditures.

In recent years, there had been a theory that food insecurity led to chronic disease. Food insecurity in households with low income was linked to chronic diseases due to the reduction in food quality and quantity (Laraia 2013). Seligman, Jacobs, Lopez, Tschann and Fernandez (2012) stated that type 2 diabetes and poor diabetes control were linked to food insecurity due to there being an increased risk of patients finding it difficult to adhere to a diet suitable for diabetics because of a shift in dietary intake, leading to a high consumption of low-cost, appetizing foods that were energy dense, and which generally included a high proportion of extra fats, sugar and other refined carbohydrates to maintain energy levels. These foods normally led to a difficulty in maintaining acceptable glycaemic levels. As a result, patients using insulin to treat diabetes had been seen to have a hypoglycaemic reaction, which was a serious problem caused by poor diabetes management with short-term effects of blurred vision, agitation and anxiety, and which could lead to coma or seizure. Laraia (2013) found that there was often a high consumption of foods rich in fats, sugar and other refined carbohydrates at the beginning of the month and then food scarcity at the end of the month which is known as a cyclical pattern, and which could lead to weight gain over a brief period due to consumption of high-fat foods or adverse physiological response to the diet. According to Kim and Frongillo (2007) depression, stress and metabolic syndrome were also linked to food insecurity.

2.5 MALNUTRITION IN THE ELDERLY

Developing countries worldwide are experiencing major socio-economic changes and these changes were having a negative effect on the health of people by bringing about diseases linked to poverty. The leading disease linked to poverty was usually undernutrition in low income households. The problem had become even worse because there was obesity as well as undernutrition in both low and middle-income countries, which created a double burden of malnutrition because of poor nutrient intake (Aitsi-Selmi, Benova, Sholkamy and Marmot 2009).

Hickson (2006) stated that malnutrition was the condition of not being adequately nourished due to the lack of one or more nutrients, which was known as undernutrition or an excess of nutrients known as overnutrition. It had been reported worldwide that there was a high rate of malnutrition in the elderly (15.0–60.0%) (Marais and Labadarios 2007). Between 1995 and 2005, South Africa was experiencing a change in nutrition transition, which recognised that there was a coexistence of both under- and overnutrition which was evident between and within populations and across age groups (Steyn, Fourie and Temple 2006).

Holmes, Krantz, Rogers, Gottdiener and Contrada (2006) stated that 16.0% of the elderly population aged 60 years and above were malnourished and 2.0% out of this 16.0% were over the age of 85. Malnutrition was also found to be closely linked to reduced muscle function, reduced bone mass, immune dysfunction, anaemia, weakened cognitive function, poor wound healing and delayed healing from surgery, and mortality.

The double burden of malnutrition causes chronic diseases like hypertension, diabetes, cancer and osteoporosis. Africa had been dealing with ongoing challenges when it came to infectious diseases as there was an increasing number of parasitic diseases such as tuberculosis (TB) and malaria (FAO 2006).

McGuire and Beerman (2013) found that undernutrition stemmed from malnutrition and was a chronic condition caused by continued poor intake of food that was needed for the body to meet the dietary energy requirements. This led to poor absorption and biological use of nutrients which had been consumed and this resulted in weight loss which promoted underweight. Popkin (2001) added to this, stating that overnutrition also stemmed from malnutrition, which was a persistent condition where there was considerable consumption of food over and above the body's dietary energy needs. The effects of overnutrition were

overweight which led to obesity, which was a large build-up of fat in adipose tissue due to the over-consumption of energy dense foods which were not properly utilised by the body. Holmes *et al.* (2006) stated that protein energy malnutrition (PEM) was caused when there was insufficient intake of energy foods and protein. This led to diseases like kwashiorkor and marasmus.

2.5.1 METHODS OF ADDRESSING MALNUTRITION

Shetty (2009) explained that food security should be focused on globally as this could lead to improving the nutritional priorities that contributed to the health of the population. A major concern in the developing world was the poor quality of food and lack of variety in the diet and this brought about complications such as ill health, decreased economic productivity and poor quality of life. Insufficient dietary intake often led to micronutrient deficiencies, which could only be fixed by sustainable food-based foundations such as a variation of nutrient-dense foods and bio-fortification and which increased the consumption of micronutrients (Houston, Nicklas, Ding, Harris, Tylavsky, Newman, Lee, Sahyoun, Visser, Marjolein and Kritcheveky 2008; McGuire and Beerman 2013).

The World Bank (2006) stated that the international community and governments in developing countries were responsible for the elimination of malnutrition in all developing countries. Malnutrition had existed for quite some time but the two bodies collectively constantly failed to eliminate the problem. The international community and the developing countries' governments knew about the causes of malnutrition, which were economic expansion and poverty but they were seemingly unable to deal with these problems. Unfortunately, more damage would be done if malnutrition was constantly overlooked because malnutrition not only affected hunger and poverty but there were also other concerns such as maternal and child health, education and gender equity. If the Gross Domestic Product (GDP) was used to overcome malnutrition, there would only be an improvement in nutrition of 2.0-3.0% (FAO 2006; Ruel 2013).

2.5.1.1 Food based dietary guidelines

The food based dietary guidelines have been used by the South African Government as a nutritional educational tool with the intention of improving the eating choices and lifestyles of individuals, communities and the country as a whole. One of the goals envisaged to improve these conditions, which were introduced at the 1992 FAO/WHO international conference, was to globally reduce malnutrition, micronutrient malnutrition and diet-related communicable and

NCDs. The problems that were linked to nutrition could be reduced through the encouragement of correct nutritional intake and a healthy lifestyle (Tyrovolas and Polychronopoulos 2011; Seedat and Rayner 2012; Vorster, Badham and Venter 2013).

The consumption of nutrients was linked to local availability and food production processes (Vorster, Love and Browne 2001). The Nutrition Society of South Africa (NSSA) had worked on improving the FBDGs to match the broad South African population. The recommendations put forward by the NSSA were as follows: each guideline should be uncomplicated, understandable and easy to interpret by other cultures, who might have minimal education and they should also be encouraging. The ingredients should be affordable and readily available so as to make consumption sustainable. Also, the guidelines should address both under- and overnutrition related problems (Vorster, Badham and Venter 2013).

According to Vorster, Badham and Venter (2013), the guidelines were as follows. Individuals are encouraged to:

- Enjoy a variety of foods.
- Be active.
- Make starchy foods part of most meals.
- Eat plenty of vegetables and fruit every day.
- Eat dry beans, split peas, lentils and soya regularly.
- Have milk, maas or yoghurt every day.
- Eat fish, chicken, lean meat or eggs daily.
- Drink lots of clean, safe water.
- Use fats sparingly. Choose vegetable oils, rather than hard fats.
- Use sugar and foods and drinks high in sugar sparingly.
- Use salt and food high in salt sparingly

2.5.1.2 Food fortification

According to South African Department of Health (2009), food fortification was a well-known method of including complete micronutrients such as vitamin A, iron or iodine in foods needed to reduce micronutrient deficiencies. In countries like South Africa, this method had been used since 1996 because the Department of Health had successfully applied to various bodies of authority to execute the national fortification programme. The programme for fortification of staple-foods was first put in place in South Africa in 2003. The legislation compelled millers

and manufacturers to fortify bread with vitamin enriched wheat flour as well as maize meal. Nesamvuni, Vorster, Margetts and Kruger (2005) stated that maize meal and bread flour needed to be fortified with the following vitamins: vitamin A, thiamine, riboflavin (vitamin B12), pyridoxine (vitamin B6), niacin and folic acid. The minerals that were to fortify maize meal and bread flour are iron and zinc. Bread flour and maize meal (super, special, sifted and unsifted) were used for fortification, as these products were consumed by the majority of people in South Africa.

The Department of Health (2009) stated that salt was fortified with iodine in 1996 due to the evidence of iodine deficiency in South Africa at the time. The shortage of iodine could affect brain development in children and cause goitre in adults. A continued deficiency in iodine could cause mental retardation, cretinism, abortion and hypothyroidism.

2.5.1.3 Food supplementation

According to FAO/WHO (2006), food supplementation was the administration of a pharmacological nutrient procedure in capsule or tablet form or in the form of an injection. It should be given as an immediate response to benefit people who were at risk of malnutrition. These supplements should mainly be given to people who could not meet their required nutrition needs from food that might be available to them. The groups of people who might most need supplementation at some stage of life were women of childbearing age, babies, ageing people, people from low socio-economic groups and inhabitants that were experiencing emergency situations (FAO/WHO 2006; Leandro-Merhi, Fogaça, Gomes and Oliveira 2009).

2.5.1.4 Food diversification – genetically modified food

Friends of the Earth (2003) and Mozumdar, Islam and Saha (2012) stated that genetic modification (GM) used technological processes whereby scientists took genes from one organism and combined them with another organism. This altered the characteristics of the organism, or affected how it grew and developed. Lusser, Raney, Tillie, Dillen and Rodríguez-Cerezo (2012) found that one of the concerns with genetically modified crops was the lack of variety. Some of the crops that had shown positive results with genetic modification were soybeans and maize. These made up more than 50.0% of the world's GM crops and the reason for soybeans being popular for genetic modification, was that soybeans could be planted as a second crop after wheat. Maize covered about 31.0% of the world's GM area of plantation. According to Mozumdar, Islam and Saha (2012), there was a possible negative effect that genetic modification had on organisms. GM products were unpredictable due to the fact that

the genes being inserted into organisms had not previously been eaten as food and new proteins were brought into the human and animal food chain. It had been suggested that they could cause allergic reactions or other health problems.

2.5.1.5 Nutrition education

According to Gibson (2005) and Margetts and Nelson (2006), nutrition education and the progression towards healthy eating and following a healthy lifestyle was increasing. Nutrition education was seen as any engagement in educational policies used to assist with the intentional acceptance of food choices, other foods and nutrition associated behaviour to support health and wellbeing. A nutrition education tool that used a logical style and policies consisted of different activities to support the specific group and assisted in making changes in behaviour and enhanced the outcome.

Further in-depth nutrition education was an important educational intervention (Homenko, Morin, Eimicke, Teresi and Weinstock 2010). This needed to focus on poor diet and lack of physical activity which could both lead to four of the main causes of death, which were heart disease, cancer, stroke and diabetes. A poor diet could also cause lifestyle diseases such as obesity, hypertension and osteoporosis (Nishida, Uauy, Kumanyika and Shetty 2004). The purpose of nutrition education was to improve the nutrition status of people by providing information that would help people change their eating behaviour and lifestyle. Nutrition education could be used to improve the lives of people by encouraging a well-balanced diet and increased exercise, encouraging pregnant women to eat a well-balanced diet during pregnancy so as to give birth to a healthy child, teaching people hygienic ways of handling food in order to prevent foodborne illness, encouraging breastfeeding, and informing mothers that babies who were breastfed had a stronger immune system and might be better protected from childhood diseases. According to Unicef (2018), these common childhood diseases were pneumonia, tuberculosis, malaria and diarrhoea. Nutrition education could help improve lives and reduce health care costs. It could also improve the consumption of healthy food in families with a low income by teaching people how to make healthy food choices. This would reduce the money they spent on health care (Homenko, Morin, Eimicke, Teresi and Weinstock 2010; Nishida, Uauy, Kumanyika and Shetty 2004).

Koplan, Liverman, Kraak (2005) stated that there should be interventions to combat malnutrition, such as making the crisis of malnutrition a national priority, meaning that more

attention should be paid to this illness, and ensuring that community programmes were implemented and healthy food choices promoted.

2.6 NUTRITIONAL REQUIREMENTS OF THE ELDERLY PEOPLE

According to Whitney and Rholfes (2016), the nutritional status of a person could be influenced by many physical, psychological, economic and social changes due to ageing. There was a risk of a decrease in appetite and food intake when a person got older. Compared to younger people, elderly people were less hungry, got fuller quicker when eating a meal and thus ingested smaller meals, ate more slowly, indulged in less snacking between meals and there was generally more satiety after a meal (Whitney and Rolfes 2016).

According to Garrow, James and Ralph (2000), the existing knowledge that a person had about the importance of a good diet and good nutrition needed in order to maintain health and avoid disease, was a vital factor in the care of the elderly. There was a lower incidence of malnutrition seen in the independent living elderly compared to the institutionalised elderly. The key factor that directly and indirectly impacted the quality of life in the elderly was nutrition as at the time, overnutrition seemed to be more problematic to the health status of the South African elderly than undernutrition (Garrow *et al.* 2000).

According to Garrow *et al.* (2000), the following were nutrient requirements of the elderly that were influenced by body changes:

- Reduced energy requirements due to muscle mass decreasing; reduced physical activity requires fewer calories.
- Slower uptake of vitamin A in peripheral tissue, causing higher circulation levels.
- Reduced immune function with an increase in the vulnerability to infection and disease; this could be slowed down by the increased intake of vitamins and minerals.
- Skin synthesis of vitamin D is weakened.
- Vitamin B6 consumption is compromised.
- Thirty three percent of the elderly had a limited secretion of stomach acid, affecting the absorption of vitamin B12, folic acid, calcium, iron and zinc and this explained the reduction and possible need for supplementation of these nutrients through oral supplements.

Whitney and Rolfes (2016) stated that the dietary guidelines for the elderly focused mainly on changes in nutrient intake such as energy and nutrient dense foods in order to meet the recommended nutrients per 1000kJ. The dietary guidelines also concentrated on fluid intake as elderly people were prone to dehydration due to the physiological factors that changed when a person aged, such as:

- The kidneys' reduced capacity to sterilise urine
- A reduced thirst sensation
- Renal resistance to Vasopressin (which is an anti-diuretic hormone)
- An alteration in cognitive and functional status
- Side effects due to certain medications (Whitney and Rolfes 2016; Turley and Thompson 2016).

Nestlé (2008) stated that there was a greater requirement for certain vitamins and minerals, even though elderly people required fewer total kilojoule. It was particularly important for the elderly to eat foods such as fruit and vegetables, whole grains, lean meat, fish, poultry, low-fat milk and dairy products, and nuts and seeds, as these foods were high in nutrients. There should be a reduction in sweets and alcohol but they did not have to be totally excluded, as consuming a healthy, balanced diet should allow for as much pleasure as possible but within reasonable limits.

2.6.1 DIETARY REFERENCE INTAKE (DRIs)

The Nutrition Information Centre of the University of Stellenbosch (NICUS) (2003) had reported on the DRIs created by the United States Food and Nutrition Board of the Institute of Medicine (IoM). The DRIs were formulated based on an extended concept. This included gauges to control good nutrition and good health, to prevent diseases and to prevent a person from over- or under consuming nutrients. DRIs consist of nutritional guidelines for groups of people at various stages of life and are defined as the lowest ongoing level of intake of a nutrient that, for a specific indication of adequacy, will maintain a defined level of nutrient in an individual.

The data used in the creation of the DRIs primarily emerged from scientific, dose-response, balanced, observational and case-control studies and only publications in peer reviewed journals were used (NICUS 2003).

The DRIs were classified into a set of four nutrient-based reference values, where each type referred to the average daily nutrient intake and it was therefore the average mean intake over a period of time that was the nutritionally important reference value (NICUS 2003).

- Estimated Average Requirement (EAR) was the estimated average dietary intake level needed daily to meet the nutrient requirements of half of all healthy individuals in a certain stage in life and gender group. The EAR was a dietary intake value and it consisted of an adjustment for a presumed bioavailability of the particular nutrient. The EAR was used as the foundation in setting the Recommended Dietary Allowance (RDA). No RDA was set if there was insufficient scientific evidence available to establish an EAR.

- The Recommended Dietary Allowance (RDA) was the average dietary intake level needed daily to meet the nutrient requirements of nearly all healthy individuals in that gender group at the given life-stage.

- Adequate Intake (AI) was used when the scientific evidence was insufficient to set an EAR. Therefore, in cases like these, the AI reference was used instead of the RDA. The AI was based on intake levels that have resulted experimentally or estimates of examined average nutrient intakes by a group of healthy people who had normal circulating nutrient blood concentrations, growth, or other functional indicators of health. An AI was seen as an indication that more significant research was needed in order to have an EAR established and to have an RDA calculated.

- Tolerable Upper Intake Level (UL) was the maximum level of daily nutrient intake needed to pose no risk of adverse health effects for almost all individuals in the general population (NICUS 2003).

2.6.2 MACRONUTRIENTS

According to Wellman and Kamp (2008), macronutrients were the nutrients which provided calories or energy. Nutrients were substances needed for growth, metabolism and other functions of the body. According to Nestlé (2008) and the McKinley Health Center (2014), the word ‘macro’ meant large, therefore macronutrients were nutrients that were needed in large quantities. There were three main macronutrients: carbohydrates, protein and fats. Each of these provided kilojoules; however, each one provided different amounts per gram.

The FAO and WHO (2001) suggested that there was a fourth macronutrient and this was alcohol. The amounts per gram were as follows:

- **Protein:** gave 16.7kJ per gram of food
- **Fats:** gave 37.7kJ per gram of food
- **Carbohydrates:** gave 16.7kJ per gram of food
- **Alcohol:** gave 29.3kJ per gram of food.

2.6.2.1 Energy

According to Whitney and Rolfes (2016) and Turley and Thompson (2016), as a person aged and physical activity decreased, the total and resting energy requirements for elderly people reduced significantly. The reduced physical activity consequently reduced the energy outlay, causing a reduced basal metabolic rate due to lost lean mass. Observing energy distribution of the macronutrients (carbohydrates, protein, fats and to a lesser degree, alcohol) of the diet could be useful in improving the physiological status of the elderly. Ahmed and Haboubi (2010) stated this reduction in appetite and energy intake, which was physiologically age-related, was called the 'anorexia of ageing'.

According to FAO and WHO (2001), energy was not just a nutrient but a requirement of the body which was needed for metabolic processes, growth and synthesis of new muscles, muscular activity, physiological functions and the production of heat. Oxidation caused the energy to be released from food components.

The unit that was used to measure the amount of energy found in foods was the kilojoule or megajoule (1 MJ= 1,000kJ). Kilojoule needs were dependent on the activity levels of an individual, as well as body weight and composition. For example, a person who was bedridden would need fewer kilojoules than a person who was more active. There was a 10.0% decrease in the kilojoule needs of people between the ages of 50 and 75 and for a person older than 75 years, there was a 10.0 to 15.0% reduction; however, this depended greatly on the activity level of the individual (Nestlé 2008).

2.6.2.2 Carbohydrates

The McKinley Health Centre (2014) stated that carbohydrates were the macronutrients that a person needed the largest amounts of. According to the DRI published by the USDA, 55.0% to 75.0% of the daily intake of kilojoule should come from carbohydrates. This amount was needed because:

- Carbohydrates provided the body with the main source of fuel.
- Carbohydrates were used easily by the body for energy.
- All the tissues and cells in our body could use glucose from carbohydrates for energy.
- In order for the central nervous system, the kidneys, the brain and the muscles (including the heart) to function properly, the body needed carbohydrates.
- Carbohydrates could be stored in the muscles and liver and used for energy at a later stage.
- Carbohydrates were important for intestinal health and waste elimination.
- Carbohydrates were found mainly in starchy foods (like grains and potatoes), fruits, milk and yoghurt. They were also found in foods like vegetables, beans, nuts, seeds and cottage cheese (McKinley Health Centre 2014).

Carbohydrates were found in a wide variety of foods. The foods most rich in carbohydrates were very often plant-based foods like grains, cereals, vegetables, fruits and legumes (Duyff 2012: 55).

2.6.2.3 Protein

According to the DRIs published by the USDA in 1994, 10.0 to 35.0% of kilojoules should come from protein which was needed for:

- Physical growth (especially important for children, teens, and pregnant women).
- Tissue repair.
- Immune function.
- Production of essential hormones and enzymes.
- A source of energy when carbohydrate was not available.
- Preservation of lean muscle mass.

According to the McKinley Health Centre (2014), sources of protein were meat, poultry, fish, meat substitutes, cheese, milk, nuts and legumes and smaller quantities were found in starchy foods and vegetables. When these types of foods were consumed, the body broke down the protein into amino acids (the building blocks of proteins). Some amino acids were essential and needed to come from the diet, while others were not as vital and the body could make them. Protein from animal sources contained all the essential amino acids that were needed. Protein

from plant sources did not contain all the essential amino acids and was, therefore, incomplete protein, making the protein imbalanced.

Duyff (2012) stated that protein was a very important nutrient for the development of lean muscle and was the product of amino acid strains. There were 20 amino acids that made up a complete protein, nine of which were seen as essential amino acids, and which were very important for muscle synthesis and if these were not present in sufficient amounts, there was a limitation on the development of muscle and tissue. It was important to consume a daily intake of essential amino acids, as the body was unable to store or reproduce these. If there was not a sufficient intake, this resulted in muscle wasting. (Duyff 2012).

Protein was a vital macronutrient which had to be consumed daily. The RDA of protein/kilogram (kg) of body weight was 0.8 g per day for adults irrespective of age. It was suggested that the amount for elderly people be increased from 10.0 to 20.0%; therefore it would be between 0.9 to 1.0 g of protein per kg of body weight. In a 10 year-long study done on healthy elderly women who consumed more than 1.2 g of protein per kg of body weight per day, there was a significant decrease in health issues than in similar women who consumed the recommended 0.8 g per kg of body weight per day. The reason for the need for increased protein was that due to the muscles containing over 80.0% of protein-bound amino acids in the body, protein intake was often assumed to have the greatest impact on muscle mass and function. Sufficient dietary protein was a requirement for muscle synthesis. Decreased protein intake led to the reduced efficiency of digestion and reduced muscle mass (muscle wasting) and increased the risk of infection in older years (The Academy of Nutrition and Dietetics 2012; Nowson 2010 and Nestlé 2008).

2.6.2.4 Fat

The McKinley Health Centre (2014) stated that although fat had a bad reputation for being the leading cause of weight gain, some fat was needed for survival. According to the DRIs, 15.0–30.0% of kilojoules should come from fat.

The McKinley Health Centre (2014) stated that fat was needed for:

- Normal growth and development.
- Energy at 38kJ per gram (fat is the most concentrated source of energy).
- Absorption of certain vitamins (like vitamins A, D, E, K, and carotenoids).
- Providing protection for the organs.

- Maintaining cell membranes.
- Adding taste, consistency and stability to foods.

Fat could be found in meat, poultry, nuts, milk products, butter and margarine, oil, lard, fish, grain products and salad dressings. The three main types of fat were saturated fat, unsaturated fat and trans-fat. Saturated fat was found in foods such as meat, butter, lard and cream and trans-fat was found in baked goods, snack foods, fried foods and margarine. These two fats had been shown to cause a rise in the risk of heart disease. Substituting saturated and trans-fat with unsaturated fat, which was found in foods like olive oil, avocados, nuts and canola oil, had been shown to decrease the risk of developing heart disease (McKinley Health Centre 2014).

2.6.2.5 Fibre

According to the Food and Nutrition Board (2005), fibre was a specific type of carbohydrate that the body was able to digest. Fibre passed through the intestinal tract whole and assisted with moving waste out of the body. Diets that were low in fibre could contribute to constipation, which could cause haemorrhoids and increase the risk of certain cancers, such as colon cancer. Diets that were high in fibre had been shown to decrease the risk of heart disease and obesity and assist with lowering cholesterol. Foods that were high in fibre were fruit, vegetables and whole grain products. Sharkey, Johnson and Dean (2010) stated that there was a decrease in the intake of fibre in the elderly due to sensory barriers, for example, chewing, shrinkage of the salivary glands and the deterioration of the digestive tract. However, fibre was an essential component of the diet and elderly people should be encouraged to consume fibre as it improved gastric motility, glycaemic control and reduced cholesterol.

NICUS (2003) stated that there were two types of fibre: insoluble and soluble. Examples of insoluble fibre were hemicelluloses, lignin and cellulose found in wholegrain cereals, brown rice and skins of fruit and vegetables; examples of soluble fibre were mucilages and pectins found in legumes, flesh of fresh fruit and vegetables, nuts and beta-glucans present in barley, oats and some yeasts.

In a study done on pre- and post-menopausal women in Illinois, USA in 2017, Burton-Freeman, Liyanagea, Rahmana and Edirisinghea (2017) found that a meal with a higher amount of soluble-rich type fibre would satisfy hunger more and keep someone full for longer. It was also found that insoluble fibre provided bulk to the diet and increased the rate of movement through the small bowel. Dai and Chau (2016) stated that the physiological benefits of soluble fibres

were that they delayed gastric emptying, regulated blood glucose levels and lowered serum cholesterol levels. The physiological benefits of insoluble fibres were that they shortened bowel transit time of food and supported the growth of intestinal microflora, especially probiotic species.

2.6.2.6 Water

Water was the perfect method of transporting nutrients to the cells and for cellular metabolism to have chemical reactions and it was an important solvent (NICUS 2003). Wellman and Kamp (2008) stated that an amount of 1500 ml/day of water was required for the elderly. Maintaining the intake of fluid was vital as hydration helped prevent dehydration caused by reduced fluid intake, decreased kidney function or increased fluid loss due to increased urination caused by some medications. The elderly often limited the amount of fluid consumed because of a weakened sense of thirst, fear of incontinence and dependence on others to get beverages. Symptoms of dehydration in the elderly were electrolyte imbalance, headaches, constipation, dizziness, altered drug effects, blood pressure changes, a dry mouth as well as a dry nose (Toffanello, Inelmen, Minicuci, Campigotto, Sergi, Coin, Miotto, Enzi and Manzato 2010).

2.6.2.7 Alcohol

Dare, Wilkinson, Allsop, Waters and McHale (2014) stated that there was a link between social engagement and drinking in the elderly and there was scepticism about the health risks of alcohol. Drinking alcohol was also linked to dealing with difficulties such as anxiety, sadness, stress, social isolation, illness, bereavement, loss of physical health and impaired mobility. Alcohol could be seen to be part of a person's routine and identity.

Caputo, Vignoli, Leggio, Addolorato, Zoli and Bernadi (2012) found that alcohol-use disorders affected 1.0 to 3.0% of elderly people as follows:

- An increased level of blood pressure, which is more often seen in the elderly than in younger adults.
- A greater risk of alcoholic liver disease.
- An increased risk of breast cancer in menopausal women had been observed. The incidence of dementia in elderly alcoholics was almost five times higher than in non-alcoholic drinking elderly.

The National Institute on Ageing (NIA) (2017) further stated that drinking too much alcohol over a long time could:

- Lead to some kinds of cancer, immune system disorders and brain damage.
- Worsen some health conditions such as osteoporosis, diabetes, high blood pressure, stroke, ulcers, memory loss and mood disorders.
- Make it more difficult for doctors to diagnose and treat some medical conditions. This was due to alcohol causing changes in the heart and blood vessels. These changes could lessen or hide pain that might be a warning sign of a heart attack.
- Cause some older people to be forgetful and confused. These symptoms could be misinterpreted as early warning signs of the onset of Alzheimer's disease.

Table 2.2 below outlines the recommended daily intakes for macronutrients for men and women aged 51 and above.

Table 2.2: Dietary reference intake for macronutrients for elderly people adapted from NICUS dietary reference intakes (Food and nutrition board 2005)

Nutrients	Food sources	Functions	Male Age	RDA/AI * g/day	Female Age	RDA/AI * g/day
Carbohydrates Total digestible	Starch, such as pasta and potatoes. Sugar such as natural sugars found in fruits and added sugars found in soft drinks. (NICUS 2003; Food and Nutrition Board 2005)	Gives the body energy and helps maintain the body weight and prevents constipation. (NICUS 2003; Food and Nutrition Board 2005)	51-70 ≥70	100 100	51-70 ≥70	100 100
Total Fibre (Total Fibre is the sum of dietary Fibre and Functional Fibre)	Grain foods, for example, bran, wild black rice and oats. Raw vegetables and fruits are high in fibre. (NICUS 2003; Food and Nutrition Board 2005)	Prevents constipation, assists with maintaining healthy digestive system and normal glucose levels, provides longer feeling of fullness and reduces energy intake. (NICUS 2003; Food and Nutrition Board 2005)	51-70 ≥70		51-70 ≥70	
n-6 Poly-unsaturated fatty acids (Linoleic acid)	Nuts, seeds and vegetable oils like soybean, sunflower and corn oils. (NICUS 2003; Food and Nutrition Board 2005)	Important for normal skin function, signalling of cells and foundation for eicosanoids. (NICUS 2003; Food and Nutrition Board 2005)	51-70 ≥70		51-70 ≥70	

Table 2.2 continued

n-3 Poly-unsaturated fatty acids (Linoleic acid)	Vegetable oils such as soybean, canola and flax seed oil. Fish oils, fatty fish, animal fats but smaller amounts in meats and eggs. (NICUS 2003; Food and Nutrition Board 2005)	No specific role for these nutrients other than as energy sources. (NICUS 2003; Food and Nutrition Board 2005)	51-70 ≥70		51-70 ≥70	
Protein (amino acids)	Complete protein sources are animal protein such as meat, fish, poultry and eggs because they provide the nine vital amino acids, and incomplete proteins which are plant protein such as legumes, grains, nuts, seeds and vegetables (a combination of either two or three of the plant proteins will give a complete protein) (NICUS 2003; Food and Nutrition Board 2005)	Helps with the function, development and maintenance of the structural components of all cells, enzymes, membranes and hormones. (NICUS 2003; Food and Nutrition Board 2005)	51-70 ≥70		51-70 ≥70	

2.6.3 MICRONUTRIENTS

The WHO (2010d) defined micronutrients as the crucial foundations that were required by the body. These substances were known as the 'magic wands' that allowed the body to produce enzymes and hormones along with the other substances vital for suitable growth and development.

Micronutrients were nutrients that the body needed in lesser amounts and these were vitamins and minerals. A decrease in the intake of micronutrients and an unbalanced diet could lead to vitamin and mineral deficiencies in older people (Food and Nutrition Board, 2005). With the decreased consumption of micronutrients, there was a greater chance of a decline in immune function, which could lead to an increase in morbidity and mortality. When elderly people did not consume enough fruit and vegetables, as well as milk and milk products this aided the decline in immune function (Whitney and Rolfes 2016; Turley and Thompson 2016).

2.6.3.1 Minerals

In old age the mineral requirements remained the same. Zinc, selenium, chromium, copper and manganese levels were consistent with healthy ageing (Food and Nutrition Board 2005; Turley and Thompson 2016).

Table 2.3 below outlines the recommended daily intakes for minerals for men and women aged 51 and above.

Table 2.3: Dietary reference intake for micronutrients (minerals) for elderly people adapted from NICUS dietary reference intake (Food and Nutrition Board 2005)

Nutrients	Food sources	Functions	Male Age	RDA/AI* g/day	Female Age	RDA/AI* g/day
Calcium (mg/day)	Milk, yoghurt, cheese, greens (kale, collards) and calcium-fortified orange juice, dietary calcium supplementation. (NICUS 2003; Nowson 2010; Food and Nutrition Board 2005)	Building bones and teeth and maintaining bone strength. Muscle contraction, may lower blood pressure. (NICUS 2003; Food and Nutrition Board 2005)	51-70 ≥70	1200 1200	51-70 ≥70	1200 1200
Phosphorus (mg/day)	Red meat, poultry, fish, and dairy products and cereal grains. Phosphorus depends on the intake of calcium. (NICUS 2003; Food and Nutrition Board 2005)	It helps with the body's developmental structure and strengthens dental enamel. Plays a significant role in energy metabolism, affecting carbohydrate, fat, and protein. (NICUS 2003; Food and Nutrition Board 2005)	51-70 ≥70	580 580	51-70 ≥70	580 580
Magnesium (mg/day)	Water and milk are good sources of magnesium. Whole wheat bread, low fat dairy products, lean meats, beans. beetroot and lentils. (NICUS 2003; Food and Nutrition Board 2005)	Nerve function, lowers blood pressure, muscle contraction and energy usage. (NICUS 2003; Food and Nutrition Board 2005)	51-70 ≥70	350 350	51-70 ≥70	265 265

Table 2.4 below outlines the recommended daily intakes for trace element minerals for men and women aged 51 and above.

Table 2.4: Dietary reference intake for micronutrients (trace element minerals) for elderly people adapted from NICUS dietary reference intake (Food and nutrition board 2005)

Nutrients	Food sources	Functions	Male Age	RDA/AI * g/day	Female Age	RDA/AI * g/day
Iron (mg/day)	Lean red meat, organ meat, egg yolk, green vegetables, cooked lentils and orange juice. (IoM 2000)	Transports oxygen and carbon dioxide; strengthens immune function. (IoM 2000).	51-70 ≥70	6.0 6.0	51-70 ≥70	5.0 5.0
Zinc (mg/day)	Lean meats, low fat dairy products, beans and grain products. (IoM 2000).	Assists immune function, maintains taste acuity and protein synthesis. (IoM2000).	51-70 ≥70	9.4 9.4	51-70 ≥70	6.8 6.8
Fluoride (mg/day)	Fluoridates drinking water and fluoridates toothpaste. (Hatchcock 2004).	Strong teeth and bones; protects dental enamel from dental caries. (Hathcock 2004).	51-70 ≥70	3.8 3.8	51-70 ≥70	3.1 3.1
Iodine (mg/day)	Iodised salt and seafood. (IoM 2000)	Necessary to make thyroid hormones, which are needed to maintain normal metabolism in all cells of the body. (IoM 2000)	51-70 ≥70	95 95	51-70 ≥70	95 95

Table 2.4 continued

Selenium (mg/day)	Meat, fish, seafood, nuts, whole grain products. (IoM 2000).	Mineral antioxidant in human nutrition; has role in reducing muscular oxidative stress. (IoM 2000)	51-70 ≥70	45 45	51-70 ≥70	45 45
Chromium (mg/day)	Whole grain breads and cereals and meats. (IoM 2000)	Helping cells use glucose. (IoM 2000).	51-70 ≥70	30 30	51-70 ≥70	20 20

2.6.3.2 Vitamins

Table 2.5 below outlines the recommended daily intakes for fat soluble vitamins for men and women aged 51 and above.

Table 2.5: Dietary reference intake for micronutrients (fat soluble vitamins) for elderly people adapted from NICUS dietary reference intake (Food and nutrition board 2005)

Nutrients	Food sources	Functions	Male Age	RDA/AI * g/day	Female Age	RDA/AI* g/day
Vitamin A (µg/day)	Carrots, spinach, bell peppers, sweet potatoes, turnip greens, tomatoes, pumpkin, winter squash, apricots, green beans and beef liver. (NICUS, 2003 and Food and Nutrition Board, 2005).	Helps the eyes adjust to light changes. Plays a significant role in bone growth, tooth development, reproduction, cell division and gene expression. The skin, eyes and mucous membranes of the mouth, nose, throat and lungs depend on vitamin A to remain moist. An important antioxidant that helps the body fight the harmful effects of free radicals. (NICUS, 2003 and Food and Nutrition Board, 2005).	51-70 ≥70	625 625	51-70 ≥70	500 500
Vitamin D (Calciferol) (µg/day)	Milk and other dairy products fortified with vitamin D, salmon, cod liver oil, mackerel, fortified breakfast cereals, eggs, milk, and tuna. (NICUS, 2003 and Food and Nutrition Board, 2005).	Needed for absorption and use of calcium, and vitamin D also regulates the body's use of phosphorous. It increases the amount of calcium absorbed from the small intestine and helps form and maintain bones. (NICUS, 2003 and Food and Nutrition Board, 2005).	51-70 ≥70	10 15	51-70 ≥70	10 15
Vitamin E (a-tocopherol) (mg/day)	Vegetable oils and margarines, fruits and vegetables, grains, nuts, seeds and fortified cereals. (NICUS, 2003 and Food and Nutrition Board, 2005).	An antioxidant, protecting vitamins A and C, red blood cells and essential fatty acids from free radicals. Maintaining a healthy reproductive system and nerves. Promotes healthy skin. (NICUS, 2003 and Food and Nutrition Board, 2005).	51-70 ≥70	12 12	51-70 ≥70	12 12
Vitamin K (µg/day)	Liver, green vegetables such as turnip greens, spinach, cauliflower, cabbage and broccoli and certain vegetable oils including soybean oil, canola oil and olive oil. Naturally produced by a bacterium in the intestine. (NICUS, 2003 and Food and Nutrition Board, 2005).	Used by the body for blood clotting and also to make bone and kidney tissue. Essential for healthy bones, especially in the elderly. (NICUS, 2003 and Food and Nutrition Board, 2005).	51-70 ≥70	120 120	51-70 ≥70	90 90

Table 2.6 below outlines the recommended daily intakes for water soluble vitamins for men and women aged 51 and above.

Table 2.6: Dietary reference intake for micronutrients (water soluble vitamins) for elderly people adapted from NICUS dietary reference intake (Food and nutrition board, 2005)

Nutrients	Food sources	Functions	Male Age	RDA/AI * g/day	Female Age	RDA/AI* g/day
Thiamine (Vitamin B1 or Aneurin) (mg/day)	Lean pork, wheat germ, sunflower seeds and organ meat. (NICUS 2003; Food and Nutrition Board 2005).	Releases energy from foods, in particular carbohydrates through break-down and use of glucose. (NICUS 2003; Food and Nutrition Board 2005).	51-70 ≥70	1.0 1.0	51-70 ≥70	0.9 0.9
Riboflavin (Vitamin B2) (mg/day)	Milk and milk products, for example cheddar cheese, cottage cheese and organ meat. (NICUS 2003; Food and Nutrition Board 2005).	Participates in many energy-yielding metabolic pathways. Promotes the metabolism of glucose and fatty acids. (NICUS 2003; Food and Nutrition Board 2005).	51-70 ≥70	1.1 1.1	51-70 ≥70	0.9 0.9
Nicotinic acid (Vitamin B3 or Nicotinic acid) (mg/NE/day)	Lean meats, fish, brewer's yeast and eggs. (NICUS 2003; Food and Nutrition Board 2005).	Cell respiration. Helps in the release of energy and metabolism of carbohydrates, fats, and proteins. Proper circulation and healthy skin. Functioning of the nervous system. Normal secretion of bile and stomach fluids (NICUS 2003; Food and Nutrition Board 2005).	51-70 ≥70	12 12	51-70 ≥70	11 11
Vitamin B6 (Pyridoxine) (mg/day)	Potatoes, cauliflower, avocados, bananas and dates. (NICUS 2003; Food and Nutrition Board 2005).	Promotes nerve function and helps prevent heart disease. (NICUS 2003; Food and Nutrition Board 2005).	51-70 ≥70	1.4 1.4	51-70 ≥70	1.3 1.3
Folic acid (Folate, Folacin) (µg dietary FE/day)	Oranges, strawberries, cantaloupe, leafy greens, liver, chickpeas, lentils, spinach and beans. (NICUS 2003; Food and Nutrition Board 2005).	Red blood cell formation, cell growth and division and may prevent heart disease. (NICUS 2003; Food and Nutrition Board 2005).	51-70 ≥70	320 320	51-70 ≥70	320 320
Vitamin B12 (Cobalamin (µg/day)	Organ meat, seafood, beef, eggs, ham, milk and milk products. (NICUS 2003; Food and Nutrition Board 2005).	Red blood cell formation, cell growth and division, nerve function and may prevent heart disease. (NICUS 2003; Food and Nutrition Board 2005).	51-70 ≥70	2.0 2.0	51-70 ≥70	2.0 2.0
Vitamin C (Ascorbic acid) (mg/day)	Citrus fruits, cantaloupe, guava, pineapple, tomato and potato. (NICUS 2003; Food and Nutrition Board 2005).	Immune function, antioxidant and wound healing. Deficiency leads to bleeding gums, poor wound healing, fractures and bleeding. (NICUS 2003; Food and Nutrition Board 2005).	51-70 ≥70	75 75	51-70 ≥70	60 60

Vitamins are important nutrients needed in small amounts to help with growth, normal metabolism and physical wellbeing (Wellman and Kamp 2008). The absorption of vitamins could be altered by drugs and this could cause an interference with hepatic metabolism, which

caused delayed excretion of vitamins. The absorption of vitamins, in particular vitamin C, could be hindered by smoking and tannins. Reduced dietary consumption as well as gastrointestinal and renal disease could lead to reduced vitamin D absorption, which could lead to osteomalacia, rickets and myopathy. This was linked to reduced bone density, impaired mobility, increased risk of falls and an increased chance of developing type 1 diabetes, rheumatoid arthritis and cardiovascular disease. Older people had a higher dietary requirement of vitamins, as there was reduced skin production, decreased exposure to sunlight and thinning of the skin (Nestlé 2008; Turley and Thompson 2016).

The biochemical processes within the cells and tissues needed vitamins. There were two types of vitamins: fat soluble or water soluble. Fat-soluble vitamins were dissolved in fat and when unused, could be stored in the body. Water-soluble vitamins were dissolved in water and could not be stored in the body (IoM 2000).

- **Vitamin A:** In the elderly the need for vitamin A was reduced to 635 g per day for men and 500 g per day for women. Therefore, vitamin A supplements should be avoided. Vitamin A requirements should come from different food choices.
- **Vitamin D:** In the elderly the need for vitamin D was increased to 10g per day for both men and women between the ages of 51 and 70 years old and then from 70 years old it increased to 15 g per day for both men and women. It was recommended to increase sun exposure and consume vitamin D rich foods, for example, fish and fortified skim milk.
- **Vitamin B12:** In the elderly the need for vitamin B12 was increased to 2 g per day for both men and women aged 51 and older. This vitamin was exceptionally vital for brain function and could be found in lean red meat, chicken and skim milk. It was said that all the B vitamins were vital as a person aged.
- **Folate (vitamin B9):** This was not needed in increased amounts as a person aged. It was found mostly in green vegetables, liver and yeast (Nestlé 2008; Whitney and Rolfes 2016).

2.7 NUTRITIONAL ASSESSMENT IN THE ELDERLY

2.7.1 EVALUATION OF DIETARY INTAKE DATA

According to Truswell (2007), an individual or community could be classified as nourished, undernourished or overnourished by evaluating dietary intake. This could be done together with other methods of examination. Some of these were weight, height, chemical concentration in the blood or urine used to measure the nutritional status of a person as well as other methods. Dietary intake assessed in isolation was not definite due to the fact that food consumption was measured over a one- or two-day period and did not represent food intake over time. A person's nutritional status could not be assessed by a health professional using only one method.

2.7.1.1 24-Hour food recall

Rankin, Ellis, MacIntyre, Hanekom and Wright (2011) stated that the 24-Hour recall was applicable to different ethnic populations. The 24-Hour food recall was first developed in 1942 by Wiehl. It was a very simple, quick and non-invasive tool. It could be used in both developed and developing countries. The 24-Hour recall could be administered in an interview setting by a person who was knowledgeable about food and beverages. It was used to record the food that an individual had consumed over the past 24 hours. The main disadvantage of the 24-Hour recall was that it represented only the food intake for one day and might not show a person's normal intake. Data might be affected if the participant had cognitive impairment or if the trained interviewer's knowledge of estimated portion size of the different foods was inadequate.

2.7.1.2 Food Frequency Questionnaire

The Food Frequency Questionnaire (FFQ) was appropriate for use in epidemiology studies as it could provide information on the quality of an individual's intake of certain foods and nutrients to determine the reasonable risk of disease vis-a-vis the quantities consumed (Rankin *et al.* 2011). Certain traditional food items that were eaten by a sample group over a period of seven days were recorded; however, the quantities were not required. The questionnaire was developed based on the information obtained from the qualitative dietary assessment. The FFQ arranged food into the nine food groups namely, cereals, roots and tubers, other vegetables, vitamin A rich fruit and vegetables, flesh foods (meat, poultry, fish), fats and oils, dairy, other fruit, legumes and nuts, and eggs. Food frequency questionnaires were used to compile

information on the occurrence of a specific food or category of food that was consumed per day, per week or per month (Oldewage-Theron and Kruger 2008).

2.7.1.3 Food records

Rankin *et al.* (2011) stated that this tool was seen as the most efficient dietary assessment and was used to validate other dietary assessments because it did not depend on the memory of the participants or estimated portion sizes. There were two types of food records: weighed food record (WFRs) and estimated food record (EFRs). Rankin *et al.* (2011) stated that there was no given time for the food record but discovered that under-reporting in adolescence increased from day one at 7.7% to day seven at 15.5%. The weight of a participant tended to decrease when keeping a food record due to the fact that there was more awareness of food intake. The food record could be influenced by various factors, such as gender, age and BMI.

2.7.1.4 Nutrition knowledge, attitude and behaviours survey

This survey was a tool used to effectively and consistently measure nutrition knowledge, attitudes and behaviour, which were seen as vital in nutritional studies or research (Macías and Glasauer 2014). Nutrition knowledge, attitude and behaviour surveys were used to evaluate the effect of policies and nutrition education programmes that were developed to assess the health nutrition status of an individual or a population (Steyn, Labadarios, Nel and Robertson 2005).

2.7.1.5 Diet history

According to Maqbool, Olsen and Stalling (2008), diet history was important because it provided information on the quantity and quality of food consumed as well as the eating patterns and behaviour of the individual and the family. It provided details on the quantity and number of meals eaten. It also looked at snacks and beverages eaten with and between meals. It indicated what vitamins, minerals and supplements had been taken and ascertained whether there were any food allergies or intolerances. It picked up on any religious, cultural or other unusual dietary requirements determining the individual's eating patterns. Other questions related to psychological factors that could affect food selection and intake were associated with family history and socio-economic status and assisted with analysing the family's nutritional situation (Maqbool, Olsen and Stalling 2008).

Table 2.7 below outlines the various dietary assessment methods that were used in this study.

Table 2.7: A combination of dietary assessment methods (Adapted by Wolmarans and Wentzel- Viljoen 2008)

Method	Advantages	Disadvantages
24-Hour recall	• Used for collection and describing intakes of a group of individuals. • To report on the mean intakes of a group, 24-Hour recalls from quite a few different participants should be collected. The exact number of participants needed for a study can be calculated making use of specific formulas (Gibson, 2005). • Used to describe habitual dietary intake.	• Information depends on the memory of the respondent. • Does not represent normal dietary intake. • Cannot be used to describe the dietary intake of an individual. • Not appropriate for collection of dietary intake from children under the age of 7 years. • Should be used for the classification of dietary intake, e.g., percentage of participants consuming more or less than the recommended intake. • Extensive training needed for interviewer.
FFQ	• Used to describe usual dietary intake. • Classifies individuals into high/low consumers, or those meeting/not meeting recommended intake. • Used to collect dietary intake with other factors.	• Information depends on the memory of the respondent. • Developing the questionnaire can be time-consuming. • Must be developed for the study group that is being interviewed. • Does not provide information on intakes at different meal times. • May not be valid for the elderly due to memory loss which could be a significant factor. • Not appropriate for use on young children.
Food record	• Describes usual dietary intake. • Groups the individuals as a high or low consumer, or those meeting or not meeting reference values. • Compares the dietary intake with other factors, such as biochemical, anthropometric. • When other dietary intake methodologies are validated, it is often used as the standard.	• Questionnaires validated for different genders, age and cultural groups not always available. • Extensive training for interviewers is needed. • Literate participants are required. • Participants may change their diet based on heavy respondent burden. • Time consuming • With estimated records, the conversion of food intake reported in household or conversion of other measures to gram of food is time consuming.
Diet history	• Collects information on total diet intake. • Determines usual meal patterns and food combinations eaten by the individual over a period of time. • Uses a detailed list of foods as a checklist to verify dietary intake. Classifies the individual's info as high or low consumer, or those meeting/not meeting reference values. • Combines dietary intake with other factors, e.g. biochemical or anthropometric factors.	• An interview of one or two hours by a highly trained interviewer is needed. • Difficult to standardise between interviewers • Nutrient intake estimate tends to be over-estimated. • A respondent who is co-operative and can recall the usual diet is needed.

2.7.2 SOCIO-DEMOGRAPHIC SURVEYS

Banda (2003) stated that these surveys were used to gather social and demographic data on the population, administrative records and household samples. If the survey was administered carefully, it could assist the researcher to complete and complement the integrated programs of data collections. Social and demographic statistics were vital for the development and monitoring of socio-economic growth programmes to improve the lives of people. The social and demographic statistics looked at the composition of the population by age and sex and included geographical distributions, which were among some of the most important data needed to explain a population or sub-group of a population. This important data provided the framework by means of which other essential information on social phenomena, such as education, health, nutrition, crime, disability, labour, fertility, mortality and migration could be studied (Banda 2003).

2.7.3 HEALTH ASSESSMENT METHODS

According to Wolfe, Michaud and Pincus (2014), health surveys were used to gather logical knowledge and technological health information that could be used in the improvement of the health of the individual or groups of individuals in a population. This health information could be used as a foundation for encouraging good health through the prevention of disease and the promotion of good health care management through health programmes that could be developed from the information gathered from these surveys.

2.7.3.1 Biochemical indices

Biochemical tests were often the most sensitive and unbiased measurements for nutritional status; however, not all tests were seen to be appropriate (Wellman and Kamp 2008). Results needed to be handled with care when being interpreted due to the fact that they could be affected by the status of the disease. Nutrient and enzyme levels, DNA characteristics and other biological markers were factors of a biochemical assessment of nutritional status (Brown 2008). Laboratory tests done on blood and urine were vital indicators for nutritional status but they were influenced by non-nutritional factors as well. For example, laboratory results could be altered by medication, hydration status and disease status or other metabolic processes, such as stress (Gibson 1990; Brown 2008; Wellman and Kamp 2008).

2.7.3.2 Anthropometric measurements

According to Sánchez-García, García-Peña, Duque-López, Juárez-Cedillo, Cortés-Núñez and Reyes-Beaman (2007), anthropometric and nutritional characteristics were connected to genetic, environmental and socio-cultural conditions and also to lifestyle, health and functional status. The American National Health and Nutrition Examination Survey (NHANES) (2009) stated that anthropometry was the study of the human body measurements relating to the dimensions of bone, muscle and adipose (fat) tissue. These measurements included measurements of weight, stature (standing height), recumbent length, skinfold thickness, circumferences (head, waist and limb), limb lengths and breadths (shoulder, wrist). The basic anthropometric measurements were easy to take, effective, simple, uncomplicated, inexpensive and safe to use (Truswell 2007).

According to Wellman and Kamp (2008), skinfold thickness was used to evaluate the amount of body fat an individual has. This was based on the total body fat estimates assuming that 50.0% of a person's body fat was subcutaneous. Truswell (2007) stated that to perform this measurement, the skinfold was picked up between the finger and the thumb and gently held away from the muscle. Then, special precision callipers were carefully used to clamp and pinch the subcutaneous fat and the width was measured. What was caught between the clasps of the callipers was a double layer of fat and skin and this fold was measured in millimetres. There were many parts of the body that could be used to measure skinfold thickness, namely, the tricep skinfold, which was located above the tricep muscle midway behind the back of the upper arm and the bicep skinfold, where the callipers were placed on an upright fold in the middle of the front of the upper arm over the bicep muscle. To measure the subscapular skinfold, the callipers were placed on an upper skinfold which was just below and next to the substandard angle of the scapular, with the shoulder and arm held in a relaxed manner. To measure the suprailiac skinfold, the calliper was placed on the mid-axillary line above the iliac crest and held diagonally.

Truswell (2007) stated that to keep track of the ongoing progress of an individual's nutritional status, stature measurements needed to be taken. This measurement was taken using a stadiometer, which had a moveable headboard at a fixed 90° angle to the back of the stadiometer. The individual stood up straight on a flat floor, feet touching, heels, buttocks and back of head touching the stadiometer, shoulders relaxed with arms down and the individual looking ahead. This measurement was done twice.

Total weight was made up of different body components which could alter due to different factors. These led to an individual being overweight (an accumulation of fat) or underweight (negative energy balance where fat is lost). The following all contributed towards a person's overall weight: fat (triacylglycerol), muscle (skeletal muscle), protein (skeletal muscle) bone minerals (skeleton) and organs such as skin, blood, gut, liver, brain, lungs, heart and others. Chemically, water (non-skeletal muscles and soft lean tissue) made up the largest part of the human body (Truswell 2007).

BMI was an easy guide to measure weight-for-height that was clinically and most often used to determine whether an adult was underweight, normal weight, overweight or obese as well as a measurement tool to assess nutritional status (Wellman and Kamp 2008). BMI was calculated as weight in kilograms divided by height in metres squared (kg/m²). A BMI measurement that was out of the normal weight range could be linked to morbidity and some non-communicable diseases such as type 2 diabetes, cardiovascular disease, musculoskeletal morbidity disorder and respiratory dysfunction, and ultimately, mortality. It could also indicate a decrease in physical activity and poor quality of life (Maqbool *et al.* 2008). Using BMI had one disadvantage in that it only calculated an increase in adiposity, which made it not as accurate as it should be for measuring body structure and weight contrasts due to the size of the body elements such as muscle bulk and having a broad frame and this could be interpreted as body fat (Truswell 2007).

Table 2.8 below shows the various cut-off points for underweight (severe, moderate and mild thinness), normal weight, overweight and obese (mild, moderate and severe).

Table 2.8: BMI classification (adapted from WHO 1995; WHO 2000b; WHO 2004; WHO 2016).

Classification	BMI (kg/m²) for age 20years old>	
	Principal cut-off points	Additional cut-off points
Underweight	**≤18.50**	**≤18.50**
Severe thinness	**≤16.00**	**≤16.00**
Moderate thinness	16.00-16.99	16.00-16.99
Mild thinness	17.00-18.49	17.00-18.49
Normal range	**18.50-24.99**	18.50-22.99 23.00-24.99
Overweight	**≥25.00**	**≥25.00**
Pre-obese	**25.00-29.99**	25.00-27.49 27.50-29.99
Obese	**≥30.00**	**≥30.00**

Table 2.8 continued

Obese I	**30.00-34.99**	30.00-32.49 32.50-34.99
Obese II	**35.00-39.99**	35.00-37.49 37.50-39.99
Obese III	**≥40.00**	≥40.00

2.7.4 CIRCUMFERENCES

These measurements included additional skinfold and circumference measurements. Depending on the situation of patient care, some measurements might be more suitable than others (Hammond 2008). The growth and index of energy and protein stored in the body was measured by waist circumference and limb circumference measurements. To do the limb circumference measurement on an arm, a position halfway between the lateral tip of the acromion and the olecranon should be located when the arm was flexed at a 90° angle (Truswell 2007). Head circumference could often assist with working out growth in children, mostly since head growth reflected both brain growth and development. This measurement was done on children and was beneficial for those between the ages of one and three as there was increased growth during this time (Maqbool *et al*. 2008).

2.7.4.1 Waist circumference

According to Chaoyang, Ford, Mokdad and Cook (2006), waist circumference (WC) was the easiest and most effective surrogate measure for abdominal obesity, which was the excess accumulation of central subcutaneous and visceral fat. WC had become an important method of predicting metabolic complications and adverse health effects. Abdominal obesity had been seen to be linked to type 2 diabetes and cardiovascular diseases in both men and women. Truswell (2007) stated that the metabolic difficulties of overweight and obesity could result from the adipose tissue that was accumulated in the abdomen. A person's abdominal obesity could be measured by placing a tape measure around the waist. This worked in partnership with BMI. The risk for inaccurate measurement of waist circumference was specific to different populations and was dependent on the classification of obesity and other risk factors for cardiovascular disease and diabetes in the specific ethnic group and it could also be used on people with a larger body frame but the results would still be accurate.

2.8 CONCLUSION

The literature in this chapter has shown that there is an increasing number of elderly globally because people are living for a longer period. It is predicted that the number of elderly will increase further in the foreseeable future. Not much research has been done on the elderly in spite of this group being a vulnerable group and more focus needs to be placed on this group. As a person gets older, there are many factors that come into play that might affect them. There are a growing number of elderly individuals with nutrient deficiencies, and this might be due to reduced food intake, reduced absorption or the poor use of nutrients by the body, which could be influenced by other factors, such as lack of physical activity and diseases. Negative nutritional status could lead to risk of chronic diseases, which could lead to an increase in morbidity and even mortality.

Many elderly people are also at a higher risk of food insecurity generally due to reduced income, disability, psychological problems and physical problems. Due to the challenges the elderly face as discussed in this chapter, this study has been developed to measure food intake patterns, socio-economic factors and the health and nutritional status of free-living white elderly in a residential facility in Durban.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

The purpose of this chapter is to explain how data were collected using reliable instruments in order to examine the relationship between the actual food intake and food group diversity on the nutritional and health status of white residents in an elderly residential facility in Durban in KwaZulu-Natal. Proper planning, taking precautions to ensure this study was ethically correct, research design, and measuring instruments were critical components in gathering quality data. Community studies on the elderly are essential for empowering the communities involved, as well as informing others about how vulnerable this age group is. The changing role of the elderly, as they continue to care for themselves, has exposed them to food insecurity. It was decided to restrict this study to white residents only, as they made up the largest number of the residents within the elderly care facility under investigation. The decision to restrict the study to white residents only was based on the growth of this population. According to STATSSA (2011), between 1996 and 2011 there was an increase in the white elderly in South Africa. This population grew by 5.7%, from 14.4% to 20.1%.

There have also been no previous studies done on the white elderly community in independent living care facilities in South Africa; therefore it can be assumed that the nutritional needs of this group have not been identified. Therefore, this study is seen as essential to alert the facility management and local government to the nutritional needs of this vulnerable group of the population.

When selecting the research methods, the following factors were considered in order to meet the research objectives:

- The need for group versus individual data.
- The need for absolute intake versus relative estimates.
- Population characteristics (age, sex, motivation, education/ literacy, cultural diversity).
- The income status of the participants.
- The timeframe of interest.
- Available resources including food models and food composition data if nutrients are to be calculated.

According to Nyirend *et al.* (2011), South Africa's ageing population has been growing rapidly. The number of South African people aged 60 and above is expected to increase from only 4 million in 1985 to 13.6 million in 2050. This number would represent close to 28.0% of the expected population in the year 2050. However, relatively few studies on the health status of the elderly population, and focusing on their physical, mental and social well-being had been undertaken.

3.2 ETHICAL CONSIDERATIONS

The ethics committee at Durban University of Technology (DUT) approved the study, quoting approval number REC 48/14 (Annexure A). Participation was to be on a voluntary basis only. Before the data collection commenced, a meeting with the social worker at the home was arranged to gain access to the home and to obtain permission from the Chief Executive Officer (CEO) of the home. Permission was granted by the CEO of the chosen elderly residential facility (Annexure B). Upon completion of the dissertation, the findings of the study will be presented to them.

Once permission was granted by the CEO, a community forum (comprising 10 randomly selected residents of the home) was set up with the assistance of the social worker. During the community forum meeting the study was discussed and members of the forum gave input as well as advice on how to approach the residents. It was at this meeting that the social worker and residents suggested that the height, weight, waist circumference and blood pressure be done by the resident nurse (and overseen by the researcher), as the residents trusted the nurse and would feel more comfortable having someone they knew take these measurements.

During the data collection, any person who was interested in participating arrived at the hall on the property and the aims and objectives of the study were clearly explained to them. A number was given to each person so that no names were used. Only the researcher had a list of the residents' names and the numbers assigned to them. Each file had a number on it so that it was easier for the researcher to keep a record of each participant and the questionnaires. An information letter was given to participating residents outlining the purpose of the study and the expectations (Annexure C). The participants were then requested to sign a consent form (Annexure C).

It was clearly stated to the participants that there would be no financial gain for participation in the study. Participants would also not incur any costs for being part of the study. There were no risks to any of the participants who were involved in the study. The residents were assured

that only shoes were to be removed as well as any heavy items of clothing such as jerseys or jackets where necessary and weighing and measuring would be done in private.

The participants understood that participation in the study was on a voluntary basis and that they could withdraw from the study at any given time. Participants were made aware of the fact that all information gathered would be confidential. The participants were given an opportunity to ask questions during the interview. They were informed that any personal information would be stored in a locked cupboard in the Department of Consumer Sciences: Food and Nutrition for a period of 15 years. After this period, it would be disposed of by shredding.

3.3 PLANNING AND ADMINISTRATION

A meeting was held between the researcher, the social worker of the home and the residents of the home. In the meeting, the residents were informed about the research project and the purpose of the study. From the meeting ten individuals were randomly selected to form a formal forum which would assist in modifying the already existing questionnaires so that they were applicable to the selected study group in the home. A pilot study comprising ten residents was conducted by the researcher in order to verify the suitability of the modified questionnaires.

3.4 DEVELOPMENTAL STAGES OF THE STUDY

The following stages were implemented throughout the duration of the study:

Stage 1: Planning the study design

The planning procedure consisted of the following steps:

- Writing the research proposal.
- Setting up appointments with relevant stakeholders.

Stage 2: Stakeholder consultation and plan implementation

- Holding meetings with the social worker of the elderly residential facility.
- Holding meetings with the CEO of the elderly residential facility.
- Obtaining consent from the CEO of the elderly residential facility and the Ethics department of the Durban University of Technology.

Stage 3: Rolling out the study

Rolling out of the study was done during October and November 2014.

Stage 4: Literature review

This stage involved an analysis of scientific literature relevant to the study.

Stage 5: Reporting of results

The results will be discussed in detail in Chapter 4.

3.5 RESEARCH DESIGN

3.5.1 SETTING

This study was based at a self-catering elderly residential facility in Morningside, Durban. According to STATSSA (2009), the estimated population of the Morningside area is 22 260. Of this population, an estimated 3041 are people over the age of 60. In 2016 it was reported that elderly women made up 59.4% of the South African population aged 60 years and older (Statistics South Africa (STATSSA) 2016); therefore this study comprised of mostly female residents as the number of male residents was limited. Of this group, 5.7% earned less than R4800 per annum, which was well below the food poverty line of R547 per person per month (STATSSA 2018b). These residents were independent and did their own purchasing and cooking of food. The elderly care facility was privately owned and run, with a CEO, board of directors and their own private nurses and a social worker. The criteria for residents being able to reside at the facility was that they had to be between the ages of 60 and 80 years old. There was a frail care facility for residents older than 80 years or residents who were frail and needed assistance and to be catered for. However, this facility was not on the same property as the independent residents. The independent residents purchased the flats that they lived in. Although the majority of the residents were white, other race groups (black, Indian and coloured) also lived there.

3.5.2 METHODOLOGY

This study took place over a period of eight weeks. The data were collected by going to the elderly residential facility and gathering residents together in the hall or going from house to house and administering the questionnaires. Each interview lasted between 45 minutes and an hour.

3.5.2.1 The inclusion criteria

Participants had to meet the following criteria in order to be included in the study:

- Participants could be either male or female.
- The participants needed to be 60 years or older.
- Participants had to belong to the white race group.
- Participants had to be receiving a monthly pension from the South African Government.

3.5.2.2 The exclusion criteria

The following criteria excluded residents from participating in the study:

- People not living in the elderly residential facility.
- Residents younger than 60.
- Residents who received meals from the residential facility.
- Residents belonging to race groups other than the white race group.
- Physically disabled residents (as this would make collection of weight and height data difficult).
- Residents who had any mental disorder.

Figure 3.1 below shows where Durban is located within South Africa. This is shown within the red square.

Figure 3.1: Map of South Africa showing the location of Durban (Google Earth 7.3. 2020a)

Figure 3.2 below shows where Morningside is positioned in Durban, South Africa. This is shown within the red square.

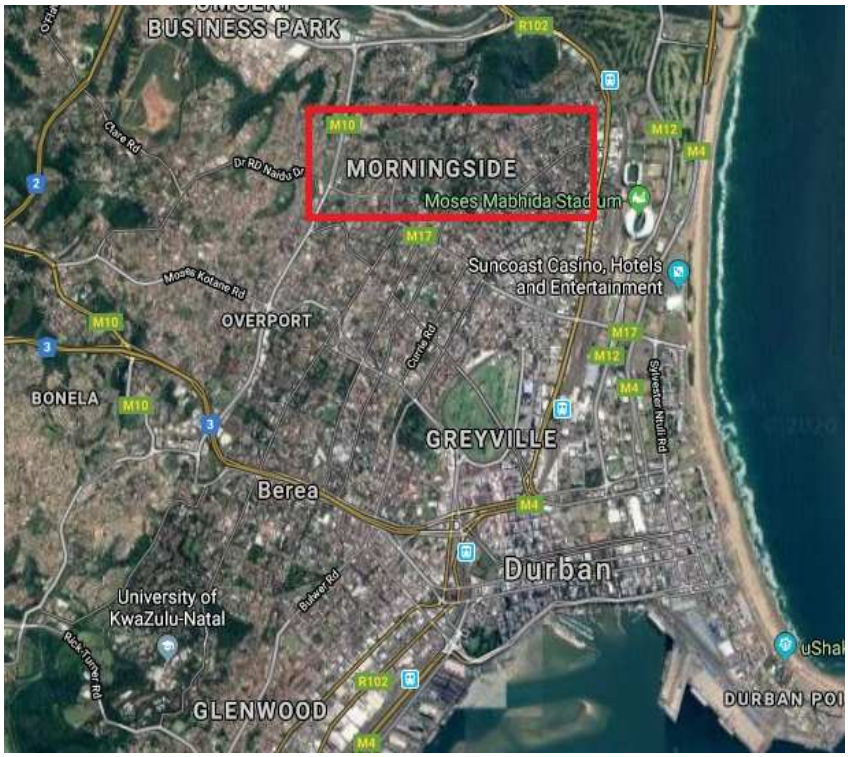

Figure 3.2: Map showing the location of Morningside in Durban, South Africa (Google Earth 7.3. 2020b)

Figure 3.3 below shows an aerial view of the elderly residential facility. This shows the buildings where the residential flats are.

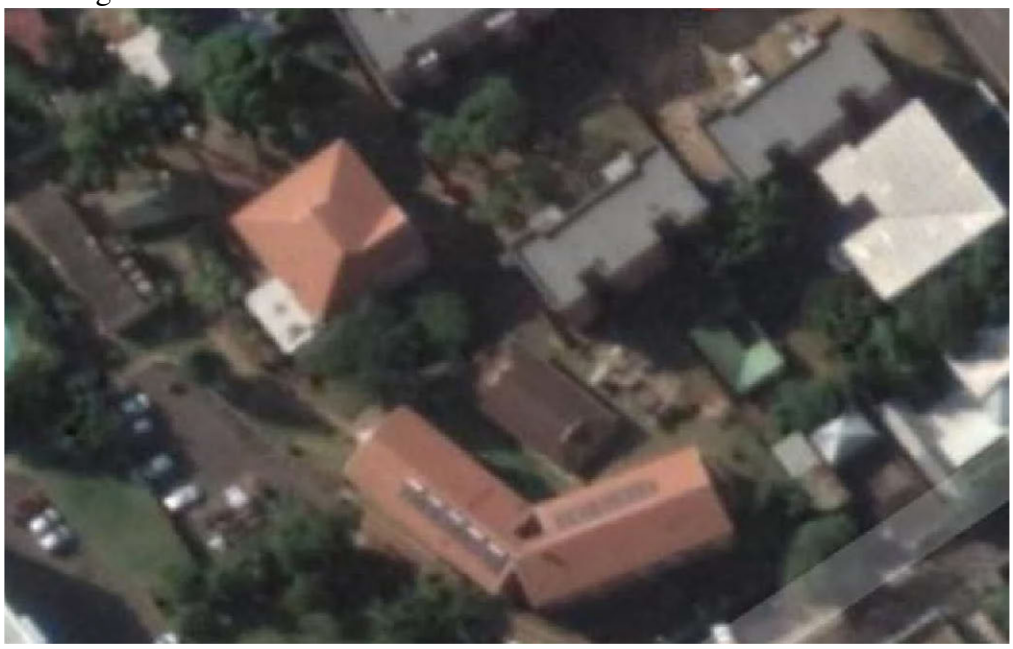

Figure 3.3: An aerial view of the elderly residential facility (Google Earth 7.3. 2020c)

3.6 STUDY TYPE

The study was of a descriptive nature with a cross-sectional design. This means that it had an observational study design. In a cross-sectional study, participants were selected based on the inclusion and exclusion criteria set for the study (Setia 2016). Quantitative data were collected by means of administering questionnaires, which included socio-demographic, 24-Hour recall, FFQ and health and behavioural questionnaires, which were administered in an interview by one of the trained fieldworkers at a private station within the facility. Anthropometric measurements were also conducted at a predetermined point by the resident nurse. All administering and collection of data done by the fieldworkers was conducted in the presence of and under the supervision of the researcher. Data were collected and recorded daily by the researcher and the field workers.

3.7 STUDY DESIGN AND ADMINISTRATION OF MEASURING INSTRUMENTS

Figure 3.4 shows the outline of the study design.

Figure 3.4: The model of the study design

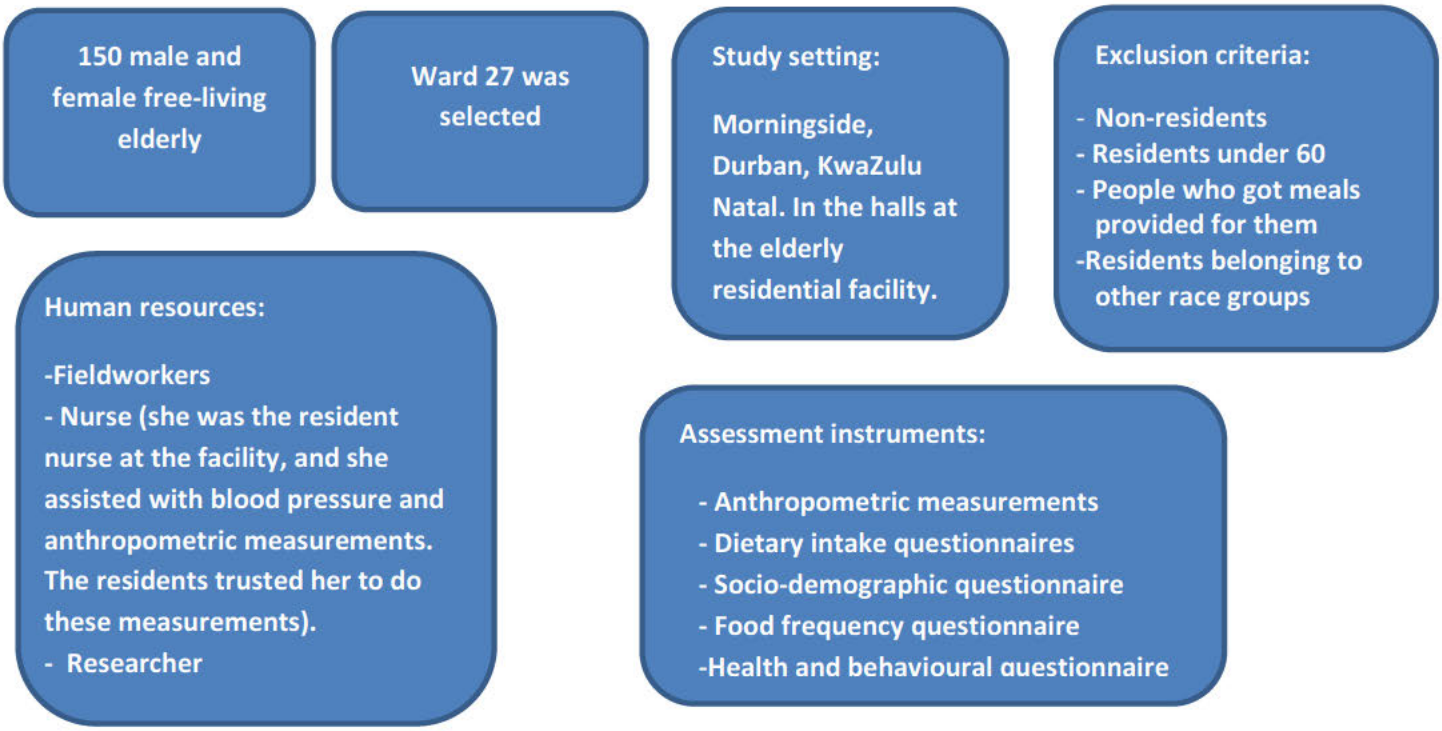

Figure 3.4 indicates the ward selected, study setting, sample size, assessment instruments and exclusions of the study, which were critical for the correct selection of human resources needed during fieldwork.

The variables measured in the study included: age, gender, employment and health status, anthropometric measurements, dietary intake and number of meals per day. The elements of a certain population may be described in terms of the individual characteristics on a given variable. According to Katzenellenbogen and Joubert (2008), social research often aimed to describe the distribution of attributes of a variable in a population. Variables to be collected in a study should be within the scope of the study, keeping the length of time per questionnaire within reasonable limits.

3.8 SAMPLE SIZE

The level of precision, the confidence level and the confidence interval need to be specified to determine an appropriate sample size. As per Annexure J, the original sample size was amended due to a number of residents at the facility declining to participate in the study. The main reasons cited by some of the residents for declining to participate in the study included lack of time, feeling that the study was a waste of time, feeling that the study was racist, poor hearing, being frail, having a bad memory, tiredness or illness.

According to Niles (2006), for a 95.0% confidence level, a good estimate for confidence interval was given by $1/\sqrt{n}$ where n is the sample size.

So, from a known population size of 270 white residents and a 95.0% confidence level, the researcher randomly sampled 150 participants.

Using the Niles approach:

Confidence interval = $1/\sqrt{n} = 1/\sqrt{150} = 0.0817$

Therefore, the confidence interval in this case was roughly 8.0%. This means that if, for example, 70.0% of the participants agreed on something, there was a 95.0% chance that between 62.0% and 78.0% of the total population would also agree.

Simple random sampling was conducted in this study, meaning that white residents were randomly selected by the researcher from a list of white residents. This list was given to the researcher by the social worker (with the CEO's permission). The list had the residents' names

and flat numbers on it. This list remained with the researcher throughout the data collection period and remained confidential and was kept away from anyone else. The researcher selected names from this list of residents and invited these residents to participate in the study by posting invitations into their post boxes. The invitation included information on what the research was about and where it would take place. The community of the residential facility was also informed that permission had been granted by the CEO and the board of the residential facility.

This strategy allowed all eligible white participants an equal opportunity to participate in the study. Data collection took place between 8:00am and 1:00pm each day as it was seen as important that participants were free to choose a convenient time to participate in the study. Refreshments and biscuits were offered to each respondent on arrival. This was to make the experience more enjoyable for the residents and to gain their trust. The study focused on white elderly residents as no existing studies could be located which explained the food intake, socio-demographic and nutritional situation of a group of white elderly people residing in close proximity to one other.

3.9 RESPONSIBILITY OF FIELDWORKERS

Four fieldworkers were recruited from among 3rd year and B-Tech students in the Food and Nutrition Consumer Science Department at DUT. There was also one fieldworker who was not a student at the Food and Nutrition Consumer Science Department due to the non-availability of some B-Tech students. This fieldworker was fluent in English and presented herself well. She was also thoroughly trained in how to administer the questionnaires and was shadowed by the researcher as she interviewed the first few participants to ensure that she was following the correct procedures. The resident nurse at the facility was made available for the anthropometric measurements as well as the blood pressure readings. The researcher did a run-through with the nurse to ensure that the correct protocol was followed; this put the residents at ease as they had someone they knew helping and taking personal measurements, such as weight and waist circumference.

The fieldworkers had to have basic skills such as the ability to read and write in English, which required the attainment of an adequate education level with a good understanding of the English language. It was important that the fieldworkers presented themselves well and were polite when dealing with the residents as they were a reflection of the Durban University of Technology and in turn, a reflection of the people associated with the study. The fieldworkers also had to have a good basic knowledge of nutrition and food variety.

The fieldworkers responded well to the training and since they could all speak English they were able to communicate well with the residents. The fieldworkers were friendly and the residents felt comfortable enough to open up to them. The fieldworkers were trained on how to complete the 24-Hour recalls using food samples to assist in estimating portion sizes. The fieldworkers were expected to show respect, friendliness and patience at all times. Punctuality and reliability were also seen as important to the success of the fieldwork, since the residents' participation depended on the time that they had available. The fieldworkers had to sign a daily register indicating the hours they worked each day. Most days after 1pm the residents would either be going to the shops on the facility's bus that had been scheduled, going to bingo, going to the supermarket or having other commitments at the residential facility, so time was limited. All the questionnaires had to be completed accurately and in full. Checklists were placed in the front of every file and fieldworkers would tick off the questionnaire once they were done and place it in the front of the file before handing it to the researcher once it was completed. This allowed the researcher to ensure that all questionnaires were completed before that resident left the hall (Annexure I).

3.10 ADMINISTRATION OF MEASURING TOOLS

Various types of questionnaires were used as measuring instruments for all variables of the study. During the fieldwork stage, socio-economic, dietary, anthropometric and health data were collected which will be discussed in detail below. Different activity stations were set up to streamline the data collection process, as represented below in Figure 3.5.

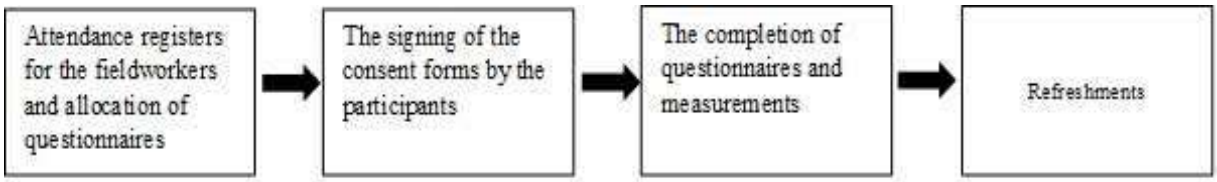

Figure 3.5: The data collection process

3.10.1 SOCIO-DEMOGRAPHIC SURVEY

The socio-demographic questionnaire was developed by Oldewage-Theron, Dicks, Napier and Rutengwe (2005). It was adapted for the community and used in the study. The purpose of the questionnaire was to measure the socio-economic status of the subjects. The main categories covered personal information, accommodation and family composition, work and economic status, education and language and household assets (refer to Annexure D). The questionnaires were conducted in an interview setting and the questionnaires were conducted by trained

fieldworkers. One hundred and fifty questionnaires were completed. The residents were reminded that all information provided would remain confidential.

3.10.2 DIETARY INTAKE

Three 24-Hour recalls were used to gather data for three different days for nutrient analysis, which was then used in conjunction with a food frequency questionnaire for validity testing.

a) 24-Hour recall

A structured 24-Hour recall questionnaire was drawn up and tested for reliability (refer to Annexure E). This is a dietary assessment questionnaire that records the eating patterns, food items and quantities consumed over a 24-Hour period. It is repeated on non-consecutive days. Before the 24-Hour recall questionnaire was validated; the questionnaire was conducted over two interviews for a three-day food consumption assessment (Oldewage-Theron *et al*. 2005). Individual interviews were conducted with the assistance of fieldworkers. Food models were used to determine portion sizes and to explain food items to the subjects. In this study the participants were asked to complete three x 24-Hour recalls for one weekend day and two weekdays. The top twenty food items consumed by the whole group were then determined.

b) Food frequency questionnaire

The FFQ gathers data on the food variety consumed, which will be a good indicator of the dietary diversity consumed by the participants. This questionnaire determines how often food items were consumed over a period of seven days and identifies favoured food groups. The food items were categorised into nine groups. The FFQ for this group was adapted during a focus group discussion with ten ladies from this community to identify the various foods consumed in this community, and the questionnaire was then updated and used (Annexure F). This instrument was also used to validate the 24-Hour recall questionnaire (Oldewage-Theron *et al.* 2008). This questionnaire was based on the nine nutritious food groups recommended by the FAO for classification of broad food intakes. A low variety of the different food groups was shown when less than 30 different foods were consumed in a period of a week, whereas a medium variety had 30 to 60 different foods and a high variety had more than 60 foods consumed in a week (Matla 2008). All the dietary diversity scores (Food Variety Score (FVS), Food Group Diversity Score (FGDS) and Dietary Diversity Score (DDS)) were calculated from the seven-day FFQ (n=150). Descriptive statistics including frequencies, means, standard deviations and confidence intervals were determined. Tables were drawn up with percentages

of the different variables included in the questionnaire. Data were presented in terms of frequencies and percentages for the various categories.

3.10.3 ANTHROPOMETRIC, MEDICAL AND HEALTH SURVEY

The health questionnaire used was validated and tested by Oldewage-Theron *et al*. (2005) in an earlier study which they conducted in Sharpeville, Gauteng. The questionnaire was compiled in English. Anthropometric measurements, health and medical information were gathered using this questionnaire. The health questionnaire focused on the health conditions of the elderly. The nature and severity of any health conditions, the use of tobacco as well as the use and description of medication were included (refer to Annexure G).

For the purpose of this study a qualified nurse was used to collect the blood pressure measurements, waist circumference, height and weight of each participant. This nurse was qualified and did these measurements with the residents on a weekly basis, so she knew what had to be done. However, the researcher still ensured that the nurse followed the correct procedure by randomly observing when measurements were being taken (refer to Annexure H).

3.11 PROCEDURES FOR CONDUCTING ANTHROPOMETRIC MEASUREMENTS

Anthropometric measurements include weight, height and waist circumference. Among other things, anthropometric data, specifically height and weight, can be used to calculate the body BMI (Annexure H).

3.11.1 WEIGHT

Weight was determined to the nearest kilogram on a good quality, electronic standardised medical scale (Scales 2000, model: portable physician scale-pps). Each participant was dressed in light clothing and they removed their shoes before being weighed. A qualified nurse was responsible for taking all the anthropometric measurements and blood pressure measurements. The scale was placed on an uncarpeted area and was levelled with the spirit level indication in the middle. The scale was switched on and had previously been calibrated and the nurse waited until the zero indication (0,0) appeared as well as the stable indicator. The subjects had to stand upright on the platform, facing the nurse and looking straight ahead. Their feet had to be flat and slightly apart, and they also had to stand still until the measurements were recorded in the space provided on the form. The participants then stepped off the scale and the fieldworker would wait for the zero recording to appear on the digital dial and weigh the participant for the second time. The next participant would be weighed when the scale's reading was at zero again.

All measurements were taken twice and the average of the two measures was recorded (WHO 1995).

3.11.2 HEIGHT

Height was measured according to the following procedure:

- The respondent had to remove his/her shoes.
- The respondent was positioned facing the fieldworker on a freestanding stadiometer.
- The respondent stood with shoulders relaxed and with shoulders, buttocks and heels against the wall.
- Arms were held relaxed at the side against the thighs, legs were straight with knees together, feet flat and heels touching.
- The respondent had to look straight ahead before the headpiece was placed on top of the head.
- The nurse then had to record the respondent's height in mm on the health questionnaire. The procedure was repeated twice for each respondent. The two readings should not vary by more than 5mm and these measurements were taken to the nearest 0.5cm by using a stadiometer (Gibson 2005; Lee and Nieman 2003; 2010). According to the WHO multicentre growth reference study group (2006), the suggested approach to obtain precise measurements is to measure twice and report the average of the two values.

3.11.3 BODY MASS INDEX (BMI)

The desirable range for BMI for persons aged 20 years and above is given by the WHO as 20 to 25, with values above 30 being associated with obesity and values below 18 seen as being underweight (Barasi 2003). Data were collected using a stadiometer and electric scale and recorded on an anthropometric form (Annexure H). The measurements were then compared and evaluated to reference standards to assess underweight, normal weight, overweight and obesity.

3.11.4 WAIST CIRCUMFERENCE

For this measurement heavy clothing had to be removed and a tape measure was held around the participant's waist (Gibson 2005; Lee and Nieman 2003; 2010). Waist circumference was measured at a level between the lower rib and iliac crest with the non-stretchable tape held around the body in a horizontal position. The measuring tape was held firmly to retain its horizontal position. The tape was loose enough to allow the observer to place one finger between the tape and the participant's body. Readings were then recorded on the Health

questionnaire. The procedure was repeated twice for each participant and the measurement was rounded to the nearest 0.1cm. The participants had to stand with their feet fairly close together (about 12-15cm apart) and flat on both feet so that their weight was evenly distributed on both legs. Participants were asked to breathe normally and the measurement was taken when the participant had exhaled. This prevented participants from contracting their abdominal muscles or from holding their breath, thus rendering the reading incorrect. Cut-off points followed in this study were: women (88cm) and men (102cm) and the waist-to-hip ratio (WHR) was ≥0.8 for women and ≥1.0 for men.

Table 3.1 below this outlines the waist circumference cut-offs for both men and women.

Table 3.1: Waist circumference cut-offs for men and women (WHO 2000b).

	Healthy waist circumference measurement (cm)	Unhealthy waist circumference measurements (cm)
Men (age 60>)	<102	<102
Women (age 60>)	<88	>88

3.12 BLOOD PRESSURE MEASUREMENT

Blood pressure of the participants was measured by a trained nurse. Using a digital sphygmomanometer device (Omron), both the systolic and diastolic measurements were recorded. Prior to the readings being taken, participants had to sit down until they felt comfortable in order for them to relax and their blood pressure to normalise (WHO 1995). The participants were asked not to talk as this could result in an incorrect reading. Blood pressure measurements were recorded on the anthropometric questionnaire (Annexure H). Systolic blood pressure (S BP) and diastolic blood pressure (D BP) measurements were captured on an Excel spreadsheet and converted to SPPS for descriptive statistics (mean and SD's).

Table 3.2 shows the different cut-off categories for blood pressure.

Table 3.2: Blood pressure categories (WHO 2000b)

Categories	Normal BP SBP/DPB <120 mmHg /<80 mmHg	Prehypertension SBP/DBP 120-139 mmHg /80-89 mmHg	High BP 1 SBP/DBP 140-159 mmHg /90-99 mmHg	High BP 2 SBP/DBP ≥160 mmHg /≥100 mmHg

Table 3.3 below shows the cut-offs for blood pressure. This is used for both men and women.

Table 3.3: Systolic and diastolic blood pressure classification for adults ≥ 18 years old (WHO 2005)

Category	Systolic blood pressure (S BP) pressure at the peak of each heartbeat (top number)		Diastolic blood pressure (D BP) heart resting between beats (bottom number)
Normal	Less than 120	And	Less than 80
Pre-hypertension	120-139	Or	80-89
High blood pressure			
Stage 1	140-159	Or	90-99
Stage 2	160 or higher	Or	100 or higher

3.13 STATISTICAL ANALYSIS OF DATA

The socio-demographic questionnaire and health questionnaire, food frequency questionnaire, 24-Hour recall questionnaire and anthropometric measurements were captured on an Excel® spread sheet by the researcher and analysed for descriptive statistics using the Statistical Package for the Social Sciences (SPSS) version 17, 0 with the assistance of a statistician. The correlations were conducted by a statistician using the ANOVA statistical test. If the p-value was less than $p<0.05$, this indicated that there was a statistical significance between the variables. If the p-value was less than 0.01, then there was a strong correlation between the variables (Yue, Pilon, and Cavadias 2002).

3.13.1 SOCIO-DEMOGRAPHIC AND HEALTH QUESTIONNAIRES

Once the fieldwork was completed, the questionnaires were sorted and checked for completeness and accuracy by the researcher. The data from the questionnaires were captured onto an Excel® spreadsheet by the researcher. These questionnaires were analysed using the Statistical Package for Social Sciences (SPSS) for Windows Version 17, 0 software program. Descriptive statistics (frequencies, means, standard deviations and confidence intervals) were determined with the assistance of a bio-statistician. Data was presented in tables, frequencies and percentages and standardised methods were used for this.

3.13.2 DIETARY ASSESSMENT QUESTIONNAIRES

The dietary intake and food consumption data from the 24-Hour recall questionnaires were analysed using the Food Finder Version 3 computer program to determine the top 20 food items consumed (Langenhoven, Kruger, Gouws and Faber 1991; Food Finder 3 2002). Means, standard deviation and nutrient intakes were calculated and compared with the DRIs. The FFQ data were captured on an Excel® spreadsheet and interpreted by a bio-statistician to determine food diversity, variety scores and means for food groups to validate the results of the 24-Hour recalls.

3.13.3 ANTHROPOMETRIC MEASUREMENTS

All weight and height (averages of the two readings) measurements were captured on an Excel® spreadsheet. BMI was calculated by dividing weight (kg) by height squared (m^2) and the results were between these groups ─ normal weight (BMI 18.5- 24.9), overweight (BMI 25-29.9), obese 1 (>30), obese 2 (>35) obese 3 (> 40). Waist circumference (Women 88cm and men 102cm) was captured on an Excel® spreadsheet and converted to SPPS for descriptive statistics (mean and SDs).

3.14 DATA QUALITY CONTROL

The researcher used pre-tested and validated questionnaires in this study. Some of the questionnaires, as mentioned previously, had to be adapted from the pre-existing questionnaires for this specific community by the researcher and the forum focus group. The researcher conducted a pilot study in order to verify and validate the questionnaires for reliability so that there was consistency. A student captured the data and the researcher randomly checked the database to ensure that data was captured correctly.

3.14.1 VALIDITY

According to Mouton and Babbie (2001), validity applied to the accuracy of a measurement. When gathering data, existing instruments could be used. Using existing instruments had some advantages such as saving cost sand time, and if the instrument's validity and reliability could be confirmed, then it did not have to be measured again. If an existing instrument was used, it was important that information was available about the validity and reliability of the instruments. The instruments that were used in the study needed to be applicable to and useable at the residential facility. The validity that was achieved was construct validity.

Table 3.4 below describes the three main types of validity.

Table 3.4: Types of validity (Heale, Twycross 2015)

Type of validity	Description
Content validity	The extent to which a research instrument (or tool) accurately measures all aspects of a construct.
Construct validity	The extent to which a research instrument (or tool) measures the intended construct.
Criterion validity	The extent to which a research instrument (or tool) is related to other instruments that measure the same variables.

3.14.2 RELIABILITY

According to Mouton and Babbie (2001), reliability was the regularity of the measurements, or the degree to which the instrument gave measurements every time it was used with the same subjects under the same conditions. In summary, it was the repeatability of the measurements. A measurement was considered reliable if a person's score on the same test was given twice and the score was similar.

3.15 CORRELATIONS

The information was correlated to determine whether there were any relationships between the different variables assessed. The information was presented to a statistician who conducted the ANOVA statistical test. This test indicated whether there were any statistically significant or justifiable relationships between data resources. Correlations between BMI and blood pressure as well as between BMI and energy intake were compared. This could then identify whether the identified variables had a statistically significant effect on the overall nutritional status of residents of the elderly residential facility.

The SPSS version 23 was used to run correlations and the Pearson's 2-tailed test was applied for this function. This test type identified whether there were any significant relationships amongst the different sample variables presented. The Spearman's Rho correlation coefficient values were used to measure strengths between the values using cut-off points. If the p-value was less than 0.05, this indicated that there was a statistical significance between the variables. If the p-value was less than 0.01, then there was a strong correlation between the variables (Yue, Pilon, and Cavadias 2002).

In line with objectives 2 and 5 of this study, correlations were drawn between the following variables:

- BMI and systolic blood pressure
- BMI and diastolic blood pressure
- BMI and energy intake.

3.16 CONCLUSION

In this chapter all the instruments used to determine the socio-economic, health and nutritional profile of the residents have been discussed. The instruments used in this study were appropriate to gather the data to achieve the purpose of the study. The purpose of the study was to determine the socio-economic, nutritional and health status of the elderly in an elderly residential facility in Durban in KwaZulu-Natal using reliable instruments. The results of the study will be reported in detail in graphs and tables in chapter 4.

CHAPTER 4: RESULTS

4.1 INTRODUCTION

This chapter reports on the results of the processed data as tabulated, interpreted and evaluated. The purpose of the study was to determine the socio-economic conditions, dietary intake and food consumption patterns and health status, in relation to food insecurity, of a group of residents in an elderly residential facility in the Morningside area.

This chapter will focus on reporting the results obtained in this study, including an analysis of the results. The findings include socio-economic factors, dietary intake and food frequency scores, anthropometric measurements and self-reported health results.

4.2 RESULTS OF THE STUDY

4.2.1 SOCIO-DEMOGRAPHIC RESULTS

The socio-demographic results present the study population categorised in percentages and numbers according to sample size, accommodation, family composition, work status, income, education and assets. A total of n=150 white participants participated in the study. The sample included (n=125) women and (n=25) men aged 60 years and above. The mean age for the men was 76.36 years and for the women it was 75.05. The results in this chapter will be presented in percentages (%). The original sample size for this study, was 205 residents.

4.2.1.1 Personal information

Table 4.1 below shows the participants' role in the family and language spoken.

Table 4.1: The participants' role in the family and language

Variable	Number (n=150)	Percentage (%)
Language		
English	142	94.7
Afrikaans	8	5.3
Role in the family		
Grandmother	88	58.7
Grandfather	17	11.3
Mother	109	72.7
Father	19	12.7

The information in Table 4.1 indicates that the majority (72.7%; n=109) of the participants were mothers and (12.7%; n=19) were fathers. Of the participants, 58.7% (n=88) were grandmothers and 11.3% (n=17) were grandfathers. The majority (94.7%; n=142) spoke English and 5.3% (n=8) spoke Afrikaans.

4.2.1.2 Accommodation and family composition

Table 4.2 outlines the living conditions of the households.

Table 4.2: The living conditions of the households

Variable	Number (n=150)	Percentage (%)
Number of permanent residents per house		
1	44	29.3
2	106	70.7
Duration of time at residence		
≤ 1 years	19	12.7
1-5 years	50	33.3
5-10 years	81	54.0
Type of house		
Brick	150	100.0
Type of floor material		
Cement	45	30.0
Tiles	122	81.3
Carpets	62	41.3
Wood	18	12.0
Number of rooms		
1	72	42.0
2	78	58.0

The information in Table 4.2 shows that of the participants, (n=44) lived alone and (n=106) lived with one other person. Fifty-four percent (n=81) of the participants had lived in the residence for more than five years and 12.7% (n=19) had lived in the residence for less than one year. All the participants (100.0%) lived in a brick home. Of all the participants' homes, 81.3% (n=122) had tiled floors and 12.0% (n=18) had wooden floors. Of these homes, 42.0% (n=72) had one room and 58.0% (n=78) had two rooms.

Table 4.3 below shows the amenities that the residents had available to them.

Table 4.3: Amenities

Variable	Number (n=150)	Percentage (%)
Toilet facilities		
Flush/sewage system	150	100.0
Water facilities		
Tap in the house	150	100.0

Table 4.3 shows that all participants (n=150) had flushing toilets connected to sewage systems.

One hundred percent (n=150) of the participants had taps inside the houses.

4.2.1.3 Work status and income

Table 4.4 shows the working status of the participants.

Table 4.4: Work status of the participants

Variable	Number (n=150)	Percentage (%)
Employed		
Yes	10	6.7
No	140	93.3
Specify status if unemployed		
Unemployed	2	1.3
Retired	135	90.0
Housewife	3	2.0
Looking for employment		
Yes	5	3.3
No	135	90.0
Duration of unemployment		
≤6 months	2	1.3
6-12 months	2	1.3
1-3 years	6	4.0
≥3 years	130	86.7
If employed, status of job		
Permanent position	5	3.3
Temporary position	5	3.3
Part time work		
Yes	17	11.3
No	130	86.7
Income bracket		
R0-R1500	35	23.3
R1501-R3000	53	35.3
R3001-R5000	32	21.3
R5001-R7000	19	12.7
R7001-R9000	5	3.3
R9001-R11000	1	0.7
≥R11000	5	3.3

Table 4.4 shows that 6.7% (n=10) of the participants were employed and 93.3% (n=140%) were not. Of the non-employed participants, 90.0% (n=135) were retired. Of the non-employed, 90.0% (n=135) were not actively looking for employment. Moreover, 86.7% (n=130) had been unemployed for more than 3 years. Of the employed participants, 3.3% (n=5) had a permanent position and 3.3% (n=5) had a temporary position. Eighty-six point seven percent (n=130) of the participants did not have part-time jobs. The majority of the participants (35.3%; n=53) had an income of R1501-R3000 and 3.3% (n=5) had an income greater than R11 000. Some of the participants received an additional amount of money per month from family members.

4.2.1.4 Education

Table 4.5 below shows the highest level of education among residents.

Table 4.5: Highest level of education achieved

Variable	Number (n=150)	Percentage (%)
Highest level of education		
None	2	1.3
Primary school	8	5.3
Standard 8	73	48.7
Matric	34	22.7
College	27	18.0
Other	6	4.0

Table 4.5 shows that the majority of participants (48.7%; n=73) had achieved a standard 8 education, 1.3% (n=2) had no education, 22.7% (n=34) had achieved a matric education and only 18.0% (n=27) had achieved a tertiary education.

4.2.1.5 Food security and household assets

Table 4.6 below outlines how many people contributed to the household income, the amount of money spent on food shopping, as well as how often and where the food was bought.

Table 4.6: Food security status

Variable	Number (n=150)	Percentage (%)
Number of people contributing to income		
0	57	38.0
1	49	32.7
2	24	16.0
3	7	4.7
4	12	8.0
6	1	0.7

Table 4.6 continued

How often do you buy food?		
Every day	9	6.0
Once a week	85	56.7
Once a month	41	27.3
Other	15	10.0
Shortage of money for food		
Always	2	1.3
Often	8	5.3
Sometimes	7	4.7
Seldom	13	8.7
Never	120	80.0
Where is food bought?		
Wholesalers	5	3.3
Supermarket	145	96.7
Type of transport used		
Taxi	41	27.3
Bus	7	4.7
Own car	65	43.3
Other	37	24.7
The amount of money spent on food per month		
R0-R500	28	18.7
R501-R1000	66	44.0
R1001-R1500	28	18.7
R1501-R2000	16	10.7
R2001-R2500	7	4.7
R2501-R3000	2	1.3
I do not know	3	2.0

Table 4.6 reflects household food security and household income. A large number of the participants 38.0% (n=57) did not receive a salary from a paying job, which therefore means the money they received came from the state pension. Most of the participants (32.7%; n=49) had one person contributing to the household income and 16.0% (n=24) had two people contributing to the household income. The majority of participants (56.7%; n =85) did shopping once a week, 6.0% (n=9) did shopping every day and 27.3% (n=41) did shopping once a month. The majority of the participants (80.0%; n=120) never had a shortage of money for food and 8.7% (n=13) seldom had a shortage of money for food. Most participants (96.7%; n=145) shopped at the supermarket and 3.3% (n=5) shopped at wholesale stores. Of the participants, 43.3% (n=65) owned a car and 24.7% (n=37) used other forms of transport such as lifts from friends or family or walked. In respect of the amount of money spent per month on food, 18.7% (n=28) spent R0-R500 on food and 1.3% (n=2) spent R2501-R3000 on food.

Table 4.7 outlines the duties within the household for food preparation and purchasing, hierarchy and food budget.

Table 4.7: Household duties in relation to food preparation, purchasing, hierarchy and food budget

Variable	Number (n=150)	Percentage (%)
Person responsible for food preparation		
Sibling	1	0.7
Themselves	130	86.7
Husband	1	0.7
Wife	16	10.7
Other	2	1.3
Person responsible for buying food		
Sibling	1	0.7
Themselves	136	90.7
Wife	11	7.3
Other	2	1.3
Head of the household		
Sibling	1	0.7
Themselves	129	86.0
Husband	18	12.0
Wife	1	0.7
Other	1	0.7
Responsible for food spending		
Sibling	1	0.7
Themselves	142	94.7
Husband	2	1.3
Wife	4	2.7
Other	1	0.7

Table 4.7 indicates that 86.7% (n=130) of the participants prepared food for themselves, 0.7% (n=1) had the husband prepare food and 10.7% (n=16) had the wife prepare the food. Of all the participants, 90.7% (n=136) were responsible for buying the food themselves and 7.3% (n=11) had the wife buy the food. Of all the participants, 86.0% (n=129) were the head of the household and for 12.0% (n=18) it was the husband and for 0.7% (n=1) it was the wife who was the head of the household. The responsibility for deciding how much money was spent on food was mainly the participants themselves (94.7%; n=142).

Table 4.8 outlines the number of meals consumed throughout the day and where the meals were eaten.

Table 4.8: Consumption of meals

Variable	Number (n=150)	Percentage (%)
Number of meals consumed daily		
1	4	2.6
2	19	12.7
3	120	80.0
More than 3	7	4.7
Place where food is eaten		
Home	149	99.3
Friend	1	0.7

Table 4.8 shows that a large number of participants (78.7%; n=118) consumed three meals a day, 4.7% (n=7) consumed more than three meals per day, 2.7% (n=4) consumed one meal a day and 1.3% (n=2) consumed zero meals a day. The majority of participants (99.3%; n=149) consumed the meals at home and 0.7% (n=1) consumed meals at a friend's house.

Table 4.9 below outlines what household assets the residents had.

Table 4.9: Household assets

Variable	Number (n=150)	Percentage (%)
Electric stove	136	90.6
Gas stove	3	2.0
Telephone/cell phone	149	99.3
Microwave	140	93.3
Hot plate	24	16.0
Radio	130	86.6
TV	148	98.6
Refrigerator	149	99.0
Freezer	68	46.2
Bed with mattress	149	99.3
Mattress only	1	0.7
Lounge suite	108	72.0
Dining room suite	36	24.0
Electric iron	139	92.6
Electric kettle	150	100.0
Car	65	43.3
Motorbike/Bicycle	2	1.33

As per Table 4.9, 90.6% (n=136) of the participants owned electric stoves, 93.3% (n=140) owned a microwave, 86.6% (n=130) owned a radio, 98.6% (n=148) owned a TV, 99% (n=149)

owned a refrigerator and 46.2% (n=68) owned a freezer. All the participants 99.3% (n=149) owned a bed and mattress. The number of participants that owned a lounge suite was 72.0% (n=108) while 24.0% (n=36) owned a dining room suite, 92.6% (n=139) owned an electric iron and all participants 100.0% (n=150) owned an electric kettle.

Table 4.10 below indicates the fuel type and material used for pots.

Table 4.10: Food preparation fuel type and material used for pots

Variable	Number (n=150)	Percentage (%)
Type of fuel used to prepare food		
Electricity	150	100.0
Type of material used for pots		
Cast iron	10	6.7
Aluminium	34	22.7
Stainless steel	101	67.3
Other	5	3.3

Table 4.10 indicates that all participants 100.0% (n=150) used electricity to prepare meals. The majority of the participants 67.3% (n=101) used stainless steel pots and 3.3% (n=5) used pots made from other materials.

4.2.2 ANTHROPOMETRIC AND HEALTH INDICATORS

4.2.2.1 Anthropometric findings

Table 4.11 summarises the BMI cut-offs as well as the mean BMI for men and women.

Table 4.11: The summary of BMI

Parameter	Classifications	Men (n=25)	(Mean)	%	Women (n=125)	(Mean)	%
Body Mass Index- BMI classifications, WHO (1995)	Underweight (<18.50)	3	18.01	12.0	2	18.21	1.6
	Normal (18.50 - 24.99)	8	22.20	32.0	45	22.49	36
	Overweight (25.00-29.99)	6	27	24.0	27	27.70	21.6
	Obese I (30.00-34.99)	6	32.22	24.0	28.0	32.38	22.4
	Obese II (35.00-39.99)	1 **8**	38.20	4.0 **32.0**	13.0 **51.0**	37.12 **38.43**	10.4 **40.8**
	Obese III (≥40)	1	**38.56**45.26	4.0	10.0	45.81	8
	TOTAL	n=25		100%	n=125		100

Table 4.11 shows that 12.0% (n=3) of the men were underweight compared to 1.6% (n=2) of the women who were underweight. The majority of the men 32.0% (n=8) were within a normal weight and 36.0% (n=45) of the women were within a normal weight. Of the men, 24.0% (n=6) were overweight and 21.6% (n=27) of the women were also within this range. Most of the

women (40.8%; n=51) were in the obese range, with most being stage one obese (22.4%; n=28). For the men, 32.0% (n=8) were obese with (24.0%; n=6) being stage one obese.

Figure 4.1 below shows the waist circumference cut-offs for men and women and the percentage of residents within the cut-offs.

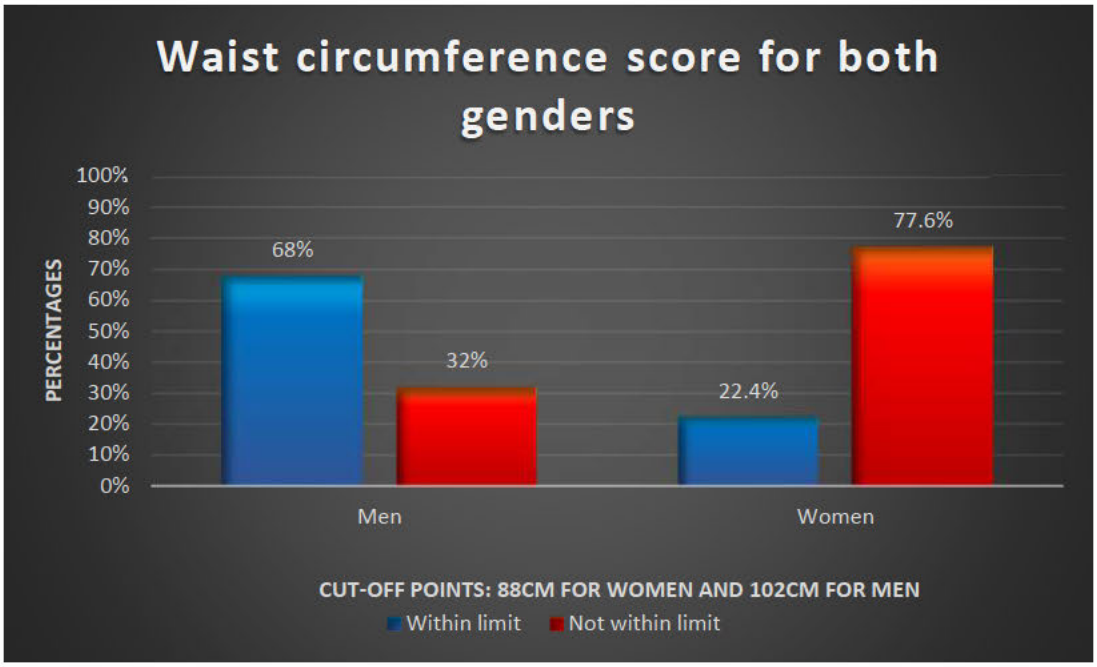

Figure 4.1: Percentage of men (n=25) and women (n=125) that were within the cut-off points for waist circumference

As per figure 4.1, the majority (68.0%; n=17) showed fat distribution within the recommended cut-off point (≤102cm) (WHO 2000b) and only 32.0% (n=8) of the men exceeded the cut-off of 102cm. The men had a mean waist circumference (WC) of 100.54cm. The majority of women (77.6%; n=97) were not within the WC cut-off point (≤88cm) (WHO 2000b) and 22.4% (n=28) were within the cut-off point. The mean WC for women was 99.01cm.

Figure 4.2 below shows the cut-offs for men and women and the percentage of residents within the cut-offs.

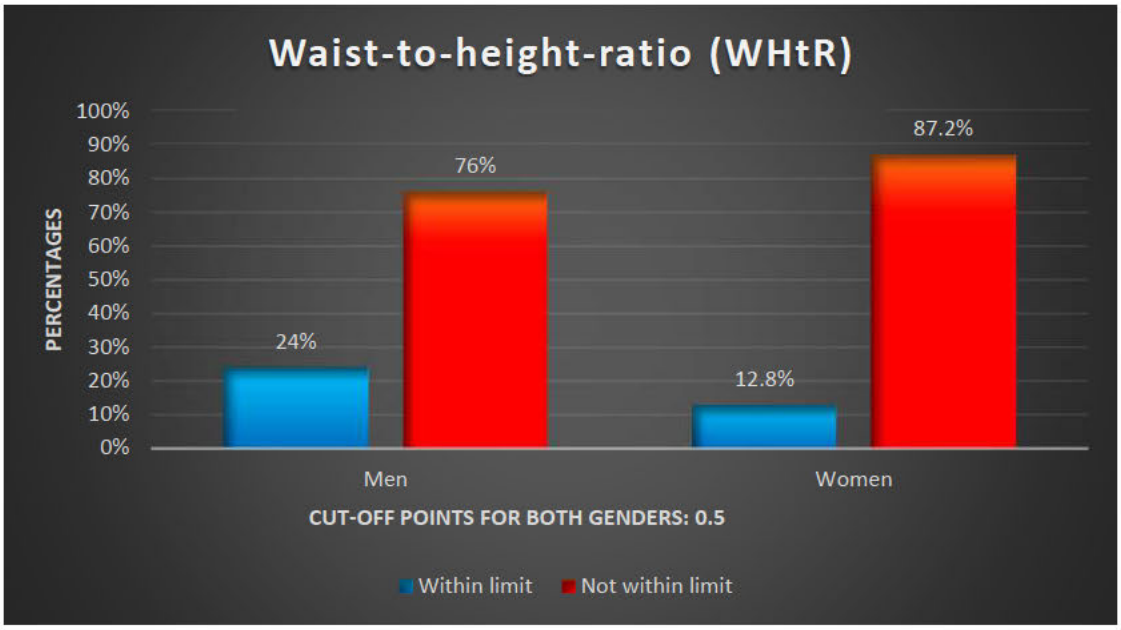

Figure 4.2: Percentage of men (n=25) and women (n=125) that were within the cut-off points for waist-to-height ratio score

The score of waist-to-height-ratio (WHtR) in Figure 4.2 was determined by dividing the waist circumference (WC) by height measurement in centimetres (cm). WHtR is used to predict coronary risk and metabolic syndrome. The results showed that the majority (87.2%; n=109) of the women were at risk of coronary disease and metabolic syndrome, as the WHtR score was ≥0.5, and 76.0% (n=19) of the men were at risk of coronary disease and metabolic syndrome as the WHtR score was ≥0.5. Only 12.8% (n=16) of the women had a score of ≤0.5, which indicates a normal value and only 24.0% (n=6) of the men had a score of ≤0.5, which indicates a normal value. The cut-off for WHtR is ≥0.5 (Hsieh and Yoshinaga 1995). The mean WHtR for men was 0.58 and for women it was 0.62.

Figure 4.3 below shows the stages of hypertension, or blood pressure for both men and women.

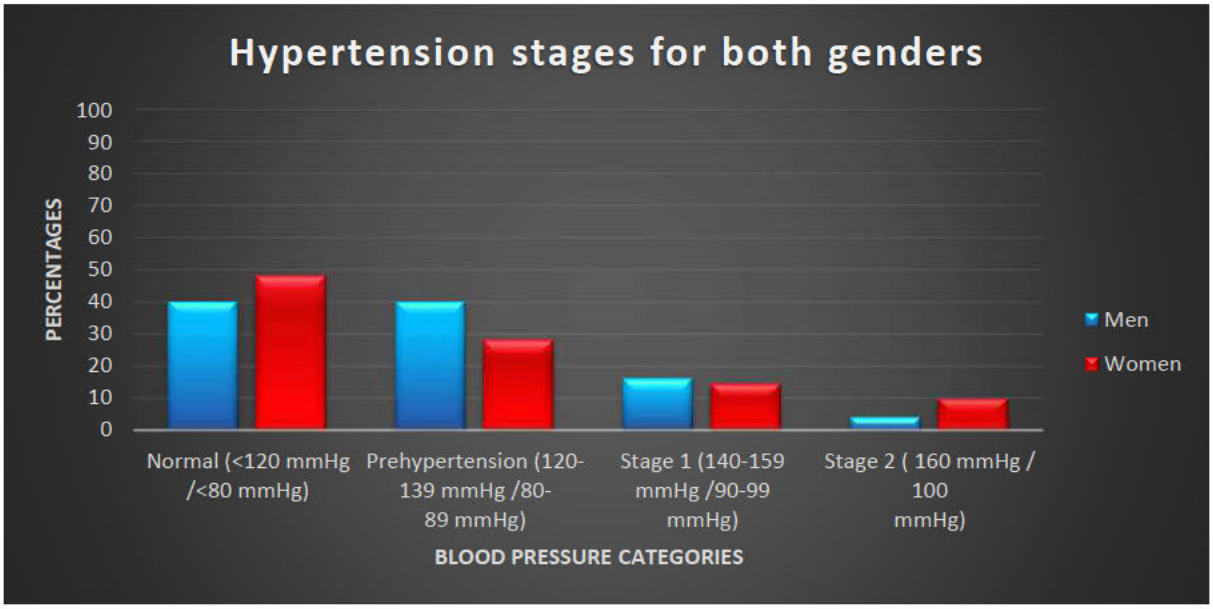

Figure 4.3: Percentages showing the different hypertension stages for both men (n=25) and women (n=125)

Figure 4.3 indicates that 40.0% (n=10) of the men and 48.0% (n=60) of the women had normal blood pressure and 40.0% (n=10) of the men and 28.0% (n=35) of the women were pre-hypertensive. Of the men, 16.0% (n=4) and 14.4% (n=18) were at stage one hypertension and 4.0% (n=1) of the men and 9.6% (n=12) of the women were at stage 2 hypertension.

Table 4.12 below outlines the mean and standard deviation for age, weight, BMI and waist for both men and women.

Table 4.12: The mean and standard deviation for age, weight, BMI and waist circumference (n=150)

Variable	Mean age (years)	Mean height (m)	Mean weight (kg)	Mean BMI	Mean waist (cm)
Men ≥60 years (n=25)	76.36 ±5.09	1.72 ±0.078	79.76 ±20.47	26.81 ±6.74	100.54 ±16.25
Women ≥60 years (n=125)	75.05 ±6.53	1.59 ±0.086	72.91 ±18.06	29.16 ±7.5	99.01 ±15.18

Table 4.12 describes the mean age, height, weight, BMI and waist circumference for the two gender groups. The mean age for the men was 76.36 years with a ± SD of 5.09 and the mean age for the women was 75.05 years with a ± SD of 6.53. The results indicated that men were slightly heavier and taller than the women, with a mean weight of 79.76 kg while the women

had a mean weight of 72.91 kg. However, when looking at the BMI, the men had a mean BMI of 26.81 and the women had a mean BMI of 29.16

4.2.3 HEALTH ASSESSMENT

4.2.3.1 Health and behavioural survey

Table 4.13 below outlines the residents' self-reported diseases or illnesses.

Table 4.13: History of disease

Variable	Number (n=150)	Percentage (%)
Skin disease	32	21.3
Affliction of the skeleton and/or joints	71	47.3
Infection of the eyes, ears, nose and/or teeth	74	49.3
Affliction of the heart or circulatory system	44	29.3
Affliction of the chest and/or respiratory system	20	13.3
Affliction of digestive system:	24	16.0
Affliction of the urinary system and/or genital organs	17	11.3
Nervous affliction or mental abnormalities	8	5.3
Headaches	35	23.3
Other illnesses	64	42.6
Any defects of hearing, speech or sight	56	37.3
Physically disabled or use of artificial limbs	4	2.6

The health information, except for blood pressure measurements, was self-reported by the participants and not confirmed by medical records. The history of health associated with diseases is summarized in Table 4.13, indicating that 47.3% (n=71) reported that they suffered from diseases of the skeleton or joints and 49.3% (n=74) had problems with eyes, ears, nose and teeth. Diseases of the chest or respiratory system were experienced by 13.3% (n=20) of the participants. Moreover, 16.0% (n=24) of the participants suffered from diseases of the digestive system and 11.3% (n=17) suffered from afflictions of the urinary system or genital organs. Of all the participants, 5.3% (n=8) suffered from nervous affliction or mental abnormalities. Forty-two point six percent (n=64) of the participants reported suffering from other illnesses. Of all the participants, only 2.6% (n=4) were physically disabled or had artificial limbs.

Figure 4.4 outlines the physical activity done by the residents as self-reported in the health questionnaire and not measured by the researcher.

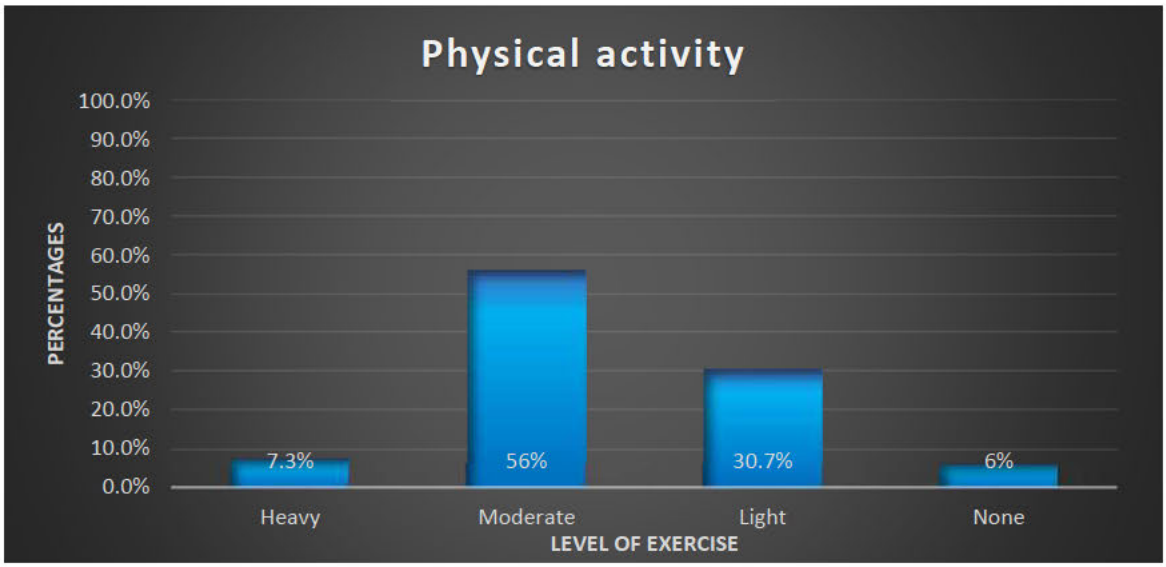

Figure 4.4: The percentage of physical activity levels for the whole group (n=150)

As per figure 4.4, 7.3% (n=11) of the participants did heavy/rigorous exercise, 56% (n=84) were moderately active, 30.7% (n=46) did light physical activity and 6% (n=9) were physically inactive. Activities performed were going for walks, playing bowls or gardening.

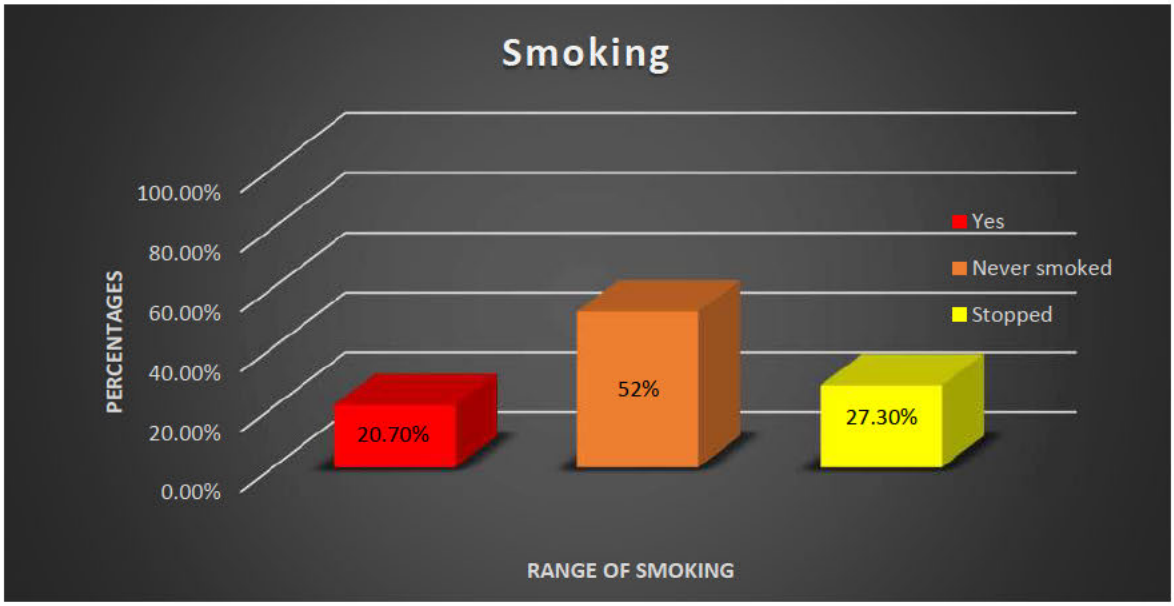

Figure 4.5: Smoking status (n=150)

Figure 4.5 shows the usage of cigarette smoking. A large number of participants (52.0%) (n=78) had never smoked and 29.7% (n=31) were active smokers.

Table 4.14 below shows whether medication was used and whether the participants had ever had surgery.

Table 4.14: Usage of medication and operations

Variable	Number (n=150)	Percentage (%)
Do you use any medication	127	84.7
Have you undergone operations	117	78.0

Table 4.14 shows that of all the participants, 84.7% (n=127) were on medication and 78.0% (n=117) of the participants had undergone surgery.

4.2.4 DIETARY ASSESSMENT RESULTS

Dietary assessments were conducted using the 24-Hour food recall questionnaire including two weekdays and one weekend day along with a FFQ indicating variety over a seven-day period. The following factors are looked at: the nutrient intake, top 20 foods consumed, energy distribution, fruit and vegetable intake, FVS and food group diversity score as well as the nutrient adequacy ratio.

4.2.4.1 Dietary nutrients intake and top 20 food items consumed

Table 4.15 below shows the recommended daily intake of nutrients and the percentage of residents not meeting these requirements.

Table 4.15: The dietary intake nutrients analysis, nutrient adequacy ratio (NARs) and percentage of the participants not meeting the DRIs measured using the average of three 24-Hour food recalls, for men and women separately (IoM 2003)

Nutrients	Men (mean ± SD) n=25	Men NARs Mean % of the DRIs	% Men consuming <100% of DRIs	Women (mean ± SD) n=125	Women NARs Mean % of the DRIs	% Women consuming <100% of DRIs	DRIs
Energy (kJ)	6 790.11 ± 2848.91	52.7	96.0	5085.77 ± 1437.41	50.3	100.0	♂ 12881kJ ♀10093kJ
Total protein (g)	78.15 ± 60.79	139.5	36.0	53.83 ± 18.65	117.0	36.0	♂56 RDA ♀46 RDA
Total fat (g)	59.52 ± 21.16			44.94 ± 17.92			
Carbohydrates (g)	172.01 ± 81.08	172.0	8.0	133.53 ± 41.75	133.5	22.4	♂100 EAR ♀100 EAR
Total dietary fibre (g)	19.69 ± 15.17	65.6	84.0	13.98 ±6.31	66.5	88.8	♂ 30 AI ♀ 21 AI
Calcium (mg)	616.75 ±409.27	51.4	92.0	499.35 ±254.94	41.6	99.2	♂1200 AI ♀ 1200 AI

Table 4.15 continued

Iron (mg)	15.66 ± 13.96	260.9	4.0	10.97 ± 5.98	219.4	8.0	♂6.0 EAR ♀5.0 EAR
Magnesium (mg)	313.32 ± 363.15	89.5	80.0	206.42 ±73.62	77.8	86.4	♂350 EAR ♀260 EAR
Phosphorus (mg)	1109.09 ±779.87	191.2	16.0	815.84 ±312.80	140.6	22.4	♂580 EAR ♀580 EAR
Zinc (mg)	11.89 ±5.19	126.4	36.0	8.81 ±3.69	129.5	28.8	♂ 9.4 EAR ♀ 6.9 EAR
Selenium (µg)	27.81 ±13.99	61.7	88.0	31.57 ±22.09	70.1	82.4	♂ 45 EAR ♀ 45 EAR
Iodine (µg)	36.11 ±18.04	38.0	100.0	34.14 ±33.70	35.9	96.0	♂ 95 EAR ♀ 95 EAR
Vitamin a (µg)	952.44 ±1102.59	152.3	60.0	687.35 ±1501.42	137.4	57.6	♂625 EAR ♀500 EAR
Thiamin (mg)	1.39 ±0.52	139.4	28.0	1.11 ±0.50	123.3	35.2	♂ 1.0 EAR ♀ 0.9 EAR
Riboflavin (mg)	1.45 ±0.75	132.2	28.0	1.20 ±0.76	133.7	36.8	♂ 1.1 EAR ♀ 0.9 EAR
Niacin (mg)	23.93 ±8.85	199.3	12.0	18.96 ±7.41	172.3	12.8	♂ 12 EAR ♀ 11 EAR
Vitamin b6 (mg)	2.94 ±1.33	210.1	20.0	2.16 ±0.99	165.9	19.2	♂ 1.4 EAR ♀ 1.3 EAR
Folate (µg)	295.61 ±165.15	92.3	60.0	239.11 ±249.38	74.7	85.6	♂320 EAR ♀320 EAR
Vitamin B12 (µg)	3.98 ±3.75	198.8	24.0	3.54 ±6.45	177.0	34.4	♂ 2.0 EAR ♀ 2.0 EAR
Pantothenate (mg)	5.03 ±2.64	100.5	56.0	4.38 ±2.69	87.5	70.4	♂ 5.0 AI ♀ 5.0 AI
Biotin (µg)	37.80 ±37.95	126.0	56.0	31.88 ±60.06	106.2	66.4	♂ 30 AI ♀30 AI
Vitamin C (mg)	54.26 ±65.64	72.3	84.0	46.76 ±50.56	77.9	80.8	♂ 75 EAR ♀ 60 EAR
Vitamin D (µg)	3.20 ±3.73	21.3	100.0	3.15 ±3.90	21.0	97.6	♂ 15 AI ♀ 10 AI
Vitamin E (mg)	11.20 ±8.60	93.3	72.0	8.77 ±5.65	73.0	80.8	♂ 12 EAR ♀ 12 EAR
Vitamin K (µg)	70.96 ±98.13	59.1	84.0	50.38 ±51.55	55.9	84.8	♂ 120 AI ♀ 90 AI

♀Women 125, ♂ Men 25
EER: Estimated Energy Requirements (Institute of Medicine, 2003)
AI: (Adequate Intake) Used where EAR (Estimated Average Requirement) is not available
EAR: Estimated Average Requirement
RDA: Recommended Dietary Allowance

Table 4.15 indicates that the phosphorus intake for men and women was high, with men consuming 1109.09 mg (SD ± 779.87) and women 815.84 mg (SD ± 312.80). The DRI for phosphorus for this group was recommended at 580 mg for both men and women. Both men (191.2%) and women (140.6%) consumed more than the NARs for phosphorus. Carbohydrate intake was also fairly high for both men (172.01 g; SD ± 81.08) and women (133.53 g; SD ± 41.75) as the DRI for carbohydrates in this group was recommended at 100 g for both genders. The NARs for niacin for men was 199.3% and for women it was 172.3%. The mean intake for men was 23.93 mg (SD ± 8.85) and for women it was 18.96 mg (SD ± 7.41). This is

significantly over the EAR of 12 mg for men and 11 mg for women. The iron intake was more than double the required amount for both men (15.66 mg; SD ± 13.96) and women (10.97 mg; SD ± 5.98), which indicated the NARs for men (260.9%) and women (219.4%) (6 mg for men and 5 mg for women).

The pantothenate intake for men was 5.03 mg (SD ± 2.64) and for women it was 4.38 mg (SD ± 2.69), whereas the recommended intake for both was 5.0 mg. For men, the biotin intake was 37.8 µg (SD ± 37.95) and for women it was 31.88 µg (SD± 60.06). For vitamin A, men consumed 952.44 µg (SD ± 1102.59) and women consumed 687.35 µg (SD ± 1501.42). Fifty-seven point six percent of the women did not reach the DRI and for the men it was 60.0%. Protein intake for both men (78.15 g; SD ± 60.79) and women (53.83 g; SD ± 18.65) was above the recommended intake. The DRI for protein was recommended at 56 g for men and 46 g for women.

Eighty-four percent of the men and 84.8% of the women did not reach the AI for vitamin K. Intake of selenium was noted as being lower in the men than the women at 27.81 µg (SD ± 13.99) and 31.57 µg (SD ± 22.09) respectively. A deficient intake in iodine was found in both men (36.11 µg; SD ± 18.04) and women (34.14 µg; SD ± 33.70). One hundred percent of men and 96% of women did not meet the DRI for iodine, which is 95 µg for both men and women. In terms of dietary fibre, both men (19.69 g; SD ± 15.17) and women (13.98 g; SD ± 6.31) consumed less than the AI of 30g for men and 21g for women. There was a deficiency in Vitamin D, with the men having an intake of 3.20 µg (SD ± 3.73) and for women it was 21.36 µg (SD ± 3.90). The NARs were also lower, at 21.36% for men and 21.03% for women. The above results indicated a mineral deficiency intake of calcium as seen in men 616.75 mg (SD ± 409.27) and in women 499.35 mg (SD ± 254.94) compared to the recommended DRI which was 1200 mg for both men and women. The EER for energy in this group was recommended at 12 881kJ for men and 10 093kJ for women. All the men (6790.11kJ; SD ± 2848.91) and women (5085.77kJ; SD ± 1437.41) consumed less than the EER for energy.

4.2.4.1.1 Top 20 foods intake

The top 20 most frequently consumed foods are shown in the total intake by the group of women (n=125) and men (n=25) aged 60 and above. The main food source across both genders was carbohydrates with bread or rolls being the most commonly consumed. This could be due to the free bread provided by the facility on a weekly basis.

Table 4.16 shows the top 20 most popular food items of the men and the average daily intake of these items over two weekdays and one weekend day included in the 24-Hour recall.

Table 4.16: The mean top 20 food items consumed by men over three days classified by how often that food was consumed as shown in the 24-Hour recall (n=25)

No	Food item	Total intake (g)	Mean intake over 1 day (g)	Frequency for 1 day by the group	Per capita intake for 1 day (g)	Mean frequency intake
1	Tea	22700	7566.67	89	302.67	85.01
2	Coffee	12750	4250.00	51	170.00	83.33
3	Milk	9765	3255.00	142	130.20	22.92
4	Bread/rolls	6310	2103.33	77	84.13	27.31
5	Oats, cooked	3425	1141.67	16	45.67	71.35
6	Vegetable curry	3200	1066.67	14	42.67	76.19
7	Rice, cooked	1887	629.00	15	25.16	41.93
8	Mixed vegetables	1840	613.33	19	24.53	32.28
9	Apple	1800	600.00	15	24.00	40
10	Salad	1786	595.33	13	23.81	45.79
11	Macaroni/spaghetti, cooked	1400	466.67	15	18.67	31.11
12	Mince (beef)	1395	465.00	13	18.60	35.76
13	Cheese	1134	378.00	23	15.12	16.43
14	Sugar	1067	355.67	120	14.23	2.96
15	Potato, boiled	1010	336.67	12	13.47	28.05
16	Banana	975	325.00	10	13.00	32.5
17	Tomato	570	190.00	13	7.60	14.61
18	Corn flakes	430	143.33	10	5.73	14.33
19	Margarine	352	117.33	49	4.69	2.39
20	Biscuits	340	113.33	16	4.53	7.08

Table 4.16 shows that the group of men consumed a large amount of tea (7566 g and 302.67 g per capita) and coffee (4250 g and 170 g per capita). Milk was the third most consumed food source, with 3255 g consumed and the per capita consumption was 130.20 g. Bread/rolls (2103 g and 84.13 g per capita) and cooked oats (1141 g and 45.67 g per capita) were next on the list of most consumed foods. Vegetable curry was a popular food, with 1066 g (42.67 g per capita) consumed by the group on average. Cooked rice was often consumed with 629 g (25.16 g per capita) consumed. Mixed vegetables were often consumed but not as often as expected (613 g and 24.53 g per capita) and came in at number eight of the most consumed foods. Apples were a popular fruit at 600 g (24 g per capita) and next was salads at 595 g (23.81 g per capita). Macaroni or spaghetti was a popular grain consumed at 466 g (18.67 g per capita) and mince

was another popular food at 465 g (18.60 g per capita). Cheese was at number 13 on the list, with 378 g (15.12 g per capita) consumed. Sugar was 14 on the list, with 355 g (14.23 g per capita) consumed. Boiled potato was 15th on the list as 336.67 g was consumed and 13.47 g per person per day was consumed. Banana was number 16 on the list and 325 g and 13 g per person per day was consumed. Tomato was consumed at 7.6 per person per day. Corn flakes were a popular cereal with 143 g consumed or 5.73 g per person per day. Margarine was consumed at 4.69 per person per day. Biscuits were consumed on average at 4.53 per person per day.

Table 4.17: The mean top 20 food items consumed by women over three days classified by how often that food was consumed as shown in the 24-Hour recall (n=125)

No	Food item	Total intake (g)	Mean intake over 1 day (g)	Frequency for 1 day by the group	Per capita intake for 1 day (g)	Mean frequency intake
1	Tea	112720	37573.33	446	300.59	84.24
2	Milk	43454	14484.67	808	115.88	17.93
3	Bread/Rolls	24490	8163.33	363	65.31	22.49
4	Oats	9505	3168.33	48	25.35	66.00
5	Yoghurt, Fruit, Low Fat, Sweetened	8880	2960.00	67	23.68	44.17
6	Apple	8170	2723.33	62	21.79	43.92
7	Salad: French (lettuce, Tomato, Cucumber, No Dressing)	7670	2556.67	66	20.45	38.73
8	Mixed Vegetables	7640	2546.67	85	20.37	29.96
9	Rice	5809	1936.33	66	15.49	29.33
10	Banana	5785	1928.33	86	15.43	22.42
11	Chicken, Cooked Dry/ Roasted	5350	1783.33	58	14.27	30.74
12	Sugar	5075.5	1691.83	533	13.53	3.17
13	Egg	4030	1343.33	58	10.75	23.16
14	Cheese	4024	1341.33	104	10.73	12.89
15	Tomato	3965	1321.67	101	10.57	13.08
16	Weet-bix	3000	1000.00	68	8.00	14.70
17	Biscuits	1430	476.67	60	3.81	7.94
18	Margarine	1090.5	363.50	164	2.91	2.21
19	All Bran Flakes	1080	360.00	330	2.88	1.09
20	Creamer	49	16.33	60	0.13	0.27

Table 4.17 indicates that the women consumed a large amount of tea (37573 g) with 300.59 g per person per day. Milk was the next frequently consumed food at 14484 g (115.88 g per

person per day). Bread or rolls were the most frequently consumed carbohydrate (8163 g) at 65.31 g per person per day. The next frequently consumed carbohydrate was oats at 3168 g (25.33 g per capita) and then rice (1936 g or 15.49 g per capita). Weetbix was popular at 1000 g (8g per capita) and then All-bran at 360 g (2.88 g per capita). Dairy products that were frequently consumed were yoghurt (2960 g and 23.68 g per capita), cheese (1341 g and 10.73 g per capita), margarine (363 g and 2.91 g per capita) and creamer (16.33 g and 0.13 g per capita). Proteins that were frequently consumed were cooked chicken (1783 g or 14.27 g per person per day) and eggs (1343 g or 10.75 g per person per day). Salad and mixed vegetables were both consumed in more or less the same amounts. Salad was consumed at 2556 g (20.45 g per person per day) and mixed vegetable was consumed at 2546 g (20.37 g per person per day) and tomatoes were consumed at 1321 g (10.57 g per person per day). Apples were a popular fruit consumed at 2723 g (21.79 g per capita) and banana was consumed at 1928 g (15.43 g per capita). Biscuits were a popular treat with 476 g (3.81 g per capita) and sugar 13.53 g per person per day (1691 g) being consumed.

Table 4.18 below shows the fruit and vegetable intake of the group.

Table 4.18: The fruit and vegetable intake measured by the 24-Hour Food recall (WHO 2003)

Men (n=25)	**Women (n=125)**
Mean intake per individual	**Mean intake per individual**
243.92 g (SD ± 75.16 g)	195.52 g (SD ± 58.87 g)

Table 4.18 indicates the fruit and vegetable intake as a mean (± SD) of the three 24-Hour food recalls and indicated that the group was consuming a lot less than the amount the WHO recommended at ≥400 g per day (WHO 2000d).

Table 4.19 shows the results of the energy distribution of the macronutrients from the average of the three 24-Hour recalls according to the dietary factor goals of WHO (2003).

Table 4.19: The percentage of energy distribution of the micronutrient from the average of three 24-Hour recalls (WHO 2003)

Micronutrients	Mean ±SD	Mean % energy contribution	WHO goal
Men (n=25)			
Total fat (g)	59.52 ± 21.16	32.4	15.0-30.0%
Protein (g)	78.15 ± 60.79	19.5	10.0-15.0%
Carbohydrate (g) & fibre (g)	191.70 ± 96.25	48.0	55.0-75.0%
Women (n=125)			
Total fat (g)	44.94 ± 17.92	32.6	15.0-30.0%
Protein (g)	53.83 ± 18.65	17.9	10.0-15.0%
Carbohydrate (g) & fibre (g)	147.51 ± 48.06	49.3	55.0-75.0%

The total fat for both groups was slightly higher than the WHO goals (15.0-30.0%), with men being 32.4% and women being 32.6%. Carbohydrates and fibre contributed slightly lower than the levels recommended by the WHO (55.0-75.0%). The contribution of protein to total daily energy intake for all the groups was higher than the recommendation of 10.0-15.0%, with men at 19.5% and women at 17.9%. This shows that the participants consumed a balanced diet with carbohydrates being the main source of energy.

4.2.4.2 Food variety score (FVS), dietary diversity score (DDS) and nutrient adequacy

A summary of the food group variety is presented in Table 4.20.

Table 4.20: Summary of FVS within the food groups for women (n=125)

Food group	Mean	± SD	Range of scores
Meat	5.77	2.036	1-11
Eggs	1	.000	1-1
Dairy	3.76	1.432	1-8
Cereals, roots and tubers	6.11	1.738	2-9
Legumes and nuts	2.23	1.075	1-5
Vitamin A rich foods	5.43	2.053	1-8
Other fruit	8.10	4.183	1-14
Other vegetables	9.62	2.706	2-13
Oil and fats	4.06	1.392	1-8
Mean number of food items	46.08	16.615	9-76

Low= 0-3 food groups or <30 individual foods
Medium= 4–5 food groups or 30–60 individual foods
High= 6–9 food groups or >60 individual foods (Matla, 2008).

As per Table 4.20, a mean of 46.08 (SD± 16.615) was observed for all the foods consumed from all the food groups over a period of seven days, which indicated a high FVS (high variety score >60 individual foods). The other vegetables group was reported to have the highest ranging score of two to thirteen, followed by other fruit, cereals, roots and tubers, meat, vitamin A-rich fruits and vegetables, oils and fats, dairy, legumes and nuts, and then eggs with the mean FVS ±SD of 9.62 (±2.706), 8.10 (±4.183), 6.11 (±1.738), 5.77 (±2.036), 5.43 (±2.053), 4.06 (±1.392), 3.76 (±1.432), 2.23 (±1.075), and 1 (±0) respectively.

A summary of the food group variety is presented in Table 4.21

Table 4.21: Summary of FVS within the food groups for men (n=25)

Food group	Mean	±SD	Range of scores
Meat	6.32	1.994	2-10
Eggs	1.00	.00	1-1
Dairy	3.68	1.1446	1-6
Cereals, roots and tubers	6.36	1.4107	4-9
Legumes and nuts	2.08	1.2028	1-5
Vitamin A rich foods	5.20	1.8028	2-8
Other fruit	8.76	4.1861	2-14
Other vegetables	10.44	2.3993	4-13
Oil and fats	4.36	1.7049	1-8
Mean number of food items	48.0	12.11	26-67

Low= 0-3 food groups or <30 individual foods
Medium= 4–5 food groups or 30–60 individual foods
High= 6–9 food groups or >60 individual foods (Matla, 2008).

As per Table 4.21, a mean of 48 (SD ± 12.11) was observed for all the food consumed from all the food groups over a period of seven days, which indicated a high FVS (high variety score >60 individual foods). The other vegetables group was reported to have the highest-ranging score of four to thirteen, followed by other fruit (8.76; ± 4.1861), cereals roots and tubers (6.36; ± 1.4107), meat (6.32; ± 1.994), vitamin A-rich fruits and vegetables (5.20; ±1.802), oils and fats (4.36; ±1.704), dairy (3.68; ± 1.144), legumes and nuts (2.08; ± 1.202), and then eggs (1; ± .00).

Table 4.22 below summarizes the food group diversity for both men and women.

Table 4.22: Summary of food group diversity in men (n=25)

Number of food groups consumed (n=9)	Frequency	Percentage
1-7	0	0
8	3	12
9	22	88
Total	25	100.00

According to Table 4.22 all participants had a high DDS for FGD because eight to nine different food groups were consumed. This shows that there was a high FVS and that most of the nine food groups were consumed on a daily basis.

Table 4.23: Summary of food group diversity in women (n=125)

Number of food groups consumed (n=9)	Frequency	Percentage
1-2	0	0
3	1	0.8
4	1	0.8
5	0	0
6	5	4
7	4	3.2
8	33	26.4
9	81	64.8
Total	125	100.00

According to Table 4.23 the majority of the participants (98.4%) had a high DDS for FGD because between six and nine different food groups were consumed. This shows that there was a high FVS and that most of the nine food groups were consumed on a daily basis. However, n=1 of the participants had a medium variety score because only four food groups were consumed. Of all the participants, n=1 had a low food variety with three food groups being consumed.

4.2.4.3 The mean NAR of energy and nutrients at different levels of FGDS (total sample)

The FVS consisted of a simple count of single foods within the nine nutritional food groups.

Figures 4.6 and 4.7 illustrate the relationship between the DDS and nutrient adequacy ratios and energy, protein, selected minerals and vitamins for women and shows an increase in nutrient adequacy ratio for all these nutrients as DDS increases.

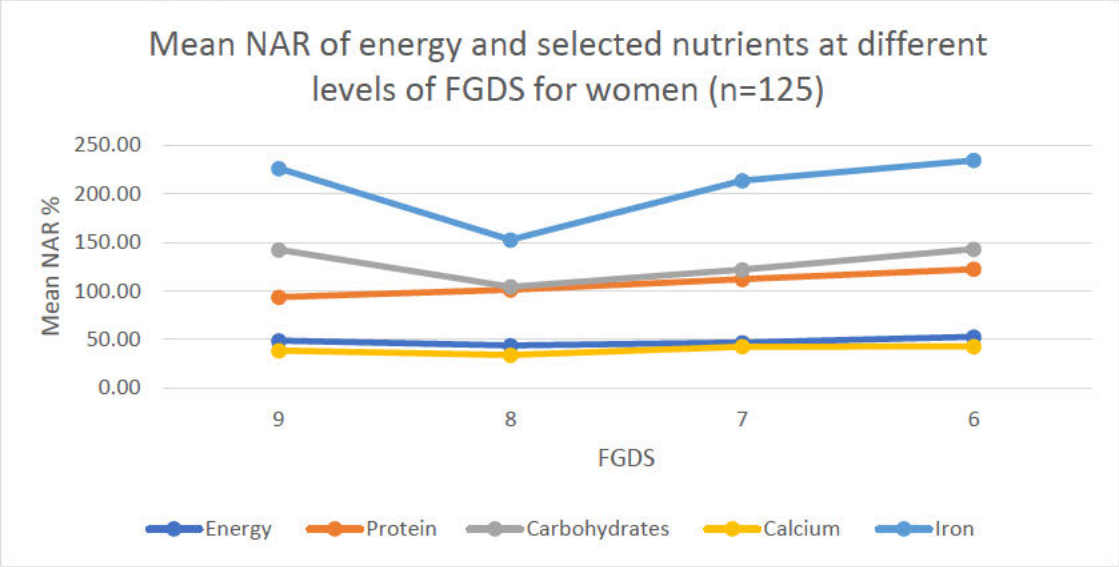

Figure 4.6: The mean NAR of energy and nutrients at different levels of FGDS for women (n=125)

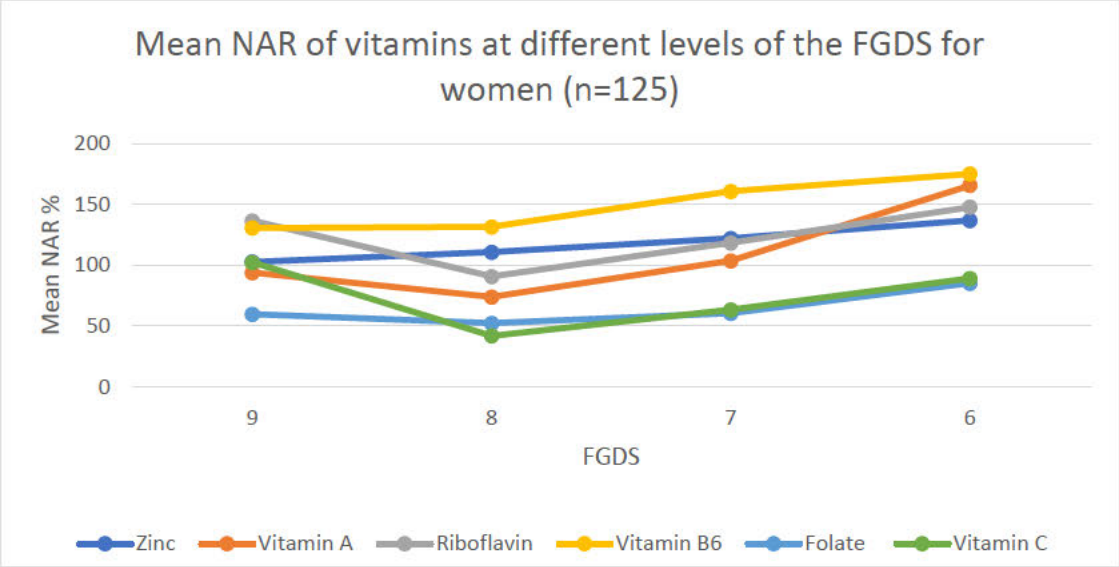

Figure 4.7: The mean NAR of vitamins at different levels of FGDS for women (n=125)

As per Figures 4.6 and 4.7, the nutrient energy ratio reached only 50.0%, whereas protein reached a diversity score of six. The nutrient adequacy ratio increased far above 100.0% at a dietary diversity of nine for iron, and zinc reached above 100.0% with a DDS of nine. However, calcium remained below 100.0%. Vitamin A, vitamin B6, vitamin C and riboflavin all reached

above a 100.0% nutrient adequacy whereas folate remained below 100.0% of the nutrient adequacy ratio.

Figures 4.8 and 4.9 illustrate the relationship between DDS and nutrient adequacy ratios and energy, protein, selected minerals and vitamins show a slight increase in nutrient adequacy ratio for all these nutrients as DDS increases.

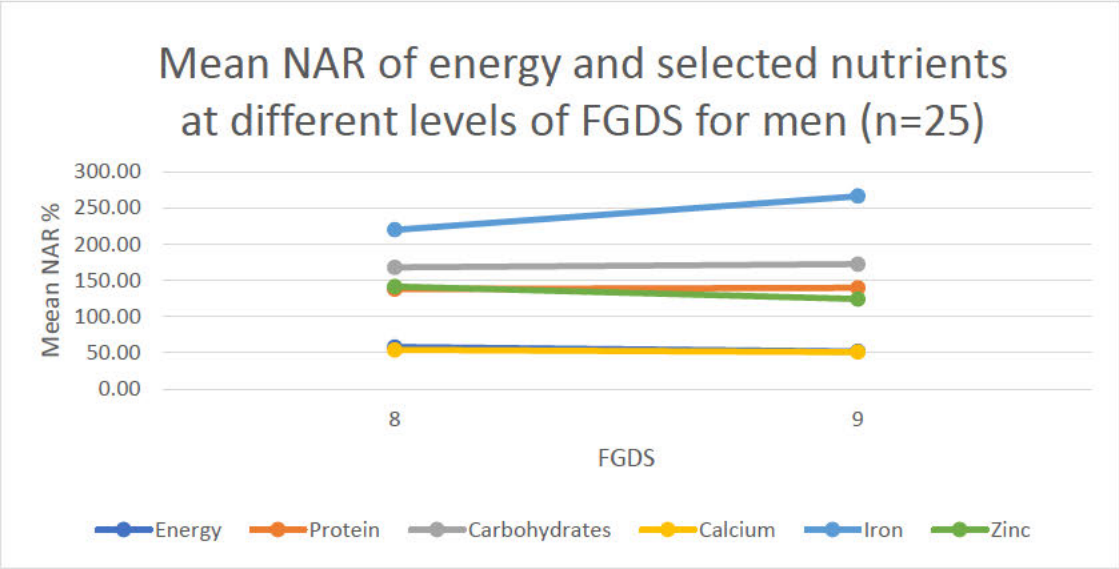

Figure 4.8: The mean NAR of energy and nutrients at different levels of FGDS for men (n=25)

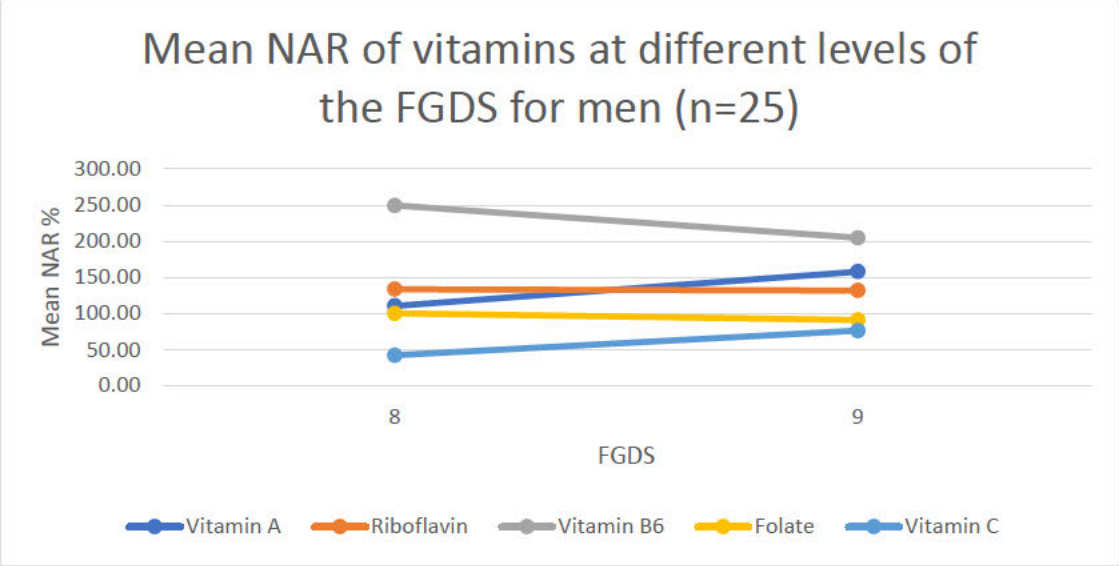

Figure 4.9: The mean NAR of vitamins different levels of FGDS for men (n=25)

According to Figures 4.8 and 4.9 the nutrients calcium and energy only reached a nutrient ratio of 50.0% with a DDS of eight and then showed a slight decline, whereas protein reached a diversity score of nine and was above 100.0% nutrient adequacy. Iron reached a high above 100.0% and had a diversity score of nine. Carbohydrates remained constant above 100.0% of the nutrient adequacy ratio. The nutrient adequacy ratio increased above 100.0% at a dietary

diversity of nine for riboflavin, zinc, vitamin A and B6. Folate and vitamin C remained below 100.0% nutrient adequacy ratio with a diversity score of nine.

4.3 CORRELATIONS

The correlations were carried out using the ANOVA statistical test program which is used to determine whether there is a statistical significance among various sample means. When testing the statistical significance of a sample, the *p*-value must reflect less than 0.05 otherwise it can be concluded that there is no statistical significance between two samples. In statistical significance testing, the *p*-value is the probability of obtaining a test statistic score at least as extreme as the one that was actually observed (Naito 2006). The researcher decided to compare the energy intake with BMI cut-off points of the group as well as the blood pressure and BMI cut-off points of the group.

4.3.1 LINK BETWEEN BMI AND BLOOD PRESSURE

Figure 4.10 presents the correlation between BMI and diastolic blood pressure for women.

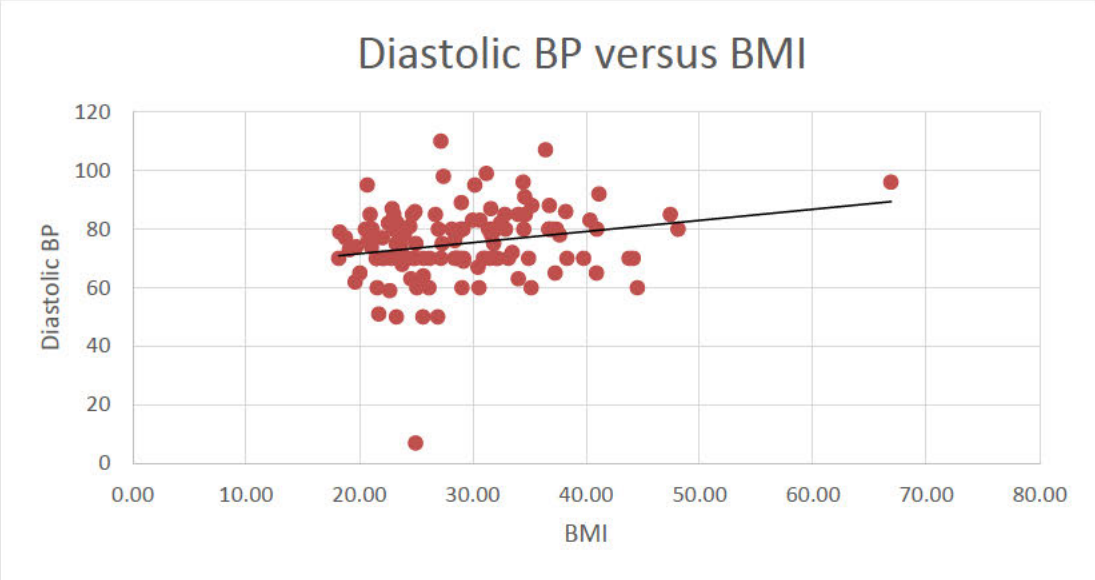

Figure 4.10: Women: correlation between BMI and diastolic blood pressure (n=125)

Figure 4.10 represents the relationship between BMI and diastolic blood pressure in women. A statistical significant relationship was observed between BMI and diastolic blood pressure, (p=0.010) indicating that a high BMI can increase the risk of hypertension.

Figure 4.11 presents the correlation between BMI and systolic blood pressure for women. This indicates the link between BMI and the pressure at the peak of each heartbeat.

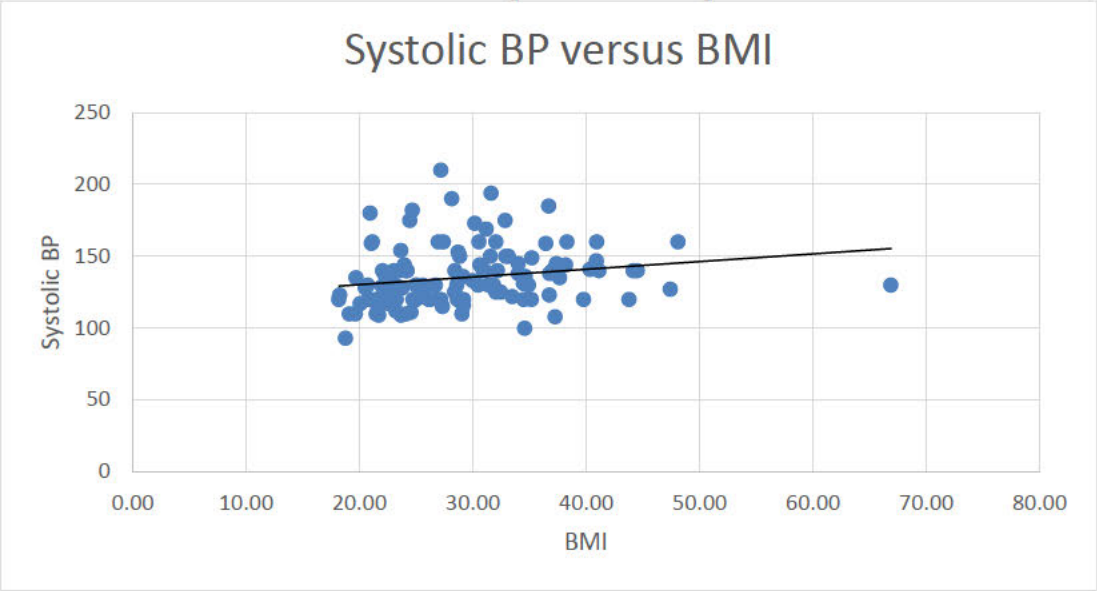

Figure 4.11: Women: correlation between BMI and systolic blood pressure (n=125)

Figure 4.11 represents the relationship between BMI and systolic blood pressure in the women. There was a direct relationship between BMI and diastolic blood pressure as there was a statistical significance (p=0.027). As shown in Figure 4.11, one of the participants had a BMI of 48.10 with a systolic blood pressure of 160. This means that having a BMI of 25 and above significantly increases the systolic blood pressure.

Figure 4.12 presents the correlation between BMI and diastolic blood pressure for men. This indicates the link between BMI and the heart resting between beats.

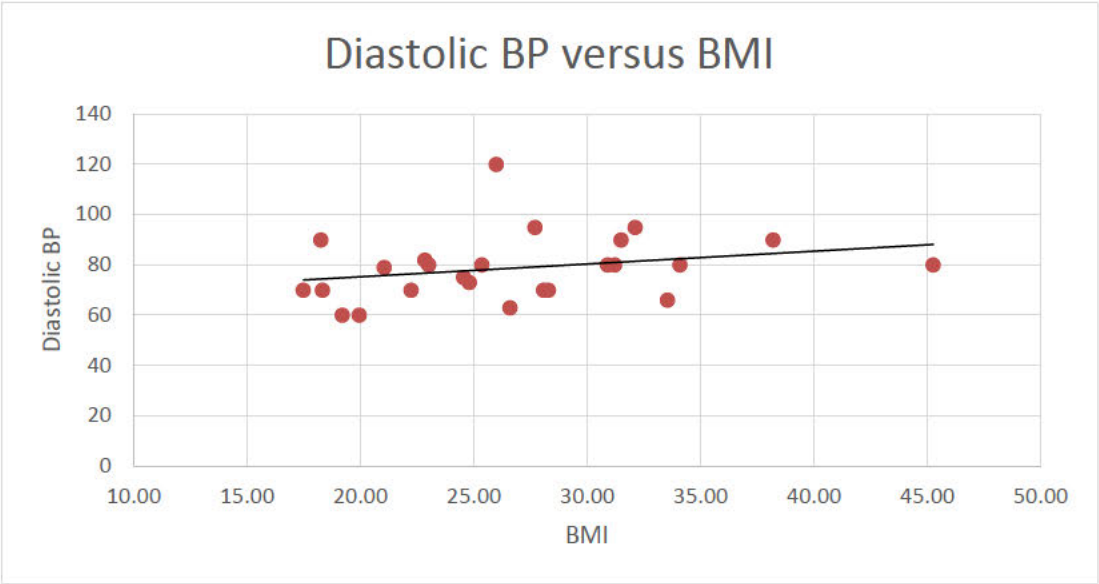

Figure 4.12: Men: correlation between BMI and diastolic blood pressure (n=25)

Figure 4.12 above represents the relationship between BMI and diastolic blood pressure in the men. There was no statistical significance (p=0.210) between BMI and diastolic blood pressure in the men. Although it was clear that there was a relationship between BMI and diastolic blood pressure, these relationships were not significant.

Figure 4.13 presents the correlation between BMI and systolic blood pressure for women

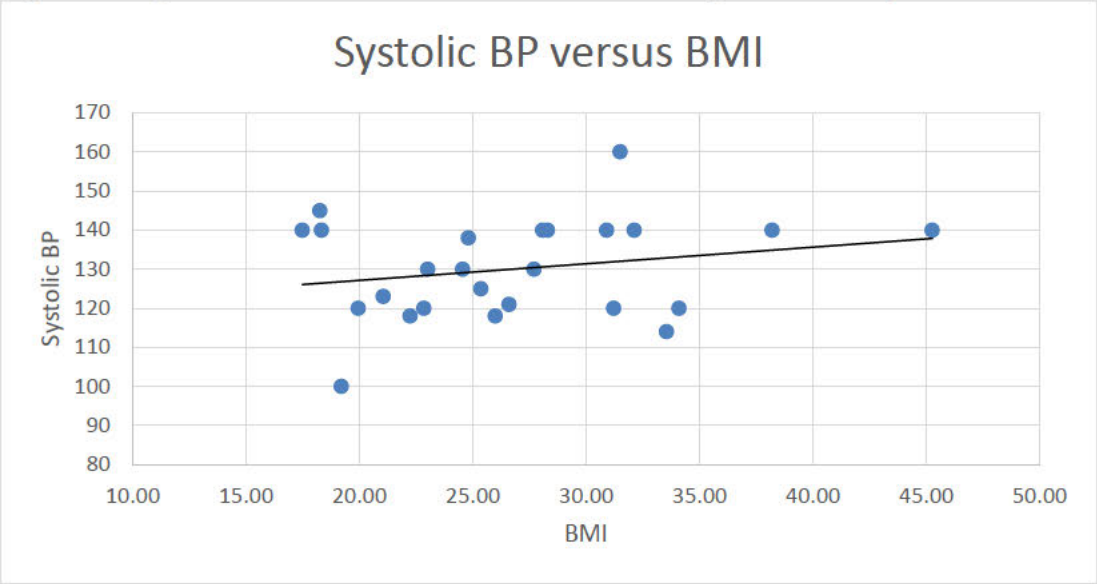

Figure 4.13: Men: correlation between BMI and systolic blood pressure (n=25)

Figure 4.13 represents the relationship between BMI and systolic blood pressure in men. There was no statistical significance (p=0.286) between BMI and systolic blood pressure in the men. Although it was clear that there was a relationship between BMI and systolic blood pressure, these relationships were not significant.

4.3.2 RELATIONSHIP BETWEEN BMI AND ENERGY INTAKE

Figure 4.14 shows whether there is a link between high energy intake and BMI for women.

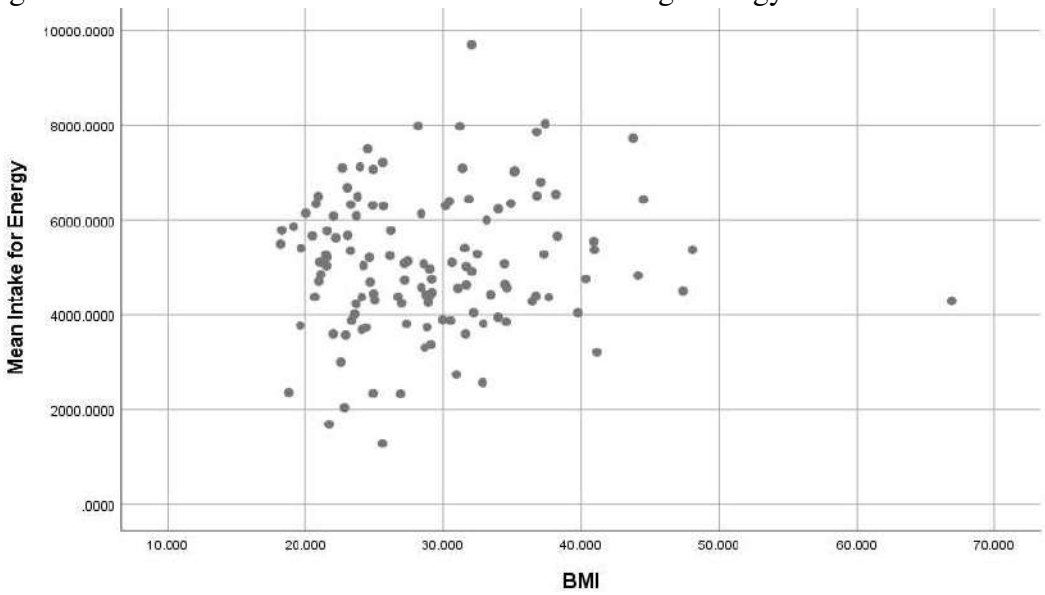

Figure 4.14: Women: relationship between BMI and energy (n=125)

Figure 4.14 shows that there was no significant correlation (p=0.328) between the energy intake and BMI for women (n=125).

Figure 4.15 shows whether there is a link between high energy intake and BMI for men.

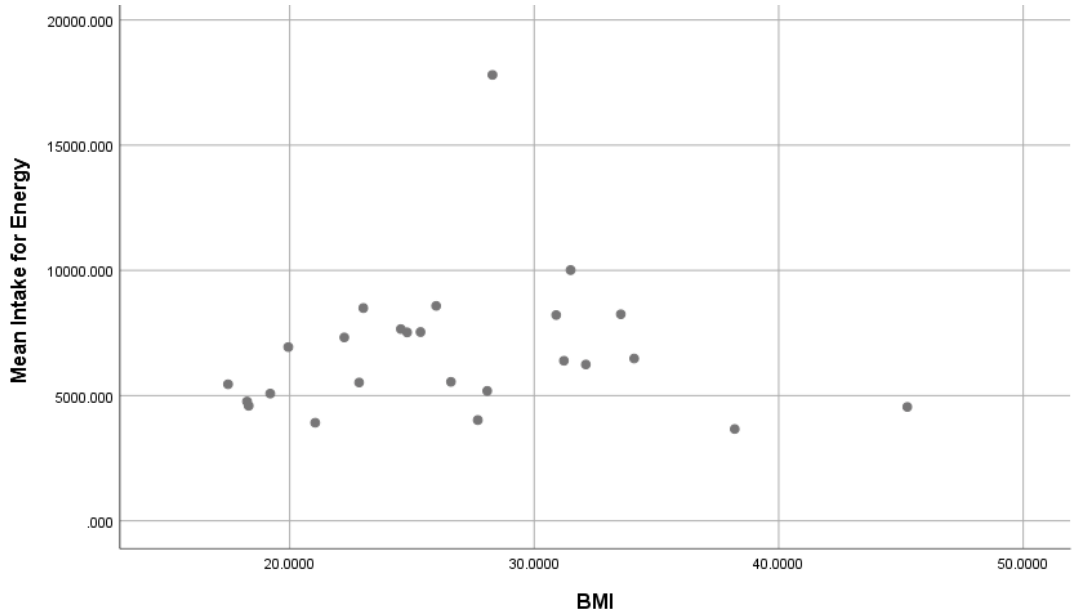

Figure 4.15: Men: link between BMI and energy (n=25)

Figure 4.15 shows that there was no significant correlation (p=0.788) between the energy intake and BMI for men (n=25).

4.4 DISCUSSION

The data collected in this research illustrated the nutritional status and dietary intake patterns of free-living men and women aged 60 years and older residing in an elderly residential facility in Durban. The WHO (2009) defined the term 'elderly' as a person that was 60 years and older. The mean age of the participants was 76.36 years for women and 75.05 years for men.

A socio-demographic questionnaire was used to collect general information about the residents' living conditions. This showed that the majority of the residents were from a lower to middle class socio-economic background. The majority of the participants (78.6%; n=118) consumed three meals a day. Most of the participants (44.0%; n=66) spent R501-R1000 on food per month and went shopping once a week. Most of the participants (80.0%; n=120) never ran out of money for food. A large number of the participants (38.0%; n=57) did not receive an income, which therefore meant the money came from their state pension. The results showed that most of the participants (93.3%; n=140) were unemployed and 35.3% (n=53) lived off R1501-R3000 per month. As per SASSA (2019), the old age pension as of April 2019 was R1780 for people between 60 and 75 and a maximum of R1800 was given for people aged 75 and above. This suggested that the majority of the participants were more than likely just managing to live off the old age pension.

Charlton *et al.* (2008) stated that the old age grant has been crucial in the survival of many households, particularly in rural households, where members of the household may be unemployed. However, the social security system was insufficient when it came to addressing food security, let alone making sure that every citizen avoids malnutrition, by being able to meet minimum dietary requirements.

A study by Isaacs (2016) correlates with this study which found that the majority of participants who earned R1501-R3000, were existing on an income much lower than the average South African national monthly income, which was recorded to be between R3500 and R4600. This shows that most participants (58.6%; n=88) were seen to be lower income earners.

The group of participants in this current study were malnourished and at a high risk of disease; this was mainly due to the fact that most of the participants were obese or overweight and this had leads to overnutrition. Women continued to be at a greater risk for obesity and disease. This also suggested that there was a higher risk for hypertension and the continual risk for other lifestyle diseases. This correlated with a study done on 125 obese participants in Ohio, USA,

conducted by Fielding, Gunstad, Gustafson, Heymsfield, Launer, Kral, Penninger, Phillips and Scarmea (2013), which stated that obesity also led to an abnormality of the metabolism of carbohydrates (leading to insulin resistance and defective insulin secretion), poor vascular function (high blood pressure) and the malfunctioning of major organs like the liver and kidneys. All of these abnormalities increased the risk of type 2 diabetes, hypertension and cardiovascular disease.

In this study, it was evident that the majority of the women (40.8%; n=51) had a high BMI, meaning they were in the obese range, with most being stage one obese (22.4%; n=28). Of the men, 32.0% (n=8) were obese with most (24.0%; n=6) being stage one obese as well. The mean BMI for women was 29.16 and for men it was 26.81, showing that both men and women exceeded the normal BMI range of 18.5-24.99. This is backed up by a study done by Han, Tajar and Lean (2011) who stated that the rate of obesity was increasing in the elderly, bringing severe and rapidly approaching afflictions of bad health related to increased body weight and fat and being the main result of poor diet and inactivity. Sarcopenia, (an increase in body fat but decrease of muscle mass and functional capacity) was often hidden in older people who were overweight and obese and had a fixed BMI and this was aggravated by inactivity. There were many consequences of a person being overweight and obese; these included type 2 diabetes mellitus, arthritis, urinary incontinence and depression and these consequences were particularly challenging for elderly individuals (Han, Tajar and Lean 2011).

In this study, the effects of having a high WC were seen more in the women than in the men. The majority of the men (68.0%; n=17) showed fat distribution within the recommended cut-off point (≤102 cm) and only 32.0% (n=8) of the men exceeded the cut-off of 102cm. The majority of the women (77.6%; n=97) were not within the WC cut-off point (≤88 cm) and 22.4% (n=28) were within the cut-off point. The mean WC for the women was 99.01cm. This shows that they were at a higher risk of hypertension. The mean waist circumference was 99.01 cm for the men and 100.54 cm for the women, showing that both men and women far exceeded the cut-off points.

Furthermore, a study conducted by Tyagi and Kapoor (2010) on 289 urban women aged 20-80 living in Delhi, India reported a link between BMI and blood pressure, which indicated that there was a higher risk of hypertension with an increase in waist adiposity among the elderly females and which was also shown in the current study where 40% (n=10) of the men and 28.0% (n=35) of the women were pre-hypertensive with a systolic blood pressure reading

between 120-139 mmHg and a diastolic blood pressure (BP) reading of between 80-89 mmHg. Of the study group, 4.0% (n=1) of the men and 9.6% (n=12) of the women were at stage 2 hypertension (greater than 160 mmHg over 100 mmHg). According to the National Institute on Ageing (NIA) (2018), as a person gets older, there is a greater risk of high blood pressure. Before the age of 55, men have a greater chance of having high blood pressure than women. However, once a woman has been through menopause, the risk of having high blood pressure is greater.

A further discovery from the results indicated that a large number of the elderly (56.0%; n=84) were doing moderate physical activity, such as going for walks, playing bowls or gardening, which could therefore have had a direct impact on their obesity levels. Physical activity levels were not measured; they were self-reported after examples of each were given.

According to NIA (2018), high blood pressure was a common occurrence in older people. As a person aged, there were changes to the vascular system. These changes included stiffening of the arteries, which could lead to elevated blood pressure. There were lifestyle changes that could be made in order to control blood pressure:

- Keeping a healthy weight. Being overweight increases the risk of high blood pressure.
- Doing moderate exercise for 30 minutes per day can lower the risk of high blood pressure.
- Healthy eating. A diet rich in fruits, vegetables, whole grains and low-fat dairy products may also reduce the risk of high BP.
- Cutting down salt intake. As a person gets older, the body and blood pressure become more sensitive to salt. Most salt is consumed through processed foods (for example, soup, spices, stock cubes or baked goods).
- Drinking less alcohol. Men should refrain from having more than two drinks a day and women no more than one drink a day to lower their risk of high blood pressure.
- Not smoking. Smoking increases the risk for high blood pressure, heart disease, stroke and other health problems.
- Getting a good night's sleep.
- Managing stress. Relaxing and coping with problems can help lower high blood pressure (NIA 2018).

According to Tyrovolas, Psaltopoulou, Pounis, Papairakleous, Bountziouka, Zeimbekis, Gotsis, Antonopoulou, Metallinos, Polychronopoulos, Lionis and Panagiotakos (2010), increasing carbohydrate consumption by 1.0% could reduce the risk of having central obesity by 12.0% while a 1.0% increase in carbohydrate and protein consumption was associated with

a 14.0% and 16.0% lower likelihood of being obese, respectively. Vegetable protein consumption was found to be associated with a 15% lower risk of being obese. However, only low glycaemic index (GI), carbohydrates seemed to be associated with a 6.0% lower risk of having central obesity. In this study, a limitation of under-reporting could be due to the poor memory of the elderly.

The results indicated a mineral deficiency intake of calcium as seen in the men of 616.75 mg (SD ± 409.27) and in the women of 499.35 mg (SD ± 254.94) compared to the recommended DRI which was 1200 mg for both men and women. Ninety-two percent (n=23) of the men and 99.2% (n=124) of the women were consuming less than 100.0% of the DRI, meaning there was a major deficiency in calcium. This was unexpected, as many calcium rich foods appeared in the top twenty foods recorded, such as milk and yoghurt, which were commonly known as high sources of calcium (Fukagawa 2015).

A study of a group of 30 women in South Africa showed that calcium and vitamin D were recorded as being far below the recommended DRIs, even though milk appeared within the top ten food items consumed (Mchiza, Steyn, Hill, Kruger, Schonfeldt, Nel, and Wentzel-Viljoen 2015). This was evident in this study, with 100.0% of the men and 97.6% of the women consuming below the recommended DRIs for vitamin D as well as 92.0% of the men and 99.2% of the women consuming less than the DRI for calcium. In the study conducted by Mchiza, Steyn, Hill, Kruger, Schonfeldt, Nel, and Wentzel-Viljoen (2015), they looked at dietary preferences of South African women and identified sugar, tea, maize porridge, oil and bread to be the top 20 food items consumed. These findings were also evident in this study with bread, tea and sugar all being within the top 20 foods for both men and women.

Furthermore, a study done on 726 elderly in Switzerland, ranging from 50 to 81 years old showed that the participants consumed 2.6 portions of dairy products per day, compared to the recommended three to four portions a day (Chollet, Gille, Piccinali, Bütikofer, Schmid, Stoffers, Altintzoglou and Walther 2014). Holick (2006) stated that when there was an absence of sufficient dietary calcium, vitamin D would mobilise the calcium and phosphorous stored in the skeleton to ensure that the serum levels were maintained but at the expense of bone health.

This study showed the overall diet quality of the elderly, which was measured according to the food patterns, the FVS and the DDS as indicators of dietary adequacy in relation to the nutritional status of the elderly living in this elderly residential facility. It was seen that the

main source of carbohydrates consumed was bread coming in at the 4th most consumed food for both men and the 3rd most consumed for women in this group. Other possible sources of carbohydrate, although contributing much smaller amounts, may have come from the other top 20 food items being potatoes, oats and cereals. However, in terms of the amount consumed per item and the frequency at which each item was eaten, the foods were found to be consumed in very small and even inadequate amounts, which contributed to an overall low energy intake. Sugar (13.53 g mean per frequency consumed by the men and 14.23 g mean per frequency consumed by the women) was the second most frequently eaten food. This all contributed to a high sugar intake mean. WHO (2015b) stated that a person should consume no more than 25 g (6 tsp) of sugar per day.

In this study the elderly were found to have a good variety of fruit and vegetable intake. A mean ± SD of 46.08 (± 16.615) for the women and ± SD of 48 (± 12.11) for the men was observed for all the food consumed from all the food groups over a period of seven days, which indicated a high food variety score (high variety score >60 individual foods). The FGDS further illustrated a high FGDS (6-9 food groups) thus indicating a good food variety. This was also reflected in the FVS and both a good FVS and FGDS are needed for dietary adequacy. This community was therefore exposed to a good food group variety, good food portion size and optimal dietary diversity.

The percentage of energy distribution of the micronutrients from the two 24-Hour recalls for both the men and the women in this community were within the WHO goals, except for carbohydrates and fibre, which were below the goal (WHO 2003). The EER for energy in this group was recommended at 12 881kJ for men and 10 093kJ for women. All the men (6790.11kJ) and the women (5085.77kJ) consumed less than the EER for energy. A study conducted amongst 270 elderly in Umlazi KZN by Mkhize (2011) illustrated similar findings in the Top 20 food items. This confirmed the findings by Townsend (2006) that there could be obesity and hunger within the same household, especially in low-income households.

The results in this chapter showed that the majority of participants were on chronic medication (84.7% n=127) (refer to Table 4.15). Other studies have shown that there were factors that prevented the elderly from having easy access to health care (Help Age International 2006). Other reasons for lack of health care included poor access to transport, a lack of knowledge of their right to health care, physical disability, the trauma of standing in long queues for long periods of time and the issue of geographical limitations.

4.5 CONCLUSION

The results of the study were presented to assist with identifying the several nutrition-related problems that the elderly face. The majority of the participants earned between R1501-R3000 per month and therefore had enough money for food, with 44.0% (n=66) spending between R501-R1000 on food per month. However, most of the participants did not spend enough money on nutritious food. It was mainly just food to survive and they were not too concerned about their nutrition status. Therefore, it could be seen that poverty could lead to food insecurity within this community.

Both the FGDS and FVS were good and most of the participants enjoyed a variety of food from the different food groups. The poor health status among the elderly could be seen by the increased BMI, hypertension and waist circumference. It could be concluded that this elderly community consumed a wide variety of food but their poor lifestyle choices and overall lack of physical activity could be seen to be significantly contributing to the high percentage of this group of the elderly who were micronutrient deficient and who were not meeting the daily recommended intakes for energy, dietary fibre, calcium, magnesium, selenium, iodine, folate, vitamin C, vitamin D, vitamin E and vitamin K to live a healthy lifestyle.

Further conclusions that reinforce the results in this chapter will be discussed in chapter 5 along with recommendations for tackling these issues.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The objective of this study, was to determine the socio-demographic profile of the participants; to determine the anthropometric status of the participants; to determine the participants' dietary intake; to determine the variety of food intake of the participants; to determine the health and behavioural patterns of the participants; to determine what the relationship was between the actual food intake and food group diversity and the nutritional status of the participants.

This chapter presents the main aim of the study, the limitations, the main findings, the conclusions and recommendations based on the analysis of the data. In chapter four, the results of the study were presented and discussed and selected literature in relation to the objective of this study was reviewed. As global food prices have risen over the past few years, so have the global climate, population structure, income growth and dietary habits. All these factors have an impact on the levels of poverty, which lead to food insecurity, and the health and nutrition status of individuals, and most of the time it affects vulnerable groups such as women, children and elderly people. As the population of Africa ages, elderly people face increased isolation, poverty and limited access to health services and legal protection.

The aim of this study was to examine the relationship between the actual food intake and food group diversity on the nutritional and health status of white elderly residents in an elderly residential facility within the Durban area, with the additional objective of identifying the socio-demographic status of the residents. The residential facility accommodated all races but this study was limited to the white residents who made up the majority in the residential facility. The interpreted results of this study could be used to formulate practical recommendations for a sustainable and reliable intervention strategy to improve the food security and nutrition status of the elderly population in the elderly residential facility.

5.2 MAIN FINDINGS

The literature in this study clearly illustrates that the world's population is increasingly ageing because of the decline in the mortality rate and an increase in life expectancy. The elderly population is increasing in developed countries but even more so in developing countries, especially in rural areas. However, poverty is a major threat to many of the elderly due to low income and insufficient pension and leads to poor health and malnourishment. Progressive ageing increases the vulnerability of an elderly person to chronic health problems and in most

cases the elderly population is faced with multi-morbidity (the presence of multiple diseases in an individual at the same time). Multi-morbidity accelerates the development of concurrent diseases, reduces quality of life and increases the risk of disability and death. Unemployment leads to financial instability as a result of insufficient welfare assistance from the government and in turn this leads to low food security and poor health. By improving the household food security of the elderly, household stability can be improved. It is evident that the nutritional and social needs of elderly people need to be addressed through policies and development programmes. Malnutrition continues to be a global problem affecting the elderly in their compromised lifestyle due to their physical, psychological and socio-economic status. Literature has also indicated that there is very little data available on the South African elderly, specifically on their nutritional and health status. Although South Africa is one of the few countries in Africa that provides social grants to this population group, it is evident that this initiative alone is not enough to overcome the burden placed on elderly people within the South African society.

5.2.1 SOCIO-DEMOGRAPHIC FACTORS

Significant socio-demographic variables that were identified in the present study were gender, age and socio-economic status. The women (83.3%, n=125) formed a larger percentage of the sample population compared to the men (17.7%, n=25). The majority of the participants (35.3%, n=53) earned between R2000 and R3000 per month. Of all the participants, 93.3% (n=140) were unemployed. Therefore, the participants only earned a pension or received money from family. Many of the participants were always able to buy food every month. The majority of the participants (80.0%, n=120) never ran out of money to buy food. The majority (44.0% n=66) of participants spent between R200-R300 on food every month; this could indicate that the majority of participants were prone to food insecurity. The highest level of education attained by 48.7% (n=73) of the participants was either a standard 8, or grade 10, qualification, which could be a contributing factor to their general poor nutrition knowledge and which has implications for the nutrient intake of this group.

5.2.2 ANTHROPOMETRIC INDICATORS

The results of this study indicated that even though a substantial number (35.3%, n=53) of the participants were of normal weight (BMI of between 18.5-24.99), the majority (39.3%, n=59) were obese (BMI >30) and this was mostly seen in the female participants (34.0%, n=51).

5.2.3 HEALTH AND BEHAVIOURAL SURVEY

The results from this survey showed that the majority of the participants stated having problems involving the sensory organs (49.3%) and the skeleton (47.3%), while fewer (29.3%) participants cited heart or circulation problems. Many of them (42.6%) reported suffering from other illnesses such as diabetes, high cholesterol and high blood pressure. The use of cigarettes was not very high and some participants had never smoked. The majority of the participants (56.0%) had a moderate activity level and activities included going for a walk, playing bowls or gardening.

5.2.4 DIETARY INTAKE AND NUTRIENT ADEQUACY

The results of this survey showed the total variety of individual foods consumed by all the participants over a seven-day period and the results indicated that the participants consumed a variety of foods but not in sufficient amounts needed to meet the daily recommended requirements. The results showed a high consumption of cereal-based foods. Meat consumption was high. Vegetarian participants substituted the meat with legumes and soy products. The fruit and vegetable consumption was relatively high but not high enough to meet the recommendations for this age group. A high consumption of dairy products was observed which was needed for this age group due to weakening bones and the risk of osteoporosis.

Participants did not consume too many energy-dense or sugary foods on a regular basis. As per the top 20 food items consumed, biscuits and sugar appeared in the list. The men consumed 4.53 g of biscuits per person per day and the women consumed 3.81 g per person per day. The men consumed 14.23 g of sugar per person per day and the women consumed 13.53 g per person per day. The energy intake of the group was below the DRI, with 96.0% of the men and 100.0% of the women being below the recommended amount.

The study confirmed that due to a lower income and with many of the participants receiving only the old-age grant, the variety of nutritious foods was lower than it should have been. Participants ate more cereal-based foods. This may be due to the fact that the residents received free bread from the facility every few days and this suggested that the residents consumed the bread as it was free and readily available.

From the 24-Hour recall, the extrapolated NAR confirmed the findings of the FFQ and DDS. The 24-Hour recall is a simple tool used to identify the risk of food insecurity and nutritional insecurity and the potential effects on health. The results assisted in a nutritional assessment,

which will enable food and nutrition interventions in other communities that are found to be food insecure. It was found that the residents in this study were not food insecure.

5.3 CONCLUSION

This study has found that in the households researched, there were many participants that cannot be classified as poor. The majority of the participants lived a comfortable life, with access to a variety of food, having support at the residential facility, having amenities (bed, fridge, oven and more) and were financially stable. Some participants had other sources of income, so were not solely reliant on the government pension. The participants that relied solely on their pension struggled financially. Many participants did not spend much of their income on food. Many of them did not find it necessary to spend any more on food and in particular, healthy foods such as more fruit and vegetables, low GI carbohydrates, lean meat, nuts and seeds and healthier fats, like olive or avocado oil. This mindset could be linked to the increase in malnutrition and, in particular, overnutrition as many of the participants were found to be overweight or obese.

5.4 RECOMMENDATIONS

The elderly constitute a large proportion of the population. Many face poverty, neglect, inadequate health care and lack of medical aid. The high prevalence of inadequate nutrient intake amongst the participants showed the need for effective and wide-reaching nutrition strategies aimed at improving nutrient intake.

5.4.1 RECOMMENDATIONS TO POLICY MAKERS

- **Government initiatives**

  The steps taken by government to financially assist the elderly population through old-age grants has been well received. However, pensions for the elderly should be reviewed by government as the funds are totally inadequate to meet the daily requirements of the elderly. More attention should also be given to the proper administration of the pensions received by the elderly. Consistent monitoring should be done by senior authorities in charge of community-based nutrition programmes to ensure these programmes are properly implemented by the authorities and that the elderly benefit from them. Appropriate government interventions should therefore be aimed at improving the health status of the elderly, which would lead to a healthier elderly community.

- **Integrated Nutrition Programme (INP)**

There are various nutritional programmes available to assist the elderly which are not as effective as planned, and community-based nutritional strategies should be better co-ordinated when implemented by local government or NGOs. It is of the utmost importance that the INP co-ordinators acknowledge the elderly when establishing nutrition strategies to eradicate malnutrition, both over- as well as undernutrition, and this will result in improved physical and cognitive functional ability in this age group. In addition, nutrition education, food fortification and supplementation strategies are needed in the elderly care facilities to improve nutrient adequacy for the elderly. This could be done on a regular basis by nutritionists and other health professionals taking the time to educate the elderly to make informed healthy food decisions.

5.4.2 RECOMMENDATIONS FOR THE COMMUNITY

Kimokoti and Hamer (2008) suggested that household diversification was necessary. Ireland (2011) highlighted the benefits of having fresh vegetables in the diet which provided more nutrients than canned or frozen vegetables. The WHO (2004b) stated that vegetable gardening was a good activity for the elderly, due to the fact that tending to the garden promoted physical activity without over-exertion, coupled with mental stimulation and being able to enjoy the fresh air outdoors. Growing plants produced calming chemicals in the body, which could assist in keeping blood pressure down, and it would also add another dimension to the activities of the elderly (Ireland, 2011 and WHO, 2004b). By encouraging the elderly to practise planting vegetables in a small area or in containers at the facility or other place of residence, their activity levels would be enhanced and they would be provided with essential nutrients (WHO, 2004b).

5.4.3 RECOMMENDATIONS FOR NUTRITION EDUCATION

- **Nutrition education**

  A study conducted by Bernstein, Tucker, Ryan, O'Neill, Clements, Nelson, Evans and Singh (2002) showed how important nutrition education programmes for the elderly were. Dietary diversity should be included in the diet to minimise nutritional problems and related diseases. Nutrition education was necessary in order to educate the elderly to modify their food procurement and meal patterns and preparation to focus on the common issue of micronutrient deficiencies. However, the community would also benefit from an adequate nutrition education programme by being assisted to make informed nutritious food choices and improve their dietary patterns, food habits, food

preparation and meal planning skills while having to contend with a limited household budget. The problem of nutrition fell into two categories. The first category was the result of an insufficient intake that did not meet their nutritional needs and the second category was the result of an excessive and unbalanced intake of food or any specific dietary component. The majority of people in Africa fall under category one. That is why it is necessary to educate people from a young age so that by the time they reach old age, the elderly are adequately informed about what foods and nutrients are required for their continued good health and they will then be able to make the necessary adjustments.

- **Increasing physical activity levels**

  Hallaj, Geneidy, Mitwally and Ibrahim (2010) indicated that when the elderly pursued a physically active lifestyle, it significantly delayed age-related risk factors associated with cardiovascular disease, respiratory control, high blood pressure and type 2 diabetes and helped to maintain weight and musculoskeletal functions and also delayed many of the physical and psychological problems that commonly occurred with ageing. It was therefore important to encourage physical activity. In addition, stimulating social interaction was a key aspect in assisting the elderly to enjoy a positive quality of life. Many (67.2%, n=84) of the elderly in this study indicated that they only participated in moderate physical activity: this was gardening, walking or playing bowls. Ideally, an exercise programme should be developed for the elderly at the facility so that they could participate every day, preferably in the morning. Suggested activities are yoga, some form of aerobics adapted for the elderly, keep fit or stretching classes or even just guided social walks around the residential facility's grounds. A sedentary lifestyle should be avoided at all costs.

5.4.4 RECOMMENDATIONS FOR FUTURE RESEARCH

The results of the research study indicate that further research is needed as follows:

- More research needs to be done on the elderly in order to prevent malnutrition in the future. For example, dietary guidelines could be put in place as a model for them to follow in order to live a healthy life and nutrition education could be provided to educate elderly people about the ideal foods to eat and to inform them about healthier options. More emphasis needs to be placed on this age group and more assistance needs to be given.

- This study highlighted the need for nutrition interventions to prevent the development of risk factors and empower the elderly community to change their current food choices when purchasing food and adopt healthier food preparation methods to address the increased prevalence of lifestyle disease and micronutrient deficiencies.
- There is a need for further multi-racial studies on the elderly.
- Future studies on fast food, or takeaway, consumption in the elderly should be undertaken as these meals could potentially be consumed due to their ready availability.
- Future studies on the consumption of sweets and sugary-rich foods and drinks by the elderly should be undertaken.
- Future studies investigating the consumption of energy-dense foods consumed by the elderly should be undertaken.
- There is a need to investigate micronutrient malnutrition in the elderly, especially with regard to gender differences in nutrient intakes and deficiencies.
- There is a need to identify the link between obesity and diet since, due to overnutrition, the majority of the elderly in the community studied experienced lifestyle diseases that compromise longevity. Feasible effective strategies need to be implemented in order to improve the diet of the elderly in the community.
- Making nutritious dietary supplements more affordable, to add to the daily dietary requirements of the elderly should be further investigated to ensure residents are getting the necessary daily nutrients.
- There is a need to establish a relationship between cooking techniques and an increased BMI and then promoting an awareness programme promoting healthy cooking methods.
- There is a need for the elderly to acknowledge the need for dietary diversity and food variety and increase fruit and vegetable portion sizes in a nutrition education programme designed to improve overall diet content since the elderly did not meet the World Health Organisation goals for fruit and vegetable intake of >400 g.
- The association between socio-economic status, food intake patterns and overweight status of the elderly needs to be established together with any suitable interventions required to improve overall dietary intake patterns.
- Support from the general community is required to improve the nutrition status of the elderly.

5.5 LIMITATIONS OF THE STUDY

- The first limitation was that the study was seen by some residents as racially biased and they refused to participate in a study that only focused on one race group.

- The second limitation was that the administration of the questionnaires ended up being quite time-consuming for the residents. Many of the residents also wanted to have private conversations with fieldworkers during the data collection process, which delayed the process. This could have been due to loneliness. The researcher did take some time to engage with some of the residents when there was spare time.

- The third limitation was time constraints. This was due to the fact many residents relied on transport to get to and from the shops or had prior appointments that they had to keep.

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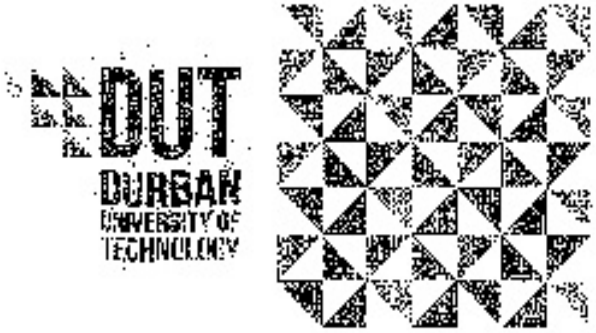
ANNEXURE A: Ethics clearance letter from the Institutional Research Ethics Committee (IRECC), Durban University of Technology



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29 July 2014

Ms S D Bodin
17 The Curl
Sunningdale
Durban

Dear Ms Bodin

ACKNOWLEDGEMENT OF RECEIPT OF APPLICATION FOR ETHICAL APPROVAL

Title: Food intake patterns and nutritional status of free living white elderly in an elderly residential facility in Morningside, Durban
Reference Number: REC 48/14

The Institutional Research Ethics Committee wish to acknowledge receipt of your research proposal received on 29 July 2014 which is to be reviewed via the expedited process.

A reference number has been assigned to your proposal. You are required to quote this number for all queries relating to the study.

Yours Sincerely

Prof J K Adam
Chairperson: IREC

ANNEXURE B: Permission letter from the chief executive officer of the chosen residential facility

19 February 2014

Miss. Shenaye Bodin
Durban University of Technology
Department of Consumer Science: Food and Nutrition
Durban

RE: PERMISSION FOR MASTERS STUDY (M.Tech) A
ASSOCIATION FOR THE AGED COMPLEXES - A
S

Permission is granted to Miss. Shenaye Bodin to use the residents of
as for her research sample in her Masters studies.

Miss. Bodin will pick 205 white residents from these complexes who prepare their own food to fill in 4 different questionnaires regarding their knowledge of food and nutrition, and what they consume on a daily basis. The study will take place over a few days.

We accept the facts that:

- For the residents the study is not compulsory (they have the right to choose to be part of the study), but on acceptance need to sign a consent form;
- That the study is confidential;
- The participating residents will be weighed and measured at the start of the study;
- The blood pressure of the participating residents taken at the start of the study;
- The participating residents need to answer questions on the questionnaires regarding what they eat, how often they eat, and other socio-demographical information (for example: how they live, their age);
- The residents be handled with respect and dignity; and
- This study will not demand any monetary compensation from the Association or the residents.

ANNEXURE C: Letter of information and consent form for the residents

DUT DURBAN UNIVERSITY OF TECHNOLOGY

LETTER OF INFORMATION

Dear R n resident

Thank you for allowing me to explain to you my research study for your consideration

The title of my study is "The effect of actual food intake and food group diversity on the nutritional status of white elderly in Durban"

Principal Investigator/s/researcher:

I Shenaye Bodin, (B. Tech: Consumer Sciences Food and Nutrition) will be the main researcher and I am supervised by Professor Carin Napier (D Tech Food Service Management).

It is important to do this study because many South Africans are food insecure and do not have sufficient nutrition knowledge to make informed decisions about healthy eating. A poor diet, lacking the right amounts of essential vitamins and minerals, could lead to malnutrition. Overtime this could be detrimental to a person's health and can cause many diseases.

It is important that the Government can assist the people in making right eating choices and helping the people obtain healthy foods.

This research aims to investigate food security status, nutritional status, food consumption patterns and nutrition knowledge of the community. We need 205residents from to be included in this study. This will help in the development of guidelines to educate your community in bettering food security and habits.

What will it involve?

- Ethical clearance was obtained from DUT.
- I will need you to sign a consent form to indicate that you agree to participate in the study after I explained all the procedures to you.
- If you agree you will be asked to complete 4 questionnaires in an interview situation it could take up to 1 hour.
  The questionnaires will include:
- Food security coping strategies
- A Socio- demographic questionnaire
- Three 24-hour food recall questionnaires.
- A Food Frequency Questionnaire to determine the food variety and dietary diversity.
- We will also weigh you and measure your height and weight at your home at an agreed time, we will not ask you to remove your clothing except for shoes and jerseys.
- Participation is voluntary and you can withdraw at any time with no penalty.

ANNEXURE C: Letter of information and consent form for the residents continued

You will not feel any discomfort. All measurements and weighing will be done at the clinic and in your own home. You will be asked to remove shoes and jackets and jerseys only and you will not have to undress.

The rresults of the study will be shared with DUT and [redacted] community after the study has been concluded but your name will not be mentioned, with the hope that interventions can be planned in the community for any identified problems. If you have any personal nutrition questions or concerns we are prepared to come back to you after the data collection to assist you.

Please note the following:

- Participation is voluntary and you can withdraw at any time with no penalty.
- No pay will be given to any of the participants.
- It won't cost you anything to participate in this study.
- You will be given a participant number so no names will be used in the study.

Research-related injury:

No injuries are expected in this study

For any questions or concerns please feel free to contact my supervisor or our Ethics committee

Your participation will be greatly appreciated and thank you for allowing us to explain this study to you.

Kind regards

Shenaye Bodin

Persons to Contact in the Event of Any Problems or Queries:
Supervisor: Prof. Carin Napier
Researcher: Shenaye Bodin 083 659 8070
Supervisor contact: 031 373 2326 carinn@dut.ac.za
The Institutional Research Ethics administrator: 031 373 2900.
Complaints can be reported to the DVC: TIP, Prof F. Otieno on 031 373 2382 or dvctip@dut.ac.za.

ANNEXURE C: Letter of information and consent form for the residents continued

INSTITUTIONAL RESEARCH ETHICS COMMITTEE (IREC)
CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, _____ (name of researcher), about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _____,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature / Right Thumbprint**

I, _____ (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____	_____	_____
Full Name of Researcher	**Date**	**Signature**
_____	_____	_____
Full Name of Witness (If applicable)	**Date**	**Signature**
_____	_____	_____
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

ANNEXURE D: Socio-demographic questionnaire

Food and Nutrition Consumer Sciences

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

This questionnaire covers certain aspects of your life, including work and personal details, health and illness, lifestyle and social life that is relevant to health. The answers to these questions will be kept strictly confidential and the information will not be identifiable on any reports or publications.

1. GENERAL INFORMATION

Participant number:……..……. Date: ……

Fieldworker name: ……

Please answer all questions by marking the correct answer with **X,** except where otherwise indicated.

Where do you live?

.....

2. PERSONAL INFORMATION

2.1 Your role in the family

Mother	Grandmother	Father	Grandfather	Other, specify……..

2.2 When were you born? Year: Month: Day:

2.3 How old are you? years

2.4 Gender:

Male	Female

ANNEXURE D: Socio-demographic questionnaire continued

3. ACCOMMODATION AND FAMILY COMPOSITION

3.1 Do you live in?

Town/City	Farm	Squatter camp	Rural village	Hostel	Township	Other, specify……...

3.2 How are you currently living?

Homeless	
Living with relatives	
Living with friends	
Hostel accommodation	
Squatter home	
Rented house/flat	
Own house/flat	
Employees Properties	
Other, specify…….	

3.3 Do other people live in the house with you?

Yes	No

3.4 How many people are permanent residents living in the house with you? (Only if these people eat and sleep in this house at least 4 days a week?)

1	2	3	4	5	6	7	8	9	10	10+

3.5 How long have you been staying permanent in this house?

< 1 year	1-5 years	>5 years

3.6 In what type of house are you staying?

Brick	Clay	Grass	Wood	Zinc/shack

3.7 How many rooms does your house have?

1 room	2 rooms	3 rooms	4 room	>5 rooms

3.8 Are there other houses/shacks within the same yard of the main house?

Yes	No

ANNEXURE D: Socio-demographic questionnaire continued

3.9 Do you have the following facilities/ services at home?
3.9.1 Water

Tap in the house	
Tap outside the house (in yard)	
Borehole	
Spring / river / dam water	
Fetch water from elsewhere	

3.9.2 Toilet facilities

None	
Pit latrine	
Flush / sewage	
Bucket system	
Other, specify…….	

3.9.3	Waste removal	Yes	No
3.9.4	Tarred road in front of house	Yes	No
3.9.5	Gravel road in front of house	Yes	No
3.9.6	Access to electricity	Yes	No

3.10 To what extent do you have problems with the state of your house (e.g. size, repairs, damp, etc.)?

……

3.11 Do you have problems with the following?

Mice/ Rats	
Cockroaches	
Ants	
Flees	
Mosquitoes	
Geckos	
Frogs	
Snakes	
Bed Bugs	

3.12. What is the floor inside your house made of?

Cement	
Tiles	
Carpet	
Dirt	
Sand/mud	
Dung	
Other, please state	

ANNEXURE D: Socio-demographic questionnaire continued

4. WORK STATUS AND INCOME

4.1. Are you currently employed?

Yes	No

If YES, go to Question 4.5.

4.2. If NO, how would you describe your current status (tick one box only)?

Unemployed	Retired	Housewife	Student	Other, specify……

4.3. Are you actively looking for paid employment at the moment?

Yes	No

4.4. How long have you been unemployed?

< 6 months	6-12 months	1-3 years	> 3 years

4.5. If YES (question 4.1) is your current job a:

Permanent position	Temporary position	Fixed term contract	Other, specify……..

4.6. Are you doing part time jobs as a second job on weekends and school vacations?

Yes	No

4.7 What is the exact title of your current job?
(Including self-employed)

4.8. What is the total income in the household per month?

R0- R500	R501-R1000	R1001-R1500	R1501-R2000	R2001-R2500	R2501-R3000
R3001-R3500	R3501-R4000	R4001-R4500	R4501-R5000	R5001-R6000	R6001- R7000
R7001- R8000	R8001- R9000	R9001- R10 000	>R10 000		

4.9. Please specify the monthly income in the household (if willing)……..

4.10 Do you receive any of the South African Government social grants?

Old age grant	Child grant	Disability grant	Foster grant

ANNEXURE D: Socio-demographic questionnaire continued

4.11. How often does it happen that you do not have enough money to buy food? for you and your family?

Always	Often	Sometimes	Seldom	Never

4.12. How many people e.g. partner, relatives & others (including yourself) contributed to your household income from any source, (including wages/salary from paid employment, money from second or odd jobs income from savings investments, pension, rent or property, benefits and or maintenance etc.) in the last 12 months?

People	0	1	2	3	4	5	6	7	8	9

4.13. How often do you buy food?

Every day	Once a week	Once a month	Other, specify……

4.14. Where do you buy food?

Tuck shop	Street vendor	Wholesalers	Supermarket	Other, specify……

4.15 What type of transport do you use to get around?

Taxi	
Bus	
Train	
Own car	
Bicycle/ Motorbike	
Other Specify	

4.16 How much money is spent on food PER MONTH? (Tick only one box)

R 0 – R 200	R 201 – R 300	R 301 – R 400	R 401 – R 500	R 501 – R 600	R 601 – R 700	R 701-R800	R801-1000
R1001-R1200	R1201-R1400	R1401-R1600	R1601-R1800	R1801-R2000	>R2001		

5 EDUCATION AND LANGUAGE

5.1 What is your highest education level?

None	Primary School	Standard 8	Standard 10	College/FET	Other post school

ANNEXURE D: Socio-demographic questionnaire continued

5.2 What language is spoken mostly in the house?

Zulu	Xhosa	English	Afrikaans	Other, specify……

5.3 How many children (in the household) have birth certificates?

None	1	2	3	4	5	6	7	8	All

5.4 How many children have completed their immunisation schedule?

None	1	2	3	4	5	6	7	8	All

5.5 Has any children in your household died in the past?

Yes	No

Reason: ……..

5.6 Number of children attending school

None	1	2	3	4	5	6	7	8	All

5.7 How do the children get to school?

Walk	Bus	Taxi	Parents car	Other, specify…….

Food practices in the household

Tick one block for every question:	Father	Mother	Sibling	Grandma	Grandpa	Aunt	Uncle	Cousin	Friend	Other
5.8 Who is mainly responsible for food preparation in the house?										
5.9 Who decides on what type of food is bought for the household?										
5.10 Who is mainly responsible for feeding/serving the children?										
5.11 Who is the head of this household?										
5.12 Who decides how much is spent on food?										

ANNEXURE D: Socio-demographic questionnaire continued

5.13 How many meals do you eat per day?

0	1	2	3	> 3

5.14 Where do you eat most of your meals?

Home	Friends	Work	School	Other, specify…….

5.15 Where do your children eat most of their meals?

Home	Friends	School	Other, specify…….

6. ASSETS

6.1 Does your home have the following items and how many?

	Yes
Electrical stove	
Gas stove	
Primus or paraffin stove	
Microwave	
Hot plate	
Radio	
Television	
Refrigerator	
Freezer	
Telephone/ Cell phone	
Bed with mattress	
Mattress only	
Lounge suite	
Dining room suite	
Electrical iron	
Electrical, kettle	
Car	
Bicycle	
Motorbike	

6.2 What type of fuel do you usually use for food preparation?

Wood fire	Paraffin	Electricity	Gas	Coal/Charcoal	Other, specify……

6.3 What type/s of material are your pots made off (tick all relevant options)?

Cast iron	Aluminium	Stainless steel	Clay	Other, specify……

Thank you very much for your co-operation. We appreciate the time.

ANNEXURE E: 24-Hour recall questionnaire

24 – HOUR RECALL

Subject number: _____ Interviewer: _____

Date: _____ / _____ / 20___

Tick what the day was yesterday:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

Would you describe the food that you ate yesterday as typical of your habitual food intake?

Yes	1	No	2

If not, why? _____

I want to find out about everything you ate or drank yesterday, including food you pick from the veld. Please tell me everything you ate from the time you woke up to the time you went to sleep. I will also ask you where you ate the food and how much you ate.

Time (approximately)	Place (Home, school, etc)	Description of food and preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
From waking up to going to work, or starting day's activities					
During the morning at work or at home					

ANNEXURE E: 24-Hour recall questionnaire continued

Time (approximately	Place (Home, school, etc)	Description of food and Preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
Middle of the day (Lunch time)					
During the afternoon					
At night (dinner time)					

ANNEXURE E: 24-Hour recall questionnaire continued

Time (approximately	Place (Home, school, etc)	Description of food and preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
After dinner, before going to sleep					

* Do you take any vitamins or supplements (tablets or syrup)	Yes	1	No	2
Folate				
Iron				
Other				
Give the brand name and dose of the vitamins/tonic:				

ANNEXURE F: Food frequency questionnaire

FOOD AND NUTRITION CONSUMER SCIENCES

FFQ LIST OF FOODS AND FOOD GROUPS DIVERSITY

Subject number: _____ Interviewer: _____

Date: _____

PLEASE INDICATE THE FOOD YOU ATE DURING THE PAST SEVEN (7) DAYS BY AN (X)

GROUP 1: Flesh Foods (Meat, Poultry, Fish) Diversity	Y	N
Meat (Chicken)		
Meat (Beef)		
Meat (Mutton)		
Meat (Pork)		
Dried Meat (Biltong)		
All Mince		
All Tripe/Offals/Runners and Heads		
Fish (fresh / whole)		
Tinned Fish (Pilchards/Tuna)		
Processed Meats (Viennas / Polony, Russians, Boerewors Sausage)		
Seafood (Prawns, Mussel's, Calamari, Crab, Shrimp, Crayfish)		
GROUP 2: Eggs Diversity	**Y**	**N**
Eggs		
GROUP 3: Dairy Products Diversity	**Y**	**N**
All Milk		
Evaporated milk (Unsweetened)		
Condensed milk		
Maas/ Inkomasi		
All Cheese		
Custard		
Ice Cream		
Yogurt		
Buttermilk		
GROUP 4: Cereals, Roots and Tubers Diversity	**Y**	**N**
All Rice		
Maize (Pap, Mealie Rice, Mealie Meal, Samp, Porridge, Corn on the cob, Popcorn, Sweet Corn)		
Macaroni/Pasta/Spaghetti		
All Bread (White/ Brown/ Whole Wheat)		
Dumpling/Steamed Bread/Fat Koek		

ANNEXURE F: Food frequency questionnaire continued

Scones/Biscuits		
Breakfast Cereals (Corn Flakes, Oats, Weet Bix, Matabela)		
All Tubers/Roots (Amadumbe, Sweet Potato)		
Potatoes		
GROUP 5: Legumes and Nuts	**Y**	**N**
All Beans dried including bean sprouts		
Dried Peas		
Lentils		
Peanuts and Nuts		
Soya		
GROUP 6: Vitamin A Rich Fruits and Vegetables Diversity	**Y**	**N**
Pumpkin		
Carrots		
Wild Leafy Vegetables Fresh and Dried – includes fresh herbs		
Spinach		
Butternut		
Apricots (Appelkoos)		
Peach (yellow cling)		
Mango		
GROUP 7: Other Fruits (and juices) Diversity	**Y**	**N**
Deciduous Fruits		
Apple		
Peaches		
Pear		
Grapes (black/green)		
Plum		
Sub – Tropical Fruit	**Y**	**N**
Lemon		
Orange		
Naartjie		
Banana		
Pineapple		
Avocado		
Watermelon		
Guava		
Paw- Paw		
GROUP 8: Other Vegetables Diversity	**Y**	**N**
Onions		
Cabbage		
Beetroot		
Tomatoes		
Green beans (fresh)		
Peas (fresh)		
Cauliflower		
Chili (red/green)		
Lettuce		

ANNEXURE F: Food frequency questionnaire continued

Green\ Yellow\ Red Pepper		
Frozen Vegetables (Mixed)		
Ginger & Garlic (Fresh)		
Gem squash		
GROUP 9: Oils and Fats Diversity	**Y**	**N**
Butter		
Sunflower oil		
Olive oil		
Margarine		
Lard (animal fat)		
Salad dressing/oil - mayonnaise		
Potato Crisps		
Coffee Creamer (Cremora, Ellis Brown)		

ANNEXURE G: Anthropometric, health, medical and behavioural questionnaire

ANTHROPOMETRIC, HEALTH, MEDICAL AND BEHAVIOURAL QUESTIONNAIRE

Section A:

Subject nr		Interviewer	
Date			

Section B:

HEALTH QUESTIONNAIRE:

ARE YOU SUFFERING OR HAVE YOU SUFFERED FROM	YES	NO	IF ANY ANSWER IS YES, GIVE DETAILS OF THE NATURE, SEVERITY AND DURATION OF ILLNESS
1. Any skin disease?			
2. Any affection of the skeleton and/or joints?			
3. Any affection of the eyes, ears, nose or teeth?			
4. Any affection of the heart or circulatory system?			
5. Any affection of the chest or respiratory system?			
6. Any affection of the digestive system?			
7. Any affection of the urinary system and/or genital organs?			
8. Any nervous affection or mental abnormality?			
9. Any headaches			
10. Any other illness?			

Would you say your usual level of physical activity is:	**Tick the correct block**
1. Heavy/ rigorous (running, playing tennis, swimming, doing heavy gardening, etc., at least three times per week)	
2. Moderate (Taking rigorous exercise once or twice a week, or steady walking, or other moderate activities at least three times per week)	
3. Light (playing golf, taking a stroll, or doing none rigorous activities occasionally)	
4. None (No exercise whatsoever)	

	YES	NO
1. Do you suffer from any defect of hearing, speech or sight?		
2. Are you physically disabled and do you use artificial limbs?		

GIVE DETAILS OF THE NATURE AND SEVERITY OF THE DISABILITY …… …… ……		

ANNEXURE G: Anthropometric, health, medical and behavioral questionnaire continued

Do you smoke at this moment?	**Tick the correct block**
1. Yes	
2. No (Never smoked	
3. No (Stopped)	

Do you make use of snuff at this moment?	**Tick the correct block**
1. Yes	
2. No (Never used)	
3. No (Stopped)	

Does you're spouse or partner smoke at this moment?	**Tick the correct block**
1. Yes	
2. No	
3. Not applicable	

	YES	**NO**
Have you undergone any operations?		
GIVE DETAILS OF THE NATURE AND DATE OF THE OPERATION/S …… …… ……		

Section C:

MEDICATION QUESTIONNAIRE:

1. Do you use any medication?	**Yes**	**No**
2. If no, go to the next block.		
3. If yes, what for/why? …… …… ……		
4. What is the name of the medication you are taking? …… …… ……		
5. What is the dosage and how often do you take this medication?. …… …… ……	**Dosage**	**How often?**

Thank you for your time

ANNEXURE H: Anthropometric measurements form

DUT DURBAN UNIVERSITY OF TECHNOLOGY

FOOD AND NUTRITION CONSUMER SCIENCES

Anthropometric Measurements

Section A:

1. Number/Name of the caregiver.....

2. Community:.....

3. Date of birth	Year	Month	Day

4. Gender	Male	Female

Section B:

1. Body weight (kg)	1. Body weight (kg)	2. Height/Length (cm)	2. Height/Length (cm)
kg	kg	cm	cm

3. Waist circumference	3. Waist Circumference	4. Blood pressure	4. Blood pressure
cm	cm	/	/

ANNEXURE I: Checklist of all the questionnaires for each file

Checklist of questionnaires

	Questionnaire	√/X
1	Information letter (given to participant?)	
2	Consent form (signed?)	
3	a) 24-Hour recall	
4	b) 24-Hour recall	
5	c) 24-Hour recall	
6	Food frequency	
7	Socio-demographic	
8	Health and behavioural	
9	Anthropometric measurements	

ANNEXURE J: Amendment to the sample size

DURBAN UNIVERSITY OF TECHNOLOGY

Institutional Research Ethics Committee
Faculty of Health Sciences
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www.dut.ac.za

23 February 2015

Ms S D Bodin
17 The Curl
Sunningdale
Durban

Dear Ms Bodin

Application for Amendment of Approved Research Proposal

Food intake patterns and nutritional status of free living white elderly in an elderly residential facility in Morningside, Durban

I am pleased to inform you that your application for amendment to the sample size of your research proposal has been Approved.

Yours Sincerely

Professor J K Adam
Chairperson: IREC

ANNEXURE K: Letter from the editor and proof reader

27 May 2019

To whom it may concern

Dissertation written by Ms Shenaye Bodin

This letter confirms that I have edited the Dissertation entitled **Food intake patterns and nutritional status of free-living white elderly in an elderly residential facility in Morningside, Durban** by Ms Shenaye Bodin for linguistic and grammatical correctness.

I am a qualified editor and proof reader.

Michael Vermeer
Editor/ Proofreader

082 093 4347

mike.vermeer3@gmail.com