ANALYSIS OF THE NUTRITIONAL STATUS AND DIETARY INTAKE DATA OF A GROUP OF ELDERLY AT A DAY AND FRAIL CARE CENTRE IN VERULAM

Submitted in fulfillment of the requirements of the degree of Master of Technology: Food and Nutrition: Consumer Science in the Department of Food and Nutrition Consumer Science Faculty of Applied Sciences at the Durban University of Technology

Theloshni Govender
BTech: Food and Beverage Management

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Supervisor: Prof. C.E. Napier
External Supervisor: Prof. W.H. Oldewage-Theron

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DEDICATION

I dedicate this dissertation to my family; especially in memory of my beloved grandparents whom have play an insightful part in my childhood and more importantly had inculcated love and appreciation towards the elderly which has become my area of interest. To my beloved parents, who have taught me that even the largest task can be accomplished if it is done one step at a time along with instilling perseverance and belief in the richness of learning.

ABSTRACT

Background: South Africa, a richly diverse developing country has been faced by the consequences of transition attributed to urbanisation and acculturation. A Westernised lifestyle has, therefore, resulted in increasing disease patterns that are characterized by a combination of poverty-related diseases together with the emerging chronic diseases. The shift to a Westernised lifestyle has resulted to a shift in the composition of dietary staples leading to dietary factors related to an increase in lifestyle diseases. These include a high fat, low fibre diet, as well as an inadequate intake of fruits and vegetables. However, this in turn has led to higher energy intakes with insufficient and imbalanced micronutrient intake.

Research conducted amongst the elderly in South Africa has clearly indicated that the elderly live within a limited financial budget leading to extreme levels of food insecurity and the social burden of being the head of the household, in addition to being the caregiver to grandchildren and sick children. Due to the current living status the elderly encounter reduced food intake in addition to a reduced variety in their diet, therefore, micronutrient deficiencies are common amongst this age group. Therefore, a consumption of energy-dense foods, particularly staple foods, to stretch the food budget which are more affordable and thus allow for an increased consumption is evident.

Aim: To determine the socio-demographic profile, health and nutritional status in relation to the dietary intake patterns to reflect malnutrition among free living elderly (60yrs+) in Verulam.

Methodology: Fifty nine randomly selected men and 191 women aged 60+ participated on a voluntary basis in this study. A descriptive survey method was used for this cross sectional study. Trained fieldworkers assisted with the administration of all questionnaires and a registered nurse measured blood pressure. Socio-demographic questionnaires were administered to determine the socio-economic characteristics of the elderly within this community. Anthropometric measurements determined the Body Mass Index according to the World Health Organisation and Asian cut-off points to indentify the risk factors. The Health questionnaire identified the health status correlated to the respondent's profundity of disease and deficiencies associated to dietary patterns. Blood pressure measurements were taken to determine the hypertension prevalence related to the dietary intake. Two 24-Hour Recall questionnaires were completed by the 250 respondents to identify actual

food intake and measured against the Dietary Recommended Intake (DRIs). A food frequency questionnaire (FFQ) determined the respondent's food variety score over a period of one week. The socio-demographic questionnaire, health questionnaire, food frequency questionnaire and anthropometric measurements were captured on an Excel® spread sheet by the researcher and analyzed for descriptive statistics using the Statistical Package for the Social Sciences (SPSS) version 17.0 with the assistance of a statistician. The 24-Hour Recall data were captured and analyzed by a nutrition professional using the MRC Food Finder® version 3.0 software, based on the South African Food Composition tables.

Results: The majority of the respondent's role in the family was mothers (70.8%) and lived in an urban area (68.8%). In addition, 73.2 percent (n=183) of the respondents shared the house with one to five people, and lived in a brick house (74.4%, n=186) with more than 3 rooms (74.0%, n=185). The elderly in this sample were pensioners and, therefore, 76.0 percent (n=190) received state grants of which the total household income ranged between R1001-R1500 (35.2%, n=88). Food insecurity is prevalent as reported by 28.4 percent. Primary school was the highest level of education completed by 52.4 percent (n=131) and English is the most spoken language amongst this group (74.0%, n=185).

Women had higher BMI values particularly in the overweight (18.32%, n=35) and obese I and II (58.6%, n=112) categories when compared with men. Blood pressure measurements indicated that 60.0 percent (n=150) of the respondents suffered from hypertension. The use of chronic medication was reported by 84.4 percent (n=212). The total range of individual food items consumed by an individual during the seven-day data collection period measured by the (FFQ) was between 4-66 foods. However, the highest consumption was four food items by 23.2 percent (n=58) of the respondents. The summary of the food variety within food groups indicated a high dietary diversity, of which the other vegetable group reported the highest individual mean FVS (±SD) of 10.86 (±5.82), followed by other fruit, cereal, flesh and Vitamin A rich groups with 5.73 (±4.41), 5.03 (±1.85), 4.08 (±2.23) and 2.43 (±1.09) respectively.

The nutrient analysis indicated a deficient intake by both men and women of all the nutrients, except for the mean (±SD) total protein in the women 45.10 (±12.55) and carbohydrate 212.83 (±36.97) in the men. The energy contribution indicated 98.3 percent (n=58) men and 85.72 percent (n=158) women consumed <100 percent of the EER for

energy. However, the findings from the Top 20 food items measured by the 24-Hour Recall indicated that this community's diet is largely carbohydrate-based, containing primarily starchy staple foods, sufficient intake of animal products, and insufficient intakes of dairy foods, fruit and vegetables, possibly resulting in the micronutrient deficiencies. The energy distribution of the macronutrients from the average of both 24-Hour Recalls indicates that both men and women are in range of 15-30 percent total fat intake, 10-15 percent protein and 55-75 percent carbohydrate.

Conclusion: The results of the study reflect that the elderly in this community are faced with poverty, food insecurity as well as social factors thus contributing to a compromised nutritional status. The progression of malnutrition in particular overnutrition is experienced by the majority of the respondents in this study, however, an increased BMI and the prevalence of hypertension is a risk marker for noncommunicable diseases. However, the high prevalence of inadequate food and nutrient intake amongst elderly discloses the need for nutrition interventions and should be aimed at modifying the elderly food choices when purchasing food, healthier food preparation methods, increasing fruit and vegetable portions and improving daily physical activity to attain a better quality of life.

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GLOSSARY OF TERMS

AI	Adequate Intake
AIDS	Acquired Immune Deficiency Syndrome
BMD	Bone Mass Density
BMI	Body mass Index
BP	Blood Pressure
CBC	Centre's for Disease Control
CBNP	Community-Based Nutrition Programme
CDC	Centres for Disease Control
CDL	Chronic Diseases of Lifestyle
CHD	Coronary Heart Disease
CHF	Congestive Heart Failure
Cm	Centimeters
CVA	Cerebrovascular Accidents
CVD	Coronary Vascular Disease
DALYS	Disability Adjusted Life Years
DBP	Diastolic Blood Pressure
DDS	Dietary Diversity Score
DNA	Deoxyribonucleic Acid
DoH	Department of Health
DRIs	Dietary Reference Intakes
DUT	Durban University of Technology
EAR	Estimated Average Requirement
EER	Estimated Energy Requirement
ESRF	End-Stage Renal Failure
FAO	Food and Agriculture Organization
FFQ	Food frequency Questionnaire
FGDS	Food Group Diversity score

FVS	Food Variety Score
g	Gram
HIV	Human Immunodeficiency Virus
HSRC	Human Science research Council
IBS	Irritable bowel syndrome
IHD	Ischemic Heart Disease
INP	Integrated Nutrition Programme
IoM	institute of Medicine
ISH	Isolated Systolic Hypertension
IoM	institute of Medicine
kg	Kilogram
kJ	Kilojoules
km	Kilometer
m^2	Square Meter
MDG	Millennium Development Goals
mg	Milligram
ml	Millilitre
mmol/l	Millimoles per litre
MRC	Medical Research Council
MSU	Monosodium Urate
n	Number
NCD	Non-Communicable Diseases
NGO	Non-Governmental Organisation
NICUS	Nutrition Information Centre of the University of Stellenbosch
PAL	Physical Activity Level
QFFQ	Quantitative Food Frequency Questionnaire
RDA	Recommended Dietary Allowance
SA	South Africa

SA RDP	South African Reconstruction and Development Programme
SASSA	South African Social Security Agency
SBP	Systolic blood Pressure
SD	Standard Deviation
STATSSA	Statistics South Africa
UL	Tolerable Upper Intake Level
WC	Waist Circumference
WHO	World Health Organisation
WHO/ISH	World Health Organisation/ International Society of Hypertension
WHR	Waist/Hip Ratio
WHtR	Waist-to-Height Ratio

LIST OF SYMBOLS

>	Greater Than
≥	Greater Than and Equals To
<	Less Than
≤	Less Than and Equal To
%	Percent
±	Plus or Minus
=	Equal To
♀	Women
♂	Men
µg	Microgram
*	Estimated Energy Requirements
≈	AI

CHAPTER 1 – THE PROBLEM AND ITS SETTING

1.1 INTRODUCTION

Population ageing is a world-wide phenomenon (Ferreira and Kowal, 2006) as the increase of the elderly world population aged 60 years and above is increasing rapidly. In 1950 the elderly statistics indicated 200 million; by 1975 the elderly population increased by 75 percent to 350 million, and by 1999 it had shot up to nearly 600 million. It is projected that by 2025, the world population will reach 1.2 billion and by 2050, 2 billion (United Nations Population Division, 2003).

The World Health Organisation (WHO), (2010a) defines the elderly as all persons over the age of 60. As noted by the World Health Organisation (2009), females encompass the majority of the elderly population around the world as they tend to outlive males. There has been recognition that nutrition plays a significant role in the elderly health status, and both undernutrition and overnutrition are associated with greater risk of morbidity and mortality (Chandra, Imbach, Moore, Skelton and Woolcott, 1991). The elderly are the gemstones of society that are often ignored and, therefore, need to be preserved and respected as they are the building blocks for the future generations.

As an individual enters old age their basic nutrition, genetics, physical activity and everyday stress affect their psychological well being as stated by Whitney and Rolfes (2008) and are an imperative resource to their families and communities. Research conducted by Clausen, Charlton, Gobotswang and Holmboe-Ottesen (2005) states that the nutritional problems relating to the elderly can be expected if there are several high-risk factors present for example, living alone, physical or mental disability, recent loss of spouse or friend, weight loss, use of multiple medications, poverty, and high consumption of alcohol (Ferreira and Kowal, 2006). The attainment of adequate nutrition during the adult stages can add value thus reducing certain illness experienced during the elderly stages.

1.2 BACKGROUND TO THE PROBLEM: A GLOBAL PERSPECTIVE

The numbers of older persons in society around the world are increasing rapidly. As the 21st century progresses the global aging will add an increased economic and social demand on all countries (WHO, 2001). According to Ogden, Carroll, Curtin, McDowell, Tabak and Flegal (2006), a notable aspect of the global ageing process is the progressive demographic ageing of the older population in most nations, regardless of their geographic location or developmental stage. Moreover, the 80 years or older age group is growing more rapidly than any younger segment of the older population. At a global level, the standard annual growth rate of persons aged 80 years or over (3.8 percent) is currently twice as high as the growth rate of the population over 60 years of age (1.9 percent) (Ogden *et al*., 2006). Food items rich in micronutrients are costly, thus discourage consumption and contribute towards micronutrient deficiencies experienced by the elderly (WHO, 2010b).

The World Health Organisation (2000a) defines malnutrition as the cellular inconsistency between the supply of nutrients and energy and the body's demand to ensure growth, maintenance, and specific functions. The prevalence of malnutrition amongst the elderly population leads to consequential ageing (Hajjar, Kamel and Denson, 2004 and Collier, 2009). Hajjar *et al.* (2004) further indicate that malnutrition is categorized as overnutrition and undernutrition, and is a common, potentially serious and commonly under-diagnosed condition amongst the elderly, as age-related physiologic changes in combination with organic and psychological disease processes contribute to the development of malnutrition in older adults. The World Health Organisation and Food and Agriculture Organisation (2003) acknowledged the nutrition transition as the transformation towards an unhealthy diet which is high in total fat, saturated fat, added sugar and salt from one that is rich in whole grains, fruits, and vegetables and low in fat, however, the range of recommended population nutrient intake goals are 15–30 percent fat, 55–75 percent carbohydrate, 10–15 percent protein and <10 percent added sugar of total energy intake.

Globally, almost two thirds of the older populations are at risk of nutritional deficiencies (WHO, 2009). The World Health Organisation (2000a) states that nutrition has a profound influence on morbidity and mortality in the elderly and, therefore, the most common nutrition related malnutrition is Protein Energy Malnutrition, iron deficiency and anaemia. Since both lean body mass and basal metabolic rate decline with age, an older person’s energy requirement per kilogram of body weight is also reduced. Significant age-related

changes include the loss of cognitive function and deteriorating vision, all of which hinder good health and dietary habits in old age. Oldewage-Theron, Dicks, Napier, and Rutengwe (2005) state that due to the diversity of environments, nature of social transformation, involvement in globalisation as well as the genetic and evolutionary experience across regions, it is difficult to generalise about health of the growing elderly population. However, it is evident that the elderly in developing countries will be vulnerable to health related predicaments associated with near to the ground income society, poor food patterns, undernutrition, overnutrition, chronic illness and diseases (WHO, 2009 and Oldewage-Theron *et al.,* 2005). Poverty nevertheless is a major contributor to the many diet related disorders amongst the elderly (Ogden *et al.,* 2006 and WHO, 2009).

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair ones health status as the BMI increases ≥30 (WHO, 2010b) and in countries undergoing nutrition transition, overnutrition often co-exists with undernutrition. The elderly are at the greatest risk of health complications related to overweight and obesity, as they also experience more advanced levels of morbidity than other population sub-groups (Chen and Guo, 2008). The World Health Organisation (2010b) states that the societal changes and worldwide nutrition transition are driving the obesity epidemic, thus raising the BMI which also increases the risks of developing type 2 diabetes mellitus, cardiovascular disease, reduces life expectancy, cancer of the breast, colon, prostate, endometroium, kidney, gallbladder and osteoarthritis, a major cause of disability and one of the key risk aspects for other chronic diseases collectively with smoking, high blood pressure and high blood cholesterol.

The prevalence of obesity is increasing rapidly in all age groups and is one of the fastest growing epidemics, now affecting 10–40 percent of the elderly population globally (Kiss, Poo´r, Dona´, Gergely, Paksy, Zajka and Antal, 2003). According to Salihu, Bonnema and Alio (2009) and Ogden *et al.* (2006), obesity is a modern problem and, therefore, did not even exist 50 years ago, but due to the increase of convenience foods, labour-saving devices, motorized transport and more sedentary jobs people of the world are getting fatter.

Economic growth, modernisation, urbanisation and globalisation of food markets are just some of the forces that are thought to underline the epidemic (Villareal, Apovian, Kushner and Klein, 2005). Popkin (2001) mentioned that overweight and obesity

are major health concerns throughout the world, both in industrialised countries and in developing regions undergoing rapid urbanisation. Research conducted by Welch, Ferreira, Santos, Gugelmin, Werneck and Coimbra (2009) amongst Brazilians ≥50 years indicated that overweight amongst men was 58.3 percent and women 27.8 percent.

The National Institute on Aging (2000), reported that a large proportion of the elderly in the United States of America are affected by chronic disease, memory impairment, and depressive symptoms. However, a study conducted in 1995, demonstrated that approximately 60 percent of people aged 70 and older reported to have arthritis, up slightly from the proportion reporting arthritis in 1984. The prevalence of arthritis and other chronic diseases, such as hypertension, heart disease, cancer, diabetes and stroke have also been reported to vary by race and ethnicity (National Institute on Aging, 2000). The National Institute on Ageing (2000) additionally indicated that one-third or more of men and women aged 85 and older have moderate or severe memory impairment and 23 percent of this group experience severe depressive symptoms.

Aging is a high risk factor for cancer; the National Institute on Ageing (2009) revealed that nearly 60 percent of all occurrence tumors take place in persons aged 65 years and older. The age-adjusted incidence rate for persons aged 65 and older (2151.2 per 100,000 population) is ten times greater than the rate for persons aged under 65 (208.8 per 100,000 population), respectively. However, the age-adjusted cancer mortality rate in America (1068.3 per 100,000 population) for persons aged 65 and older is more than 15 times greater than the rate for persons aged under 65 (67.3 per 100,000 population). The inconsistent burden of specific cancers in older Americans shows that 70 percent of all cancer deaths occur in persons aged 65 and over (Lag, Eisner, Kosary, Hankey, Miller, Clegg and Edwards, 2000).

The World Health Organisation (2010c) estimated osteoporosis and associated hip fractures and the annual hip fractures as a major cause of illness, disability and death amongst the elderly, and will increase globally from 1.7 million in 1990 to around 6.3 million by 2050. Diabetes has been of growing concern, with the adoption of a Western diet, with lots of fat, few fruits and vegetables frequently directed to obesity, which increases the risk of Type 2 diabetes, which can be fatal. Approximately half of diabetes deaths occur amongst individuals under the age of 70 years; 55 percent of diabetes

deaths are in women, and a projection indicates diabetes deaths will double between 2005 and 2030 (WHO, 2010c).

Inadequate energy (kJ) intakes, lack of protein, in addition to micronutrient deficiencies in the elderly further weaken their immunity and expose them to infections that may reduce absorption of essential nutrients, thereby compounding the cycle of undernutrition and infection. In addition, studies have illustrated that elderly people who are underweight are at greater risk of acute illness and death (Villareal *et al.,* 2005, Marton, Sox, and Krupp, 1981 and Han, Van Leer, Seidell and Lean, 1995). The underweight elderly in addition have a significantly higher risk of dying within a year of hospitalisation than those with adequate nutrition levels (Lin, Lee, Chen, Lo, Hsia, Liu, Lin, Shau and Huang, 2002). Moreover, elderly who are undernourished face additional risks, including falls, hospitalization, lengthy hospital stays, and postoperative complications (Beck, Ovesen, and Osler, 1999; Harris and Haboubi 2005). There is philosophical growing evidence that in the elderly, even micronutrient deficiencies not detectable in physical examinations are associated with decline in cognitive ability (Duthie, Whalley, Collins, Leaper, Berger, Deary and Homocysteine, 2002).

1.3 BACKGROUND TO THE PROBLEM: THE AFRICAN PERSPECTIVE

In old age, health concerns transform, since there is a shift away from the incidence of communicable diseases to non-communicable diseases, characteristically chronic, degenerative and mental illnesses (Charlton, Ferreira and Du Plessis, 2008). Moreover, these transformations are accompanied by an advanced incidence of disability. In addition these circumstances have extensive implications for health service provision, particularly since there is a widespread lack of specialist services and personnel to serve the health needs of the increasing numbers of older people in most African countries (Haan, 2000).

Charlton and Rose (2001) state that the majority of Africans enter old age after a lifetime of poverty and deprivation, poor access to health care and a diet that is frequently inadequate in quantity and quality. The pace of population ageing in Africa is slower than in other regions and increased longevity will result in growth in the absolute number of older persons. The HIV and AIDS epidemic has greatly reduced the life expectancy at birth in parts of Africa. However, the elderly in Sub-Saharan Africa have particular vulnerabilities, which are exacerbated by social, economic, cultural, political as well as environmental factors (Charlton and Rose, 2001 and Ferreira and Kowal, 2006). Poverty

is widespread and the majority of African countries lack formal social protection; in addition the elderly are consistently among the poorest of the poor as stated by Ferreira and Kowal (2006). Chronic disease patterns are characterised by a combination of poverty-related diseases associated with urbanisation, industrialisation and a Westernised lifestyle (Steyn, Fourie and Temple, 2006a). Table 1.1 illustrates the leading causes of Deaths and Disability Adjusted Life Years (DALYs) among Africans aged 60 years and over.

	African Region (AMRO)	Total Deaths %	African Region (AMRO)	Total DALYs %
1	Ischaemic heart disease	13.3	Ischaemic heart disease	9.4
2	Cerebrovascular disease	11.9	Cerebrovascular disease	8.4
3	Lower respiratory infections	7.8	Lower respiratory infections	6.0
4	Chronic obstructive pulmonary disease	5.0	Cataracts	3.7
5	Diarrhoeal diseases	4.2	Chronic obstructive pulmonary disease	3.6
6	Tuberculosis	2.5	Trachoma	3.6
7	Prostate cancer	2.2	Diarrhoeal diseases	3.4
8	Cirrhosis of the liver	2.2	Tuberculosis	2.4
9	Hypertensive heart disease	2.1	Cirrhosis of the liver	2.2
10	Diabetes mellitus	2.0	Alzheimer and other dementias	1.8

Table 1.1 Leading causes of deaths and DALYs in people aged 60 years and over in Sub-Saharan Africa, (Kowal, Rao and Mathers, 2003).

A study by Charlton and Rose (2001) noted that nutrition interventions in African countries, when available, are directed primarily toward infants, young children, as well as pregnant and lactating women, therefore, lacking in concentration on the elderly in policies and programmes which is mirrored by the rareness of data from studies on the elderly health situation, nutritional status as well as dietary intake patterns. The elderly nutritional status is principally influenced by the ageing process thus encompassing a direct effect on the requirements of macronutrients and micronutrients, which affects absorption and metabolism of the required nutrients (Oldewage-Theron, Samuel and Djoulde 2009). A nutrition, health and ageing study by Kimokoti and Hamer (2008) indicated that the demographic transition has been accompanied by an epidemiologic transition which is a change from infectious diseases and undernutrition to chronic and degenerative diseases as major foundation of mortality, which is being aggravated by a nutrition transition that causes a shift to diets high in fat, sugar, and refined grains, as well as greater tobacco use and sedentary behaviour.

The HIV and AIDS pandemic in Africa is the highest in the world and is posing an evidently huge burden including responsibilities on the elderly in Africa generally (Human Science Research Council (HSRC), 2004). Most elderly persons in their fragile health state are expected to look after their grandchildren who have lost their parents to HIV and AIDS, and have to support them financially, care for them and even care for other adults who are also ill with HIV and AIDS. The elderly over and above that perform other household chores and, however, have the insinuation of the elderly being strained financially and physically and unable to care for themselves including their health (Collier, 2009 and Makiwane, Schneider and Gopane, 2004). Care, medical treatment and funerals carry a substantial expense and this could be even more of a burden when the elderly are the main caregivers.

Natural and manmade disasters have an impact on older persons' livelihood, security and well being (Kimokoti and Hamer, 2008; HSRC, 2004 and Ferreira and Kowal, 2006). Changes in family structures as a consequence of urbanisation and additional contributing aspects diminish relative support for the elderly as suggested by Ferreira and Kowal (2006) and the pressures faced by the elderly are directly influenced by food security and health (Roberts and Williams, 1996). Makiwane *et al.* (2004) reported that protein-energy malnutrition is prevalent in association with chronic disease and is related to increased morbidity and mortality. The key predictor of malnutrition is loss of appetite resulting in anorexia in the elderly. The process of aging affects their nutrient intake thus resulting in the various deficiencies and disorders. Certain nutrients are required in an increased amount to assist with the aging process. Due to the number of elderly that encounter reduced food intake in addition to a reduced variety in their diet, micronutrient deficiencies are common amongst this age group.

Marais, Marais and Labadarios (2007) further mentioned that factors such as nutritional intake, socio-economic status, functional status, psychological conditions, oral health and pharmacological treatment are known to reduce appetite, induce malabsorption, and diminish sense of taste as well as smell. In addition to the psychological changes that negatively affect nutritional status, simply consuming enough food can become a major challenge to many elderly.

1.4 BACKGROUND TO THE PROBLEM: THE SOUTH AFRICAN PERSPECTIVE

South Africa is a richly diverse developing country and has been faced by the consequences of disease patterns that are characterised by a combination of poverty-related diseases together with the emerging chronic diseases coupled with urbanisation, industrialisation and a Westernised lifestyle (Steyn, Fourie and Temple, 2006a). According to Statistics South Africa (STATSSA, 2010), the population in South Africa is **49 991 300 million** of which the elderly (65+) form 5 percent of the total population. In Kwazulu Natal (KZN) the population is **10 645 400 million**, the elderly population comprising 7.07 percent, of which 4.12 percent are women and 2.95 percent are men (STATSSA, 2010). The elderly generations of South Africa are from the Apartheid era who received limited education and were not included into formal labour to provide for their retirement (Lombard and Kruger, 2009). However, the modernisation of lifestyle has caused the elderly to become prone to the various health prevalence's of malnutrition. Burns, Keswell and Leibbrandt (2005) have indicated that the elderly live in large, multigenerational, female-dominated and female-headed households.

A South African food balance sheet study conducted between 1962 and 2001 has shown an increase in per capita food and energy availability (FAO, 2004). A transition in increased fat intakes of which a proportion of total energy macronutrient composition was 21.2 percent fat, 68.3 percent carbohydrate and 10.5 percent protein in 1962, and 24.3 percent fat, 65.4 percent carbohydrate and 10.3 percent protein in 2001, suggests that a nutrition transition was in progress (Steyn, Bradshaw, Norman, Joubert, Schneider and Steyn, 2006b and Popkin, 1994), accompanied by an increase in nutrition related non communicable diseases

Research conducted by Oldewage-Theron, Samuel, Grobler and Egal (2008a) depicted elderly women respondents to have a higher prevalence of anaemia (13.2 percent) than men (12.5 percent), in addition, vitamin B12 and folate deficiencies were found to be common amongst these respondents. The diet of elderly subjects in South Africa presented deficiencies in intake of energy, protein, iron, zinc, and vitamins A, C and E (Oldewage-Theron *et. al*., 2009).

The significant determinants of poor nutritional status of the elderly in South Africa embrace inadequate household food security, war, famine, and the indirect impact of HIV and AIDS (Charlton and Rose, 2001 and Lombard and Kruger, 2009). A study on the

nutritional status in elderly Africans indicated that most women (65 percent) were obese (BMI ≥30 Kg/m2), and an additional 20 percent were overweight (BMI 25–29.9 Kg/m2), most men (47.1 percent) had a BMI (18.5–24.9 Kg/m2) in the desirable category for health, whereas 38.5 percent were overweight (25–29.9 Kg/m2) or obese (BMI ≥30 Kg/m2) and 20 percent of men, but very few women (2.2 percent), had a BMI of <18.5 kg/m2 (Charlton, Kolbe-Alexander and Nel, 2007). There is a rapidly increasing size of the older population in Africa combined with their increased burden of care-giving responsibilities and poverty related to malnutrition. Table 1.2 illustrates nutrient intake and dietary patterns studies that were conducted between 2000 and 2010 amongst the elderly (60+) in South Africa.

Table 1.2 Nutritional statuses and dietary intake patterns research conducted between 2000 and 2010 in South Africa.

Author and reference	Study population	Measuring instruments	Summarized results
Charlton, Bourne, Steyn and Laubscher (2001) **Poor nutritional status in older black South Africans**	• 148 men and women (60+)	• 24-h recall dietary assessment • anthropometrical measurements	• Mean energy intakes fell below the recommended dietary allowance (RDA) for both men and women; 27% and 36% of men and women • Mean dietary fibre intake was low at 11–16 g/day. • Mean intakes fell below the RDA for vitamin D, calcium, zinc and vitamin B6 • Micronutrient and dietary fiber intake is inadequate, largely due to low reported energy intakes, particularly in women.
Kruger, Venter and Vorster (2001) **Obesity in African women in the North West Province, South Africa is associated with an increased risk of non-communicable diseases: The THUSA study**	• 1040 apparently healthy black female volunteers, (15–70 years old)	• Socio-demographic data • Quantitative food frequency questionnaire • Food picture books • Blood pressure • Anthropometric measurements • Height and weight • waist to hip ratio • Biochemical analysis • Glucose analysis	• A mean BMI of 26:90 (SD 6:81) kg/m2 was found, 25:2% of the subjects were overweight with BMI 25 and 30 and 28.6% were obese (BMI 30) • 33% of women had higher WHR than this cut-off point. • There was an increase in both the mean systolic and diastolic BP with age • The association of indices of obesity with risk factors for NCD in the subjects confirms the results of other studies in black populations in the USA. • Obesity, especially abdominal obesity was associated with higher BP, lower HDL cholesterol levels, and higher TG, fasting serum glucose and insulin.

Table 1.2 Nutritional statuses and dietary intake patterns research conducted between 2000 and 2010 in South Africa.

Author and reference	Study population	Measuring instruments	Summarized results
Joubert and Bradshaw (2006) **Population ageing and health challenges In South Africa**	• Men and women (60+)	• SADHS 1998 • 2001 Population Census • Initial Burden of Disease Estimates for • South Africa, 2000	• High levels of hypertension prevalence in the population 65+ years old, with 52% of men and 60% of women having had a blood pressure reading of ≥140/90 mmHg.
Oldewage-Theron and Kruger (2008) **Food Variety and Dietary Diversity as Indicators of the Dietary Adequacy and Health Status of an Elderly Population in Sharpeville, South Africa**	• 170 randomly selected elderly (60+)	• Socio-demographic health • food frequency questionnaire, • 24 h-recall questionnaire • Anthropometric measurements • Biochemical measurements.	• The major nutrition-related health problems reported by the respondents included high blood pressure (n =62, 36.7%) and diabetes mellitus (n = 10, 5.9%) • biochemical data indicated that the majority of respondents • had normal haematological indices a large percentage of the men (n = 10, 55.6%) and women (n =20, 40.8%) had suboptimal • hemoglobin levels (n = 30, 44.8%) 22.4% (n = 15) had high levels that could be associated with a risk of diabetes mellitus. • 19% of the women were deficient in calcium the men had fewer deficient nutrient intakes compared with the women • The FVS depicted the elderly consuming 1–13 foods • The majority of respondents (n = 82, 55.1%) could be classified with a low dietary diversity score (using 0–3 food groups)

Table 1.2 Nutritional statuses and dietary intake patterns research conduct between 2000 and 2010 in South Africa.

Author and reference	Study population	Measuring instruments	Summarized results
Oldewage-Theron, Samuel, Grobler and Egal(2008a) **Anaemia prevalence and dietary intake of elderly persons living in a peri-urban settlement in South Africa**	• 196 men and women (60+)	• Anthropometric, • hematological • dietary data • biochemical indices	• 47,2% of the women were overweight and obese • Mean BMI was significantly higher (p=0,000) for women than men • Serum folate levels that were low in both men and women • The prevalence of anaemia (based on hemoglobin values) was 12,5% in men and 13,2 % in women approximately 87,5% of the men and 91,1% of the women did not meet the dietary reference intake for folate (320 µg/day).
Oldewage-Theron, Salami, Zotor and Venter (2008b) **Health status of an elderly population in Sharpeville, South Africa.**	• 170 men and women (60+)	• Socio-demographic and health questionnaire • 24-hour recall questionnaire • Anthropometric indices • Biochemical indices	• 26.2% of the sample population were very obese (BMI 35+) • The body fat composition indicated that 50% of the women had more than 40% fat • 41.8% lying within the borderline risk of CVD levels (5.2-6.2 mmol/l) • 22.4% had high levels (>5.9 mmol/l) that could be associated with a risk of diabetes mellitus\ • 42.4% and 3% of the respondents had serum and iron levels higher than the cut-off point

Table 1.2 Nutritional statuses and dietary intake patterns research conduct between 2000 and 2010 in South Africa.

Author and reference	Study population	Measuring instruments	Summarized results
Medoua, Egal, and Oldewage-Theron (2009) **A Nutritional value and antioxidant capacity of lunch meals consumed by elderly people of Sharpeville, South Africa**	• 450 elderly people (60+)	• Meal samples • Proximate analysis • Sample extraction • Estimation of total antioxidant capacity	• The contribution of vegetables, flesh products and legumes • to the TDAC was low • In spite of the relatively high number of food items composing the menus consumed by the elderly of Sharpeville, which were adequate in regard to the Acceptable Macronutrient Distribution Ranges, these food items possessed a low antioxidant capacity that could hardly achieve the RDA.

1.5 RATIONALE AND MOTIVATION

Research around the world indicates the elderly as the most vulnerable to the various deficiencies and disorders pertaining to inadequate nutrient intake. Nutrition has been recognised as an important factor influencing the functional outcome of ageing amongst the elderly (Munro, 1992). Solomons (2001) provided comprehensive literature that an escalating number of elderly people in developing countries will be vulnerable to the health consequences that are associated with low-income societies, and that their diet and nutritional status will interrelate with these circumstances. Ageing individuals may be intrinsically predisposed to undernutrition and its associated infectious diseases, as well as to overnutrition and the possibilities associated with chronic diseases of lifestyle, thus a double burden of disease (Solomons, 2001). Cannon (2001) further stated that the elderly (60+) are susceptible to consume fatty and sugary foods that are most affordable and low in nutrients. There is a need for research amongst the elderly (60+) pertaining to issues of undernutrition and overnutrition and, therefore, to create a suitable nutrition intervention to promote healthier ageing and lengthen the lives of the elderly.

There are a number of basic underlying determinates amongst the elderly population in Verulam resulting in a poor nutritional status. The main focus of the research is to create an awareness directed at increasing the nutrient intake of the elderly residing in Verulam as well as to equip the staff at the Elderly Centre with the basic tools to aid in increasing the level of nutrient intake, since there has been no such study conducted.

A basic overview of the elderly residing in Verulam has concluded that poverty is one of the major factors resulting in the existing problem associated with poor food choices related to overnutrition and malnutrition. The nutritional knowledge and dietary intake behaviour of the elderly in the Verulam area will be assessed and recommendations will be given.

1.6 RESEARCH OBJECTIVE

The research objective of this cross-sectional, epidemiological, descriptive study was to conduct an analysis of the associations of nutrient intake and the dietary patterns exposure with the risk of malnutrition among free living elderly (60yrs+) in Verulam. The findings from the study will aid in formulating practical recommendations for a sustainable consistent intervention strategy to improve the nutritional status of this group.

1.6.1 Specific Research Objectives

The behaviour of consuming food among the elderly is acquired during younger years as a result of a combination of socio-demographic factors in addition to the level of nutrition knowledge (Wakimoto and Block, 2001). However, the purpose of the study was to evaluate the nutritional status and dietary intake patterns of the elderly attending an Elderly Care Centre for the compilation of nutritional recommendations for a nutrition education programme, in order to improve the elderly dietary habits and food choices.

The specific objectives of the study were to:

- Determine the socio-demographic profile of the elderly in the sample by means of a socio-demographic questionnaire.

- Establish the nutritional status of the elderly by the use of anthropometric measurements.
- Determine the health status of the elderly by completing a health questionnaire as well as completing a blood pressure test by a trained nurse at the Verulam Day and Frail Care Centre.
- Establish the food diversity score of the elderly sample by administrating the Food Frequency questionnaire.
- Determine the dietary intake patterns of the elderly sample by means of two 24-Hour Food Recall conducted on one weekend and one week day.
- Suggest recommendations for a integrated nutrition programme to improve the target group's overall nutritional status.

1.6.2 Conceptual framework of the study

The framework of the research study is represented by Figure 1.1 and was developed by the researcher under the supervision of Dr. C. Napier.

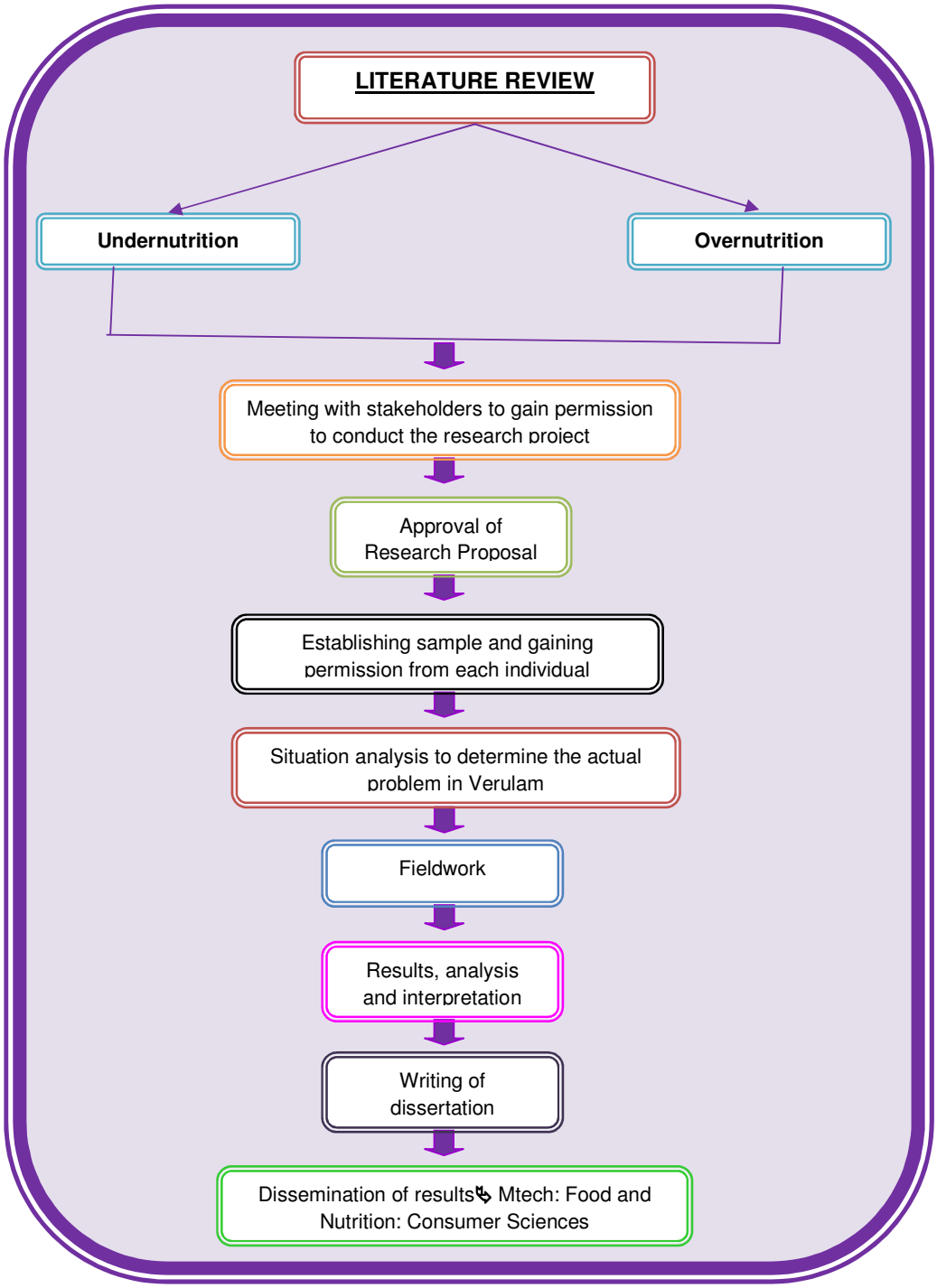
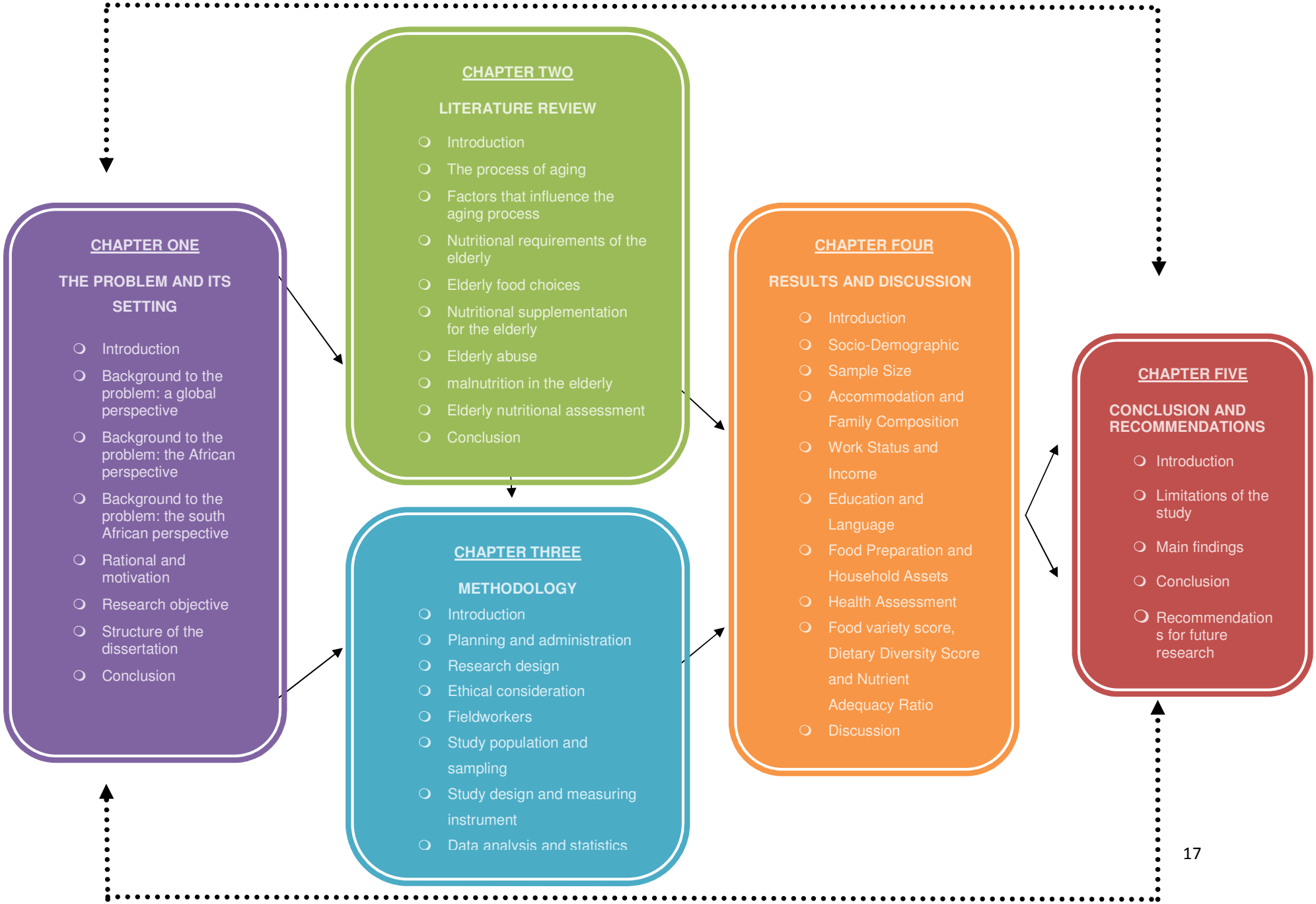


Figure 1.1. Framework of the research.

1.7 STRUCTURE OF THE DISSERTATION

An overview of the dissertation is presented by Figure 1.2, which illustrates a summary for each chapter conducted by the researcher under the supervision of Dr. C. Napier.


CHAPTER ONE
THE PROBLEM AND ITS SETTING
Introduction
Background to the problem: a global perspective
Background to the problem: the African perspective
Background to the problem: the south African perspective
Rational and motivation
Research objective
Structure of the dissertation
Conclusion
CHAPTER TWO
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Factors that influence the aging process
Nutritional requirements of the elderly
Elderly food choices
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Elderly abuse
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Study design and measuring instrument
Data analysis and statistics
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Work Status and Income
Education and Language
Food Preparation and Household Assets
Health Assessment
Food variety score, Dietary Diversity Score and Nutrient Adequacy Ratio
Discussion
CHAPTER FIVE
CONCLUSION AND RECOMMENDATIONS
Introduction
Limitations of the study
Main findings
Conclusion
Recommendations for future research

1.8 CONCLUSION

The research consists of a theoretical structure and a descriptive study. The dissertation consists of five chapters that are presented in Figure 1.1. 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 problems researched that are experienced by the elderly, globally, in Africa and specifically in South Africa.

CHAPTER 2 – LITERATURE REVIEW

2.1 INTRODUCTION

The rationale of this chapter is to contextualize the study. Nourishment and nutrition are fundamental requirements for the protection and promotion of health, thus allowing full affirmation of growth and development with quality of life in the elderly. In 2002, there were an estimated 605 million older persons aged 60+ in the world, nearly 400 million of whom were living in low-income countries. However, by 2025, the number of elderly worldwide is anticipated to reach more than 1.2 billion, with about 840 million of these in low-income countries (Charlton and Rose, 2001).

The end of Apartheid in South Africa initiated dramatic demographic, socio-political, and economic transitions and united with these changes there has been rapid urbanisation of the black South African population (Lester, Nel and Bins, 2000). The average annual growth rate of South Africa's urban population reached 2.9 percent between 1990 and 2004 (Population Reference Bureau and African Population and Health Research Centre, 2008). South Africa is both a developed and developing country and its population aged 60+ numbers 1.7 million, which is 43 percent of the total population as stated by Charlton *et al.* (2008). The elderly population is exceptionally diverse ranging from fit, active and healthy to extremely frail (Hickson, 2006). It is to be anticipated that the rise in the elderly population worldwide carries various issues regarding the quality of life of the older generation. Globally, the trend related to obesity and the various health related diseases and deficiencies in the elderly are familiarly correlated to the consequences of the evolutional social and dietetic transition caused by the economic progression (Charlton and Rose, 2001 and Charlton, *et al.*, 2008).

In developed countries, research has revealed that urbanisation increases the risk of nutrition related non-communicable diseases (NCDs) such as obesity, diabetes and cardiovascular diseases (Caballero, 2001). A study conducted by Popkin, Horton and Soowon (2001) demonstrated the epidemiological transition marked by a shift from predominantly endemic deficiency diseases (themselves caused by inadequate diet) and infectious diseases (the risk of which is often increased by poor nutrition), to predominantly epidemic chronic diseases.

Popkin, Keyou, Zhai, Guo, Ma and Zohoori (1993) further indicated that current evidence, therefore, suggests that the nutrition transition is underway in South Africa. Nutrition transition is a sequence of characteristic changes in dietary patterns and nutrient intakes associated with social, cultural and economic transition during demographic transition. Tucker and Buranapin (2001) stated that the leading cause of death among older people worldwide is vascular disease and associated chronic conditions, however, poor food choices, lack of physical activity, and usage of alcohol and tobacco during early years of the ageing process are key contributors associated with the nutritional transition. Popkin *et al.* (1993) have called this process the "nutrition transition" which appears to be occurring rapidly and predictably in countries throughout the world. The epidemiological transition leading to an elevated prevalence of noncommunicable diseases is associated with overweight and obesity, which includes a variety of factors that may be responsible for higher prevalence of obesity even in developing countries, such as urbanisation and life style factors, lower energy expenditure labour, mechanisation and automation (Charlton *et al.,* 2008) which also incorporates watching television and other sedentary activities (Tucker and Buranapin, 2001). However, transformation in dietary behaviour includes the fast food culture, increase in energy density of diet (more percentage of fat), and consumption of more meals outside the home.

According to Vorster, Bourne, Venter and Oosthuizen (1999), in a change from conventional, rural communities to more population-dense, urban environments, there is a change in diet from one high in fibre and low in fat to rich in animal fats and sugars in addition to refined products that are low in fibre. Although the overall nutrient intake adequacy improves with an increasing variety of foods, the movement toward more fats, sugars and refined foods quickly moves beyond this more optimal state to one in which diet contributes towards rapid escalating rates of obesity and chronic disease. Caballero (2001) states in addition that developing countries have a high prevalence of undernutrition, but this era of nutrition transition has also brought about a double burden of undernutrition and overnutrition in these countries. Reduced physical activity by the elderly and corresponding habitual inactivity accompanies the nutritional transition (Popkin and Doak, 1998). Moreover, one of the common inexorable shifts with modernisation and industrialisation is the reduction of physical activity at work and home for both men and women during younger years, which impacts on weight gain during the ageing process (Popkin Horton and Soowon, 2001). Figure 2.1 demonstrates the influence of the diet shift acceleration, therefore resulting in the nutritional

transition that has affected the various life stages related to the different health factors. However, Popkin *et al.* (2001) acknowledge that the progression from rural to urbanisation is, therefore, associated with household income growth.

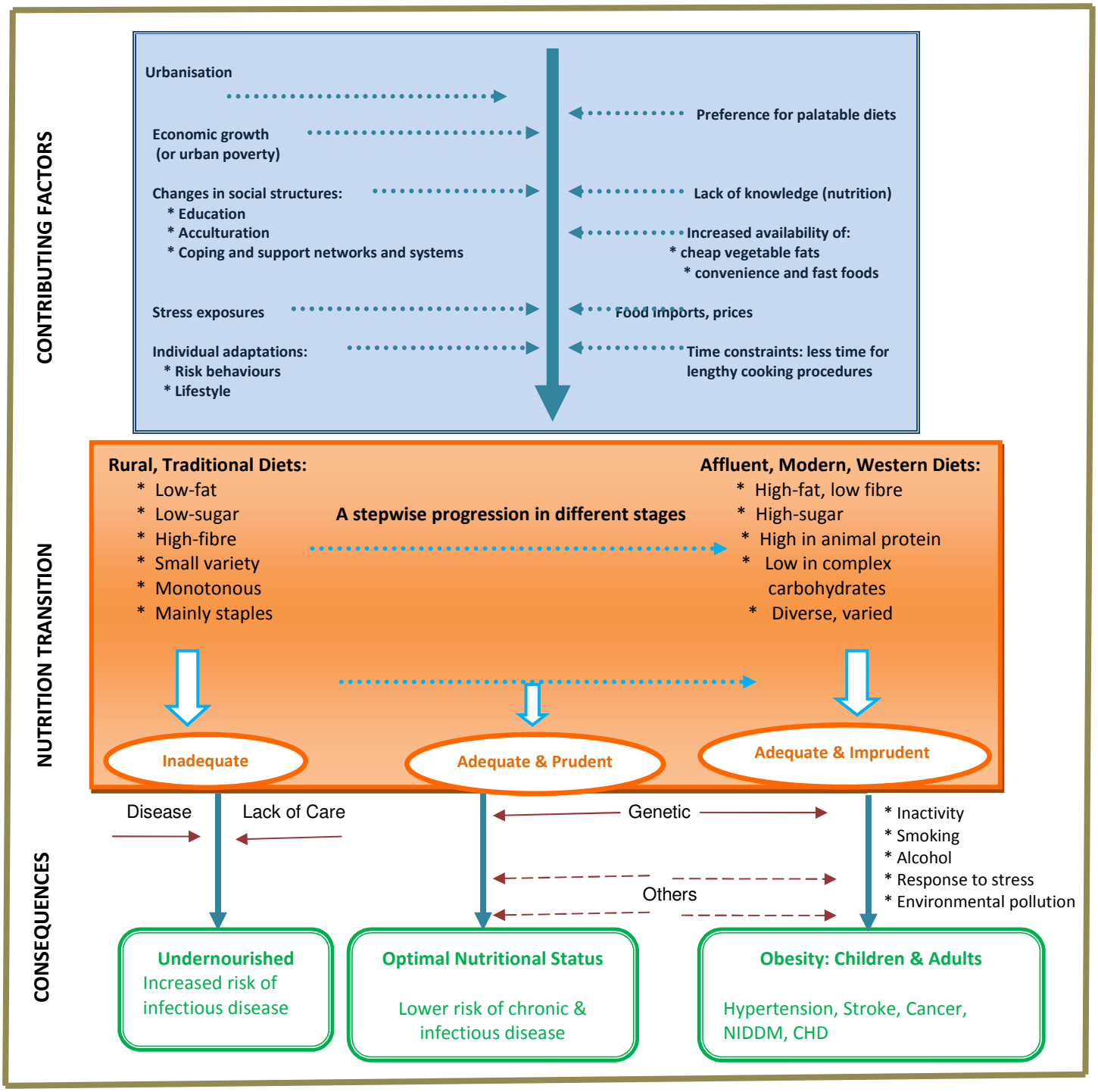

Figure 2.1: The contributing factors and the consequences of the nutrition transition (Vorster *et al.*, 1999).

2.2 THE PROCESS OF AGING

Ageing is a natural and inevitable procedure which takes place gradually and affects the whole organism leading to anatomical and physiological changes that make increasingly greater demands on the homeostatic mechanism which enables a living organism to adapt to its environment (Haan, 2000).

South Africa has one of the most rapidly ageing populations in Africa. Despite the demographic impact of the HIV and AIDS epidemic, the population is projected to continue ageing over the next two decades mentioned (Jourbert and Bradshaw, 2006). Throughout the 21st century ageing population poses particular challenges in developing nations due to the rapidness of the ageing process (United Nations, 2007). Magalhaes (2005) identifies ageing as a progressive functional decline, or a gradual deterioration of physiological function with age, together with a decrease in fecundity or the intrinsic, inevitable, and irreversible age-related process of loss of viability and increase in vulnerability. Similarly, Haan (2000) insinuates that ageing is the progression of growing old and thus developing the characteristics of old age. The transition from a young to old age structure will be additionally compressed in time for the less developed countries than it has been for the further developed countries, and will contain profound effects on the infrastructure, the economies, and their health care systems of which few of these countries currently have programmes intended for older individuals.

The mechanisms underlying normal aging are not fully understood; elderly may experience physiological changes, cognitive decline, poor dental status, increased prevalence of chronic diseases, and conditions such as hypertension, cardiovascular disease, diabetes, cancer, and osteoporosis, among others (McKevith, 2005). Similarly, these phenomena are often cited as key features that could influence appetite and hunger, consequently leading to changes in diet composition (Lahmann and Kumanyika, 1999 and McBee, Cotugna and Vickery, 2001) and energy intakes (Wakimoto and Block, 2001). Grouped together, the most frequent nutrition-related concern in the elderly is undernutrition, nutrient deficiencies, dehydration, and constipation (McBee *et al*., 2001). Elderly dietary changes typically comprise of consuming less food along with making different food choices with aging. For example, when compared with their younger counterparts, the elderly may possibly consume

fewer high-energy sweets in addition to infrequently consuming fast foods, but they eat more grains, fruit, and vegetables, which have positive dietary consequences (Haan, 2000).

Ageing is a complex sequence of changes marked by a progressive loss of lean body mass, including changes in most body systems, as the organs and functions of the body are impaired as emphasised by Bromley (1988). However, Chou (2008) confirmed that several contributing factors may influence aging, life span, and quality of life during this life stage, which includes genes, reproduction, food, the accumulation of cellular damage, and the ability to repair. They further discuss the degenerative changes that accompany aging as a result of lifetime exposure to environmental influences. Once the body is exposed to physical maturity, the catabolic or degenerative change becomes greater than the rate of anabolic cell regeneration, and these result in loss of cells which leads to varying degrees of decreased efficiently and impaired organ function (De Magalhães, Budovsky, Lehmann, Costa, Li, Fraifeld and Church, 2009).

2.2.1 Psychosocial

Aging is a heterogeneous occurrence with substantial individual variability (Shatenstein, 2008) and the most frequent physiological age-related changes include alterations to body composition, sensory attributes, in addition to the digestive system function, by means of potential consequences for the metabolism of certain nutrients and the loss of appetite frequently observed in the elderly (Paquet, St-Arnaud-McKenzie, Kergoat, Ferland, and Dubé, 2002.). Pannemans and Westerterp (1995) further state that as people age, metabolic efficacy decreases for some nutrients, such as protein and glucose (Morais, Gougeon, Pencharz, Jones, Ross, and Marliss, 1997). However, inadequate nutritional knowledge affects the nutrient intake including a lack of mealtime companionship, along with a decreased motivation to prepare meals, also make dining a less gratifying occasion and thereby reducing appetite. Reduced contact with others in addition inhibits poor nutrient consumption. Figure 2.2 represents a systematic representation of the intrinsic and extrinsic causes of ageing on the physiological basis of behaviour (Jackson, 2001; Defronzo, Bpnadonna, Ferrannini, 1992 and Meneilly and Tessier, 2001).

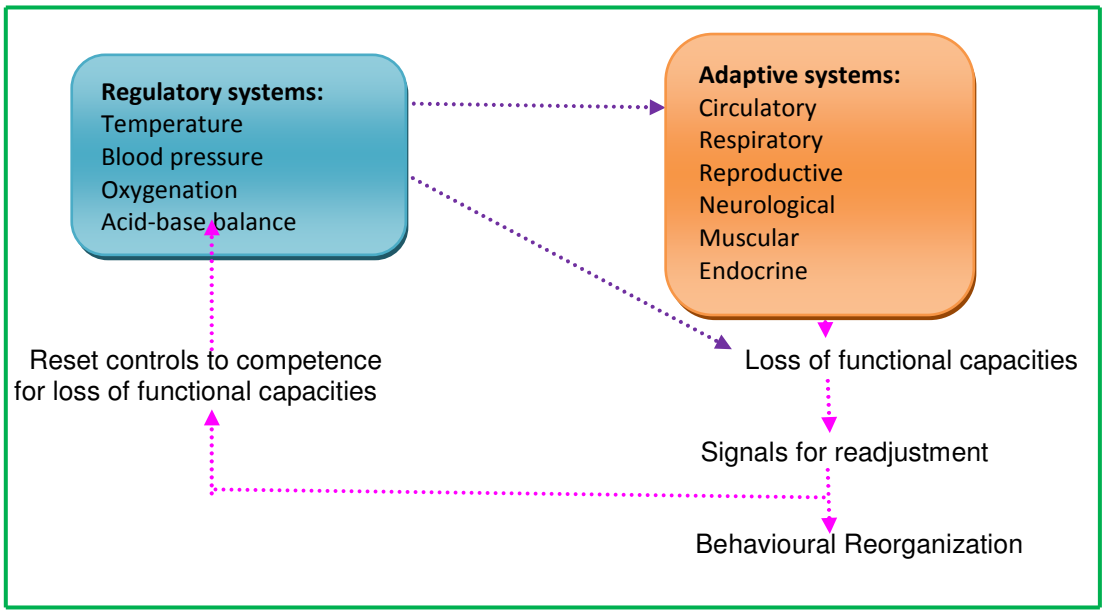

Figure 2.2 A systematic representation of intrinsic and extrinsic causes of ageing on the physiological basis of behaviour (Bromley, 1988).

2.2.2 Sensory

The senses of taste, smell, sight, hearing and touch are diminished according to individual rates as suggested by Wellman and Kamp (2008). Recent studies have indicated that the decline in sensory perceptions is the most important part of ageing as it has a direct affect on the dietary patterns of the elderly (Walls and Steele, 2004). The relationships between hearing loss, impaired vision and loss of coordination are among the most common experienced by the elderly and may thus lead to diminished food intake with decreased appetite, food recognition and the ability to feed oneself, therefore leading to poor nutrition (De Magalhães *et al.*, 2009). Similarly, taste and smell are pertinent factors that influence elderly selection and enjoyment of food. The ability to discriminate between subtle differences in taste is diminished due to a reduced number of taste buds within the tongue (Wellman and Kamp, 2008). As visual acuity diminishes at some stage in old age, the lens becomes more opaque in addition to loss of elasticity. Moreover, the time reaction to a decline in illumination is, therefore, slower. Additionally, arteriosclerotic changes contribute to a reduction in visual

field and the blink reflex is slower as well as the eyelids hang loosely due a decreased muscle tone (Barrowclough, 1981).

Haan (2000) mentioned that hearing loss can lead to depression and social isolation, therefore, prolonged exposure to excessive noise causes loss of hearing for high tones. Bromley (1988) similarly agrees and further states that the laryngeal muscle atrophy after middle age becomes less powerful and restricted in range, thus contributing to speech becoming slower and pauses more frequent. A longer touch perception is diminished, in addition to the sensory input from the proprioceptors in the muscle, upon which the individual depends for knowledge of the body position including reduced movement and becomes less reliable.

Sensory loss translates into a decreased tactile sensation, decreased response to pain, reduced motor readiness, loss of fine control of response timing, impaired balance, along with a decreased coordination of fine motor movement (Larsen, Hazen and Martin, 1997). A study conducted by Barrowclough (1981) indicates a combination of reduced temperature sense and the impaired sweating results from decreased autonomic nervous system stimulation, producing poor adaptation to heat and cold in elderly. The sensitivity of taste buds decreases with age (Pamala *et al*., 1997). The tastes that decline first are sweet and salty, with bitter and sour decreasing more slowly. This indicates that food may not taste like it used to, and as a result the elderly over season food or may accuse others of omitting all seasonings in food preparation. However, these changes in taste may lead to a loss of appetite, which can lead to nutritional deficiencies.

2.2.3 Oral Health Status

As life expectancy increases and with it both the relative and absolute numbers of individuals age 60 and older, oral health means more than good teeth; as it is integral to general health and essential for well-being of the elderly as it is the gateway to the digestive system (WHO, 2007a). In addition to unhealthy dietary habits, smoking and other tobacco use, and alcohol consumption along with stress are a few of the common risk factors many elderly encountered during their younger years that result in bad oral health status. Consequently,

good oral health facilitates effective chewing, contributes positively towards speech, aids in social confidence and is associated with improved cognitive functioning of the elderly as indicated by Andrade, Caldas and Kitoko (2008). The elderly may take medication that may result in a dry mouth, leading to tooth decay; infections of the mouth are the main contributors towards poor dietary habits, moreover, ill-fitting dentures can thus reduce the elderly's quality of life by impeding their ability to chew (WHO, 2007a).

The World Health Organisation (2007a) indicates the following factors which hinder nutrient intake of the elderly:

- Pain and difficulty with eating can lead to poor levels of nutrients.
- Poor oral appearance, bad breath and dental incapacity can lead to social isolation.
- Oral disease is implicated in peptic ulcers, respiratory and cardiovascular illness.
- Dental decay is the most costly diet related disease in Africa.

As noted by Roberts and Williams (1996), tooth loss is an inevitable part of the normal ageing process and dentures have provided relief to chewing problems that many elderly may face. The predominant oral health problems faced by the elderly include dental caries, periodontal disease, dry mouth (xerostomia), tooth wear and oral cancer. Oral health care is poorly addressed by the elderly community due to their altered dietary patterns. Hence, economic factors may influence the prevention of the elderly from seeking professional services for the preparation and repair of dentures as stated by Roberts and Williams (1996). Andrade *et al.* (2008) furthermore indicate that oral health, although rarely life-threatening, plays an essential role in the quality of life, management of medical problems, nutrition, and social interaction of the elderly. In addition, oral health impairment can affect nutrient intake contributing to the development of nutritional inadequacy and, therefore, lead to poorer quality of life amongst the elderly.

There have been a number of studies that have agreed that the elderly prefer consuming foods that are soft and processed, therefore making chewing easier, therefore resulting in an increase intake of inadequate nutrients. In view of the fact that these findings were published by Walls and Steele (2004), many other researchers have reported on the significance of

dental status contributing towards diet, consequently demonstrating that poor dentition may possibly inhibit consumption of certain foods which leads to poor energy intakes. The decline in salivary flow as well as masticatory impairment from poor dentition (loss of teeth, lack of adequate dental and gingival care) also cause insufficient mechanical crushing and initial enzymatic first digestion in the mouth (Walls and Steele, 2004). In summary, compromised oral health status has been associated with poor intakes of fruit and vegetables, due to the hassle of chewing, and is greatly associated with decreased a intake of non-starch polysaccharides and micronutrient intakes (Walls and Steele, 2004) and, therefore, it is imperative that elderly maintain original teeth or invest in dentures.

2.2.4 Skin and Hair

The skin is the principle organ of beauty, touch, pleasure, and sensuality over and above being the largest organ of the body, therefore accounting for 12 percent to 16 percent body weight which covers 12 to 20 square feet (Delbaere, Crombez, Vanderstraeten, Willems, and Cambier, 2004). During the ageing process the appearance and characteristics of the skin alter, therefore resulting in the amount of subcutaneous fat being reduced resulting in a looser appearance. Delbaere *et al.* (2004) noted that the primary function of the skin is to protect the body by serving as a barrier against microorganisms, ultraviolet radiation, loss of body fluids, along with the stress of mechanical forces and, most importantly, the skin regulates the body temperature. It is also involved in the production of Vitamin D.

Baranoski (2000) acknowledges the theory that the skin consists of two layers namely, the outer or the hard layer known as the cuticle and the inner layer known as the dermis which contains numerous glands and nerve endings. However, Baranoski (2000) further states that age changes the surface of the body, especially in the face as wrinkling, and flabbiness of the skin throughout the body. The skin takes on a character that becomes paler and blotchy in addition to appear parchment like and loses some of its elasticity. Yardley and Smith (2002) state that, as the epidermis gradually thins, there is a flattening of the dermal-epidermal junction and effacement of dermal papillae along with epidermal rete pegs, making the skin more susceptible to mild mechanical trauma. However, aging skin is more easily stretched due to a decrease in elastin fiber.

Muscle weakness in addition to reduced physical fitness, particularly in the lower body, are the most common intrinsic risk factors for falling (Yardley and Smith, 2002). In conjunction, a loss of muscle strength, equilibrium, flexibility and coordination can contribute towards difficulty accomplishing activities of daily lifestyle (Delbaere *et al*., 2004). A study conducted by Gialloreti and Marazzi (1996) as well as Dawson, Taylor and Favaloro (2008) indicated that with age, the percentage of fat increases significantly, and this occurs at a fairly young age, beginning at 40 years and ending around at 80 years of age. Therefore, body fat increases from 18 percent to 36 percent in men, and from 33 percent to 44 percent in women. However, lean body mass, which includes muscle as well as vital organs, is decreased by 10-15 percent (Dawson *et al*., 2008). Delbaere *et al.* (2004) further state that sarcopenia or muscle loss is considered to have direct effects on performance which leads to disabilities, increased risk for falls, along with an increased vulnerability to injury. Delbaere *et al.* (2004) noted that a loss of muscle mass has metabolic effects, including accelerated bone loss, lessened heat and cold intolerance, impaired glucose homeostasis, and obesity and, therefore an increased fracture risk.

Levine (2010) identified the following factors which aid towards the ageing process of the skin:

- Sun damage causes irregular thickening of the dermis and there is a decrease in the amount of water held by the epidermis.
- Smoking.
- Muscle movement/dynamic lines for which gravity is responsible for folds in the skin.
- Hormones.
- Menopause.

Jackson (2001) elucidates that the elderly skin becomes a less-effective barrier against water loss, bruising, infection, decreases in dermal cells, blood vessels, nerve endings, and collagen leading to an altered sensation, thermoregulation, rigidity, and moisture retention as well as skin sagging. Thermoregulation is impaired in the elderly thus generating a decreased tactile sensitivity and pain perception (Jackson, 2001).

Chojnacka, Górecka and Górecki (2006) mentioned hair loss in the elderly as undoubtedly being of concern to both men and women. Hair quality in addition to distribution revolutionises significantly during the ageing process. Although the use of medication as well as certain health conditions such as thyroid dysfunction contribute towards thinning hair in the elderly, the most frequent cause of hair loss amongst elderly men and women is androgenic alopecia know as balding, of which hereditary balding is most familiar. During the ageing process the growth rate of hair decreases, as the follicles do not allow for hair growth as quickly as during the younger years (Chojnacka *et al.*, 2006). On the contrary, by the time a man is in his late 60s, 80.0 percent have some substantial balding or thinning present whereas elderly women are affected after menopause when the growth rate of hair slows dramatically. However, most elderly women do not lose significant amounts of hair to make it noticeable when compared to men.

According to Chojnacka *et al.* (2006), the impact of hair loss in elderly individuals may possibly also have a direct relation to a disease and other health conditions. Medication used to treat various illnesses can trigger hair loss. Similarly, a poor diet that is deficient in various nutrients is the foundation for the hair shafts to weaken, therefore causing hair to break and grow slower (Jackson, 2001).

2.2.5 Gastrointestinal Function

Gastrointestinal function declines significantly during the ageing process and the most common disorders experienced by the elderly are diverticulosis and ischemic bowel disease which tend to develop and thus create more problems with constipation. Wellman and Kamp (2008) indicated *gastroesophageal* reflux or heartburn as one of the most common complaints recurring amongst the elderly, caused due to subtle alterations that may increase the vulnerability to illness and malnutrition.

As suggested by Bitar and Patil (2004), a decrease in taste sensation and saliva production makes eating less pleasurable and more difficult. Dysphagia due to weakened tongue or cheek muscles can contribute to poor chewing and swallowing, therefore making it both dangerous and difficult. Gastric changes contribute to the elderly's ability to consume food,

therefore gastric mucosa lead to an habilitation to resist damage such as cancer, ulcers and infections. Gastritis causes inflammation and pain, due to delayed gastric emptying and discomfort and is the major cause affecting the bioavailability of nutrients and, therefore, increases the risk of developing chronic disease such as osteoporosis (Wellman and Kamp, 2008).

Gastrointestinal function is well preserved with aging regarding the digestion as well as absorption of macronutrients; nevertheless the aging gastrointestinal tract becomes less efficient in absorbing vitamin B-12, vitamin D, and calcium. Constipation is the major cause of a delay transit time in the gut due to medication (Bitar and Patil, 2004 and Wellman and Kamp, 2008).

2.2.6 Metabolic System

Metabolism administers the chemical and the physical changes that occur within the body that enable its continued growth and function (Wellman and Kamp, 2008). A study conducted by Bechtold, Palmer, Valtos, Lasiello and Sowers (2006) indicated that metabolism incorporates the breakdown of complex organic constituents of the body in order to liberate energy for all the bodily processes, including the building up of complex substances, which form the material of the tissues and organs. Nevertheless, change in body composition accounts for the immeasurable majority of the decline in metabolism of the elderly (Bechtold *et al.,* 2006). Bechtold *et al.* (2006) discuss multiple age related physiologic mechanisms. The elderly are at increased risk of developing intra-abdominal obesity and the metabolic syndrome, including non-alcoholic steatohepatitis.

2.2.7 Urinary System

The urinary tract is an organ system made up of the kidneys, ureter, bladder, and the urethra, as well as an array of various muscles and nerves. The main function of the kidneys is to filter waste products from the blood. They also produce certain hormones which help to regulate other organs and stimulate the production of red blood cells (Kucukardali, Oncul, Kunter, Turhan, Solmazgul, Terekeci, Sayan and Oktenli, 2009). The American Academy of Health and Fitness (2009) has indicated that urine is formed by the kidneys through three processes

namely; filtration, re-absorption as well as secretion. The ultimate source of urine is blood, and a large amount of blood is transported to the kidneys for filtration by way of the renal arteries. Renal blood flow progressively decreases from 1200 ml/minute at age 30 to 40 years to 600 ml/minute at age 80. However, a decrease in the glomerular filtration rate, or the rate at which blood is forced through and filtered by the renal corpuscle in the kidneys, is the most important functional defect caused by aging (American Academy of Health and Fitness, 2009).

Hunt (2004) mentions that during the ageing process the urinary system experiences several changes that include the following:

- A general weakening of the bladder muscles indicating the impulse to urinate, which cannot be delayed as long as in earlier years.
- The bladder does not stretch to hold as much as it used to, and therefore urination becomes frequent.
- Weakened muscles in the bladder may not empty completely which increases susceptibility to urinary infections.
- The kidneys filter the blood more slowly than in younger years. As a result, medication remains in the bloodstream longer than it does in younger people. This change in functioning compounds the danger of over-medication.

2.2.8 Renal

The decline of renal function with ageing is the most dramatic among all the organ systems, however, a study conducted by Anderson and Brenner (1986) articulated that the functioning cells are gradually lost and, therefore, the physiologic reserve capacity is reduced. Renal mass declines about 20 percent between the ages of 40 and 80. However, loss in mass is predominant in the renal cortex and includes a decrease in performance of the glomeruli as well as telomere DNA. Anderson and Brenner (1986) further indicate that the changes in renal function do not significantly compromise the well-being of older adults in unstressed circumstances (Castellani, Paladini, Paniccia, Paniccia, Di Serio, Vallotti, Ungar, Fumagalli, Cantini, Poggesi, and Serneri, 1997). However, vulnerability to environmental in addition to disease challenges increases and is, therefore, enhanced by changes in homeostatic

controls. Reduced renal function decreases the elderly's ability to act in response to a range of physiological and pathological stresses. In general, aging is associated with an increased incidence of kidney problems (Castellani *et al.,* 1997).

Mühlberg and Platt (1999) noted that renal changes that occur with aging are a decrease of renal weight, a thickening of the intrarenal vascular intima, sclerogenous changes of the glomeruli, and infiltration of chronic inflammatory cells and fibrosis in the stroma. Similarly an altered renal tubular function, including impaired handling of water, sodium, acid and glucose is also frequently present in old age. However, an impaired endocrinologic functioning manifested by changes of the renin-angiotensin system, vitamin D metabolism, and antidiuretic hormone responsiveness have been reported (Kielstein, Bode-Boger, Haller and Fliser, 2003). Moreover, the aging kidney is constantly exposed to the effects of a variety of potential toxic processes; which include drugs as well as chronic illnesses including hypertension, diabetes, and atherosclerotic disease.

Renal changes that occur with aging also consist of impairment in the ability to concentrate urine and to conserve sodium and water (Anderson and Brenner, 1986 and Zhou, Rakheja, Yu, Saxena, Vaziri and Silva, 2008). Nevertheless, these physiological changes increase the risks of volume depletion and perennial type of acute renal failure. However, a frequent cause of acute renal failure in the elderly is drug-induced nephropathy, in addition non-steroidal anti-inflammatory drugs, antibiotics, and diuretics are most often involved (Kielstein *et al.,* 2003). Nevertheless, due to the age-dependent decline of renal function, the pharmacokinetics of numerous drugs are altered in the elderly, therefore, the most important renal function to monitor with aging is the creatine clearance. Conversely, changes in pharmacokinetics of many drugs and most decisions on drug dosage can be based on this information alone, as tubular functions of the kidney decrease at rates parallel to the age-dependent decrease in glomerular filtration rate (Castellani *et al.,* 1998, Kielstein *et al.,* 2003 and Zhou *et al.,* 2008).

2.2.9 Musculoskeletal

The skeleton provides support and structure to the body, and with increasing age there is a decrease in bone mass due to the gradual process of absorption and formation of the skeletal structure (Wellman, and Kamp, 2008.). As age advances the chemical composition of the bone changes, the bones become less dense, and this increases the risk of breakages later in life. The movements in the joints become stiffer and restricted and bone mass is lost during the ageing process in addition to bones losing calcium and other minerals (Wellman and Kamp, 2008 and Freemont and Hoyland, 2007).

Changes in the muscle tissue combined with normal aging changes in the nervous system, cause muscles to have reduced tone the ability to contract. Muscles may possibly become rigid with age in addition to losing tone even with regular exercise. Similarly, changes in posture and walking patterns are universally associated with aging according to Dugdale and Zieve (2008). Osteoporosis, an age-associated condition, is a key health problem among the elderly where normal bone is composed of protein, collagen and calcium, all of which provide the bone with its strength (Steyn and Temple, 2008). As noted by Wellman and Kamp (2008), osteoporosis is a condition characterized by the loss of the normal density of bone, resulting in fragile bone, which leads to factually abnormal porous bone that is more compressible like a sponge, than dense like a brick. Therefore, this disorder of the skeleton weakens the bone causing an increase in the risk for breaking bones (bone fracture) (Hougha, 2005).

2.2.10 Neurologic

There is a significant age relation in the neurologic process. Functions including cognition, steadiness, reactions, co-ordination, gait, sensations and daily living tasks which decline by 90% or as little as 10 percent (Wellman and Kamp, 2008). An average brain loses weight of 5 to 10 percent between the ages of 20 and 90. Other significant changes include the widening of the surface grooves, decrease in surface area, increase in number of plagues, and neurofibrillary tangles. These changes affect the brain function and dementia is a disease process that occurs during ageing. However, various factors hinder the memory that include environmental factors, stress, chemical exposure, and a diet poor in adequate nutrients.

As suggested by World Health Organisation (2008), perhaps the most well-established myth is that mental and physical deterioration are inevitable. The elderly experience deterioration as they age, but much of the decline in vigour during old age largely results from the elderly expecting to decline and how society perceives the role of elderly.

2.2.11 Immunocompetence

The overall health of the elderly depends to a great extent on the proper balance between the normal removal of damaged cells via apoptosis and proliferation of the cells that comprise the body. Tipping the delicate balance towards either side may cause disease and hamper successful aging (Zhang and Herman, 2002). During the ageing process the body is exposed to various infectious agents from the environment. According to Fattal-German (1992), the immune system stages an important responsibility throughout the development in maintaining tissue homeostasis, in responding to cellular damage, and in preventing neoplastic diseases. Age associated with changes in the immune system includes the vitro responsiveness and impaired response to vaccination and acute infection and delays the wound healing process (Aspinall, 2005).

The immune system loses its ability to fight off infections during the ageing process, therefore, increasing the risk of being sick, and may make immunisation less effective. Moreover, the immune system's ability to detect and to correct cell defects also declines, and results in an increase of cancers associated with aging (Langan, 2008). Langan (2008) states that later in life, the immune system becomes less tolerant to the body's own cells and in addition, an auto-immune disorder develops where normal tissue is mistaken for non-self tissue, and immune cells attack certain organs or tissues.

According to Langan (2008) and Zhang and Herman (2002), sensation changes, gait changes, changes in the skin structure, in addition to other normal aging changes increase the risk of injury thus allowing bacteria to enter broken skin. Moreover, illness or surgery can further weaken the immune system of the elderly, thus making the body more susceptible to subsequent infections. Diabetes, most common in the elderly, can also lead to a decreased immunity. Aging also affects inflammation and wound healing and many elderly heal more slowly (Zhang and Herman, 2002). Inflammation is an immune response, where when the

immune system thinks there is trouble it sends more cells to the site of the problem. This causes swelling, pain, redness, heat and irritation. Inflammation is often a sign of infection, but it may also occur as part of an auto-immune attack (Zhang and Herman, 2002).

This may be directly related to changes in the immune system, or it may be a result of other problems such as diabetes or arteriosclerosis, which lead to decreased blood flow to some parts of the body such as the lower legs. Delves (2008) further indicates that the elderly immune system becomes less effective in the following ways:

- Decreased ability to distinguish self from oneself (that is, antigens). As a result, auto-immune disorders become more common.
- Macrophages (which ingest antigens) destroy bacteria, cancer cells, and other antigens more slowly. However the slowdown of macrophages is one of the common causes of cancer in the elderly.
- T cells (which remember antigens they have previously encountered) respond less rapidly to the antigens.
- There are fewer white blood cells capable of responding to new antigens. Consequently, when the elderly encounter a new antigen, the body is less able to remember and defend against it.
- Smaller amounts of complement proteins that do not produce as many of these proteins as younger people do in response to bacterial infections.
- The amount of antibodies produced in response to an antigen is less, and the antibodies are less able to attach to the antigen. These changes are the pneumonia related to; influenza, infectious endocarditis, and result in death more often in the elderly.

2.2.12 Special Diets

Elderly encounter dietary problems, thus making food purchasing, food preparation, eating, digestion and absorption using food more difficult. An inability to consume an adequate daily diet places the elderly person at increased risk for medical, physical, and functional problems (Davis, 2000). Good eating habits in addition to proper nutrition are key constituents intended

for healthy aging; however many seniors are at risk of malnutrition. The elderly may experience a range of age-related physiological changes and chronic health conditions and may become increasingly sedentary, and are thus key factors that could affect appetite along with hunger, thus leading to changes in diet composition (Shatenstein, 2008). Key factors contributing to seniors' poor nutritional health include, according to Schiffman, (1997):

- Loss of appetite.
- Illness.
- Medication.
- Chewing and swallowing problems.
- Ill-fitting dentures.
- Loneliness.
- Depression.
- Decreased mobility.

Healthy eating, at any age, raises energy levels, boosts the immune system and protects the body against illnesses such as hypertension, diabetes and osteoporosis (Schiffman, 1997). Shatenstein (2008) indicates that a healthy diet for the elderly provides high levels of nutrition and an appropriate number of calories in small quantities of food that can be easily digested; however, elderly in an advanced stage of illness will therefore require special nutritional attention. Davis (2000) further states that health concerns or multiple risk factors for chronic disease may sometimes necessitate a prescribed diet limited in energy, fat, sodium or cholesterol.

2.3 FACTORS THAT INFLUENCE THE AGING PROCESS

The aging process brings about tremendous changes in the elderly and it may vary from individual to individual. Figure 2.3 identifies the biological, sociological and psychological factors affecting the ageing population, and these factors will be discussed in the next section.

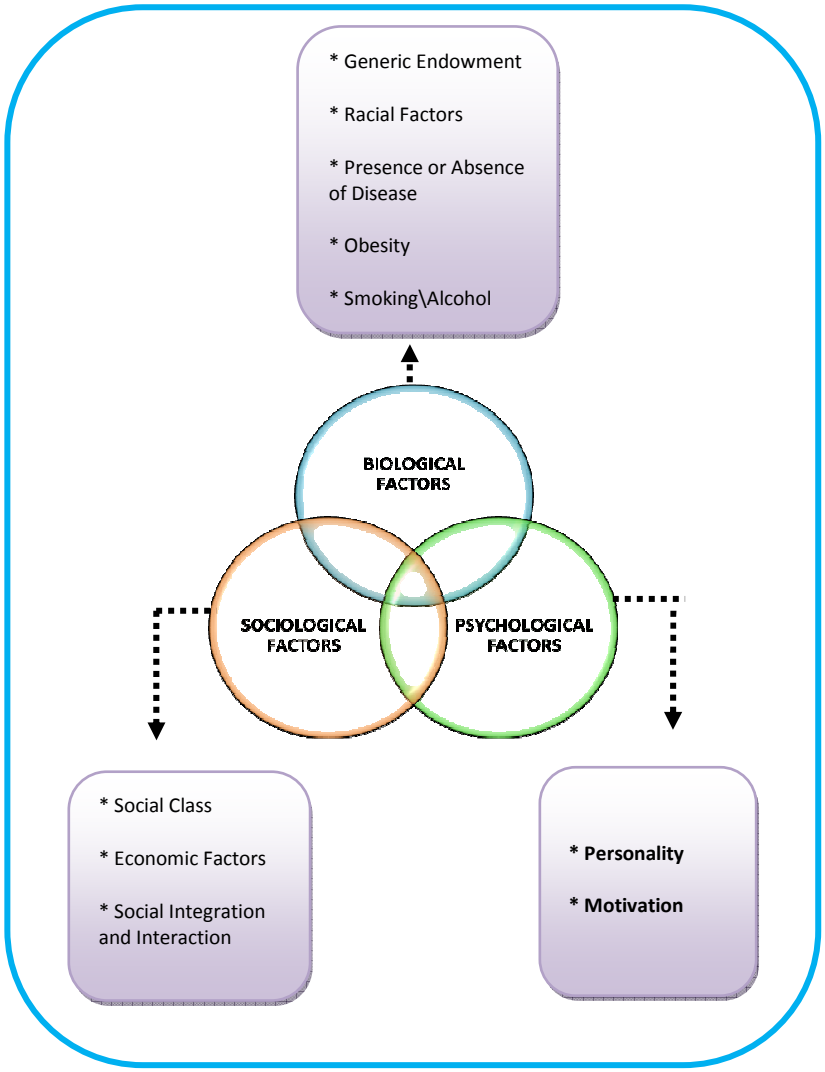

Figure 2.3 Factors affecting the ageing process (De Haan, 1996).

2.3.1 BIOLOGICAL FACTORS

The basic biology and the dynamic, organic nature of the human body are fundamental determinants of health (Haan, 2000).

2.3.1.1 Genetic Endowment

Genetic endowment represents the inherited variations in Deoxyribonucleic Acid (DNA) that is the structure of the building blocks of the human body (The Institute of Medicine (IoM), 2001).

However, human genetic background can predispose individuals to develop inherited disorders or conditions and in addition can influence resistance to diseases and promote general healthiness. Moreover, human genetic endowment, social circumstances, environmental conditions, and health care are identified to be significant determinants of health, but behaviour is estimated to have a larger impact than any of these (IoM, 2001). The choices made about using tobacco, alcohol, physical activity and diet are powerful, changeable contributors to suffering needlessly and dying prematurely (Green, 2005).

Longevity is genetically determined and there is a marked similarity in the age at which death occurs in the members of different generations of family states (Haan, 2000). Genetic endowment provides an inherited predisposition to a wide range of individual responses that affect health status (Green, 2005). However, Green (2005) suggests that socio-economic as well as environmental factors are significant determinants of overall health and in various circumstances genetic endowment appears to predispose certain individuals to particular diseases or health problems.

2.3.1.2 Racial Factors

South Africa has certainly emerged from the colour supremacy but society remains deeply scared by racial discrimination (Moleah, 2004). MacKinnon (2008) indicated that segregation in addition to the later embodiment of Apartheid in South Africa was a multifaceted network of political and economic policies which subordinated Africans to a subservient status in a White-dominated state. Racism in South Africa to a greater extent involved deracializing the ownership of assets and cultural capital while reconciling the principles of equal protection, affirmative action, and nondiscrimination as identified by Mbembe (2008) and Moleah (2004).

During the Apartheid era, strict Apartheid laws dictated where people were allowed to live, where they could go to school (Mbembe, 2008), what occupations they could hold and who they could interact with. Social contact between members of different ethnic groups was prohibited and non-Whites were denied governmental representation as suggested by (MacKinnon, 2008). Racism still exists to an extent, however the countries' elderly have reaped the benefits as they have access to the facilities previously withdrawn (MacKinnon, 2008 and Mbembe, 2008). Moreover, the fundamental need for food, social grants, access to

housing, emotional well-being, environmental harmony regarding access to amenities of transport, safe water and security, and their satisfaction with financial and material possessions have promoted the interests and catered for the elderly (Mbembe, 2008).

2.3.1.3 The Presence or Absence of Disease

Advancing age attracts certain diseases that have an effect on the total body function, where the presence or absence of disease in the elderly is related in subtle and multifaceted ways as stated by Haan (2000). However, the elderly suffering from disease usually die earlier than those less at risk as suggested by Haan (2000). The World Health Organisation (2003a) indicated that the basic diseases which afflict the elderly are the same, such as cardiovascular diseases, cancers, musculoskeletal concerns, diabetes, mental illnesses, sensory impairments and incontinence. However rates, trends and specific diseases differ between men and women as suggested by the WHO (2003b) and Haan (2000).

2.3.1.3.1 Hypertension

Age related vascular as well as neuro-humoral changes are significant aspects leading to the progression of hypertension in the elderly (Pestana, 2002). Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DSP) is relative to fluctuate in arterial resistance and stiffness (Wellman and Kamp, 2008). SBP is most common in both elderly men and women. The World Health Organisation (1999a) stated that hypertension is responsible for more deaths worldwide than any other cardiovascular risk factor which affects the elderly.

Blood pressure increases with age since the arteries become stiffer (Wellman and Kamp, 2008) and consequently, high blood pressure is a very frequent pathology in the elderly. However, the more the arteries become stiffer, there is maximal blood pressure causing the systolic increases compared to the minimal diastolic, which involves an increase in the difference which is the pulse pressure. Hypertension is, therefore, one of the major risk factors for coronary heart disease in the elderly (Steyn and Temple, 2008). Nonetheless, blood pressure is characterised into two categories namely high blood pressure known as hypertension and low blood pressure know as hypotension (Swales, 1999).

Grassi, Seravalle and Bertinieri (2000) further discuss that the arterial compliance deterioration is due to structural along with functional changes with an increase in collagen, ground substance, elastin and extracellular protein matrix which occurs with age, therefore a structural and mechanism alteration in the vessel intima and media. Proliferation of the connective tissue results in the initial thickening and fibrous, thus increasing the stiffness of the vessel with partial loss of contractility. Subsequently, arterial compliance diminishes and the windkessel function of the large arteries decreases (Safar, Blacher and Mourad, 2000). Pulse pressure and pulse wave velocity increases with an earlier reflection of pressure waves from the periphery to a disproportionate increase in SBP. Hypertension is predominantly systolic and isolated systolic hypertension (ISH) is the most common in the elderly (Messerli, Ventura and Glade, 1983). The large artery stiffness is the cause for the increase in SBP and the fall in DBP after the age of 60. Therefore, causing the left ventricular mass, circulating noradrenaline and peripheral vascular resistance to increase during cardiac output; stroke volume, intravascular volume, renal blood flow and plasma rennin activity decreases (Pestana, 2002 and Safar *et al.,* 2000).

The World Health Organisation (1999a) stated that systolic pressure is when the heart's ventricles contract and push the blood through the veins and it is called the systoles, the pressure during heartbeat action. The diastolic pressure is the lower pressure that results when air is released out of the cuff and no more sound is heard. This is called the diastole; the artery resting pressure (WHO, 1999a).

Hypertension may result from changes in dietary quality and nutrient intake and is one of the major treatable factors contributing to the burden of disease globally (Swales, 1999). High blood pressure is responsible for a large and increasing proportion of the burden of disease and it is one of the leading causes of disease in middle-income countries and of emerging importance in low-income countries (Norman, Gaziano, Laubscher, Steyn and Bradshaw, 2007). Hypotension is conversely related when there is insufficient oxygen and nutrients are delivered to the organs such as the brain, heart, and kidney; the organs do not function normally and may be permanently damaged (Swales, 1999). Table 2.1 indicates the blood pressure classification used for measuring blood pressure, whereas Table 2.2 illustrates the WHO (2005) cut off points used for measuring systolic and diastolic blood pressure.

Tale 2.1 Blood pressure classification (World Health Organisation/ International Society of Hypertension (WHO/ISH), 2003).

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

BP – Blood Pressure, SBP – Systolic Blood Pressure, DBP – Diastolic Blood Pressure

Tale 2.2 Systolic and diastolic blood pressure classification (WHO, 2005).

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

Pestana (2002) suggests that cerebrovascular accidents (CVA), congestive heart failure (CHF), coronary artery disease (CHD), end-stage renal failure (ESRF) and sudden death are the elevation of both SBP and DBP risk factors. Social factors in addition to the economic climate in the industrialised world have an enormous impact on hypertension (Grassi *et al*., 2000). In addition, a study conducted by Steyn (2006) indicated that a high intake of sodium is common in South Africa, particularly in poor settings, as it is used to preserve food or to enhance the taste. However, substantial amounts of salt are added to food while cooking and monosodium glutamate based flavouring cubes or salts are widely used to give taste to food (Steyn, 2006). In addition to a high salt intake, people in Sub-Saharan Africa frequently eat small amounts of fruit and vegetables resulting in low potassium intake (Steyn, 2006).

2.3.1.3.2 Stroke

Stroke is one of the most common chronic diseases of lifestyle that affect the elderly (Barnes Miyasaka, Seward, Gersh, Rosales, Bailey, Petty, Wiebers, and Tsang, 2004 and Elkind

2003). Fourie (2007) acknowledges a stroke to be known as a cerebrovascular accident (CVA), which occurs when the blood flow to the brain is interrupted. However, this could either happen when a blood vessel to the brain ruptures, causing bleeding, or becomes blocked by a blood clot. The affected brain cells then start to die due of a lack of oxygen and other nutrients. The severity of a stroke varies from a passing weakness or tingling in a limb to a profound paralysis, coma or death (Barnes *et al.,* 2004 and Fourie, 2007). The Heart and Stroke Foundation of South Africa (2010) and Elkind (2003) indicate the following as key predictors of stroke in the elderly:

- High blood pressure above 140/90.
- Current heart disease.
- Overweight.
- Diabetes.
- Poor physical activity.
- Smoking.
- Excessive alcohol consumption.

There are two major varieties of stroke, namely haemorrhagic and ischemic. Table 2.3 identifies the varieties of strokes amongst the elderly as approximately 15 – 20 percent of strokes are haemorrhagic, divided between subarachnoid haemorrhage and primary intracerebral haemorrhage. The former 85 – 80 percent is classically related to the rupture of berry aneurysms (Elkind, 2003).

Table 2.3 Stroke subtypes that effect the elderly (Elkind, 2003).

Type	Proportion of All Strokes
Hemorrhagic	15 – 20%
Subarachnoid haemorrhage	
Intracerebral haemorrhage	
Ischemic	80 – 85%
Proportion of ischemic strokes	
Extracranial atherosclerosis	10%
Intracranial atherosclerosis	10%

Cardioembolic	20%
Lacunar	20 – 30%
Cryptogenic	30 – 40%
Other (dissection, vasculitis, etc.)	<5%

A stroke often leaves its sufferers being more disabled and is a high social burden to family and friends (Mazza, Pessina, Pavei, Scarpa, Tikhonoff and Casiglia, 2001). Fourie (2007) states that the effect of a stroke consequently leave some parts of the body paralysed and problems with speech may be experienced.

2.3.1.3.3 Diabetes Mellitus

Diabetes Mellitus is a condition characterised by chronic hyperglycemia in addition to disturbances of carbohydrate, fat and protein metabolism, associated with an absolute or relative deficiency in insulin secretion and/or insulin action (Gupta and Suri, 2002 and Wellman and Kamp, 2008). The prevalence of diabetes within the elderly population has increased as suggested by (Meneilly and Tessier, 2001). According to a study conducted by Meneilly and Tessier (2001), there are a number of age-related changes in carbohydrate metabolism which include alterations in glucose-induced insulin release and resistance to insulin-mediated glucose disposal; the genetic environment associated by means of the progressive increase in the incidence of diabetes with aging. Meneilly and Tessier (2001) further acknowledge that the prevalence of diabetes has increased in certain ethnic groups, thus implying that genetic factors also play an important role. Lifestyle factors have a profound impact on the development of diabetes. Similarly, Morley (2000) states that obese elderly, especially if the distribution of body fat is central, with diets high in saturated fat and low in complex carbohydrates, or inactive, are most expected to develop diabetes. The World Health Organisation (2003c) indicated that during the past decade it has been obvious that the prevalence of type 2 diabetes is increasing rapidly and by the year 2030 at least 350 million people in the world will be diagnosed with type 2 diabetes.

Diabetes is classified in 2 types namely, type 1 is identified as the juvenile diabetes, insulin-dependent diabetes mellitus (IDDM), and is an auto-immune disease that occurs when the

producing beta cells within the pancreas are gradually destroyed and eventually fail to produce insulin (WHO, 2006). However, type 1 diabetes is inherited or has generic predisposition. According to the World Health Organisation (2006), type 2 diabetes known as non insulin dependent and results from the body's ineffective use of insulin.

According to the World Health Organisation (2006), diabetes over time can have the following effects on the elderly's heart, blood vessel, eyes, kidneys as well as nerves:

- Diabetes increases the risk of heart disease as well as stroke.
- Combined with reduced blood flow, neuropathy in the feet increases the chance of foot ulcers and eventual limb amputation.
- Diabetic retinopathy is an important cause of blindness, and occurs as a result of long-term accumulated damage to the small blood vessels in the retina. However, after 15 years of living with diabetes, approximately 2 percent of the elderly become blind, and 10 percent develop severe visual impairment.
- Diabetes is among the leading causes of kidney failure.
- Diabetic neuropathy is damage to the nerves as a result of diabetes, and affects up to 50 percent of the elderly with diabetes. Although many different problems can occur as a result of diabetic neuropathy, common symptoms are tingling, pain, numbness, or weakness in the feet and hands.
- The overall risk of dying among people with diabetes is at least double the risk of their peers without diabetes.

Therefore, following a simple lifestyle to maintain healthy body weight, being active, following a nutritious balanced diet and avoiding the use of tobacco and alcohol will be beneficial to the elderly.

2.3.1.3.4 Cardiovascular Disease (CVD)

Goldberg and Chavin's (1997) study has identified chronic disease as the main cause of old age disability. According to the World Health Organisation (2007b), chronic diseases or health conditions are caused by permanent pathological alteration in addition to leaving residual disabilities that require long-term care. However, degenerative diseases, such as

cardiovascular, cerebrovascular disease, diabetes, osteoporosis as well as cancer, are all diet related and are among the most common diseases that affect the elderly (Goldberg and Chavin, 1997). Cardiovascular disease is regarded as deaths later in life rather than a cause of ageing as suggested by Wellman and Kamp (2008), and is a nutrition related disease that transpires from unhealthy food choices. Contributing factors to CVD is a decreased minimum heart rate, decrease arterial wall compliance; decreased responsiveness to b-adrenergic stimuli, increased left ventricle muscle mass and a slow ventricular relaxation (Wellman and Kamp, 2008).

Poor nutritional status is a principal concern for the elderly and nutritionally insufficient diets can contribute to or exacerbate chronic and acute diseases and these hasten the advancement of degenerative diseases associated with aging (Blumberg, 1994). Globally the aged is an underlying determinate of chronic diseases (Wang, Kong, Wu, Bai and Burton, 2005). According to the World Health Organisation (2002a), chronic diseases are of long duration and generally slow progression as there were estimates of 56 million deaths globally and 37.0 percent in South Africa. Munro and Schlierf (1992) acknowledged in their research that the major chronic diseases are influenced by long term intake of fat, calcium, sodium, vitamin A or fibre, and Wang *et al.* (2005) stated that cardiovascular disease is generally the frequent cause of death amongst the elderly.

2.3.1.3.5 Osteoporosis

Ersoy (2007) defines osteoporosis as a systemic disease causing bones to become porous and more susceptible to fractures of especially the spine, hip and wrist. The risk factors include advancing age, female gender, ethnic background, decreased calcium intake, gastric acid suppression therapy, sedentary lifestyle, premature loss of gonadal function, decreased estrogen secretion, thin body habitus, decreased physical activity, cigarette smoking, alcohol abuse, excess glucocorticoid exposure, and possibly some genetic factors. According to Crandall (2010), a normal bone is composed of protein, collagen and calcium, all of which provide bone with its strength. Bones that are affected by osteoporosis have the ability to break with relatively minor injury that normally would not cause a bone to fracture. The fracture can be either in the form of cracking (as in a hip fracture) or collapsing (as in a compression fracture of the vertebrae of the spine) (Wellman and Kamp, 2008 and Crandall,

2010). The spine, hips, ribs, and wrists are generally common areas of bone fractures from osteoporosis although osteoporosis-related fractures can occur in almost any skeletal bone (Hougha, 2005).

According to Hougha (2005) and Ersoy (2007) the following are the risk factors for osteoporosis in the elderly:

- Bone mass density (BMD) is one component of fracture risk in the elderly.
- Osteoporosis has a large genetic component, as parental history confers an increased risk of fracture that is independent of BMD.
- Physical inactivity and a sedentary lifestyle as well as impaired neuromuscular function that is reduced muscle strength, impairs gait and balance.
- Smoking can lead to lower bone density and higher risk of fracture as this risk increases with age.
- A high intake of alcohol confers a significant risk of future fracture, the risk of vertebral and hip fractures in elderly men increases greatly with heavy alcohol intake, particularly with long term intake.
- Prolonged use of corticosteroids is the most common cause of secondary osteoporosis.
- Proton pump inhibiting drugs can reduce the absorption of calcium from the stomach and long term use of these drugs can significantly increase the risk of an osteoporosis-related fracture.
- Low body weight and weight loss is associated with greater bone loss.
- After an initial low trauma fracture from a fall, both older men and women have an increased risk.
- Equivalent risk of all types of subsequent fractures.
- Falls contribute to fractures - 90% of hip fractures result from falls. However, a third of the elderly fall annually, with approximately 10-15% of falls resulting in fracture, and almost 60% of those who fell the previous year will fall again.

However, a well balanced diet can maximize bone health in the elderly in addition to supplementation which has a positive effect on bone mineral density (Ersoy, 2007).

2.3.1.3.6 Gout

A study by Wu, Patel, Yu, Mody, Cahill, Tang and Krishnan (2008) indicated that gout is by far the most common inflammatory arthritis experienced by the elderly population characterized by sudden attacks of extremely painful, swollen, hot joints. However, gout is a metabolic disease characterized by the formation in addition to reversible deposition of monosodium urate (MSU) crystals within the joints and extra-articular tissues, usually occurring after a prolonged period of hyperuricemia. Nevertheless, Choi (2005) mentioned that the elderly who experience gout are associated with dissolving uric acid in the blood as it passes through the kidneys and out of the body in urine, although uric acid can build up in the blood when the body increases the amount of uric acid it creates; the kidneys do not get rid of enough uric acid and the consumption of too many foods high in purines (Wu *et al.,* 2008). Poor dietary as well as lifestyle trends and the increasing prevalence of obesity (Choi, 2005 and Wu *et al.,* 2008) indicate that the metabolic syndrome shows the increasing incidence of gout in the elderly.

2.3.1.3.7 Anaemia

Anaemia in the elderly is a very common problem that is associated with increased mortality and poorer health-related quality of life, regardless of the underlying cause of the low haemoglobin (Steensma and Tefferi, 2007). Anaemia defined as the below-normal level of haemoglobin or hematocrit with haemoglobin being the protein in red blood cells that carries oxygen to all parts of the body (Ohta, 2009). According to the World Health Organisation (2001), anaemia occurs when haemoglobin levels fall below 13 g/dl in men and 12 g/dl in women. The most common cause of anaemia in the elderly is the type that is associated with chronic disease (Steyn and Temple, 2008) however, Vitamin B_{12} deficiency, folate deficiency, gastrointestinal bleeding and myelodysplastic syndrome are among other causes of anaemia in the elderly (Kumar and Carson, 2008). As suggested by Oldewage-Theron *et al.* (2008c), the South African dietary inadequacies of iron are likely to occur in situations due to economic constraints, staple diets are predominantly plant-based, poor in iron and of low iron bio-

availability. Low economic status contributes significantly to a higher risk of anaemia in the elderly (Oldewage-Theron *et al*., 2008a).

2.3.1.3.8 Pressure Ulcers

A study conducted by Steyn and Temple (2008) mentioned that pressure ulcers are frequently associated with age-related diseases as well as generating discomfort of daily activities A pressure ulcer is an area of skin that breaks down when the elderly stay in one position for too long without shifting their weight, which often occurs if the elderly uses a wheelchair or is confined to bed, even for a short period of time (Dharmarajan and Ugalino, 2002). The constant pressure against the skin reduces the blood supply to that area, and the affected tissue dies. A pressure ulcer begins as reddened skin but gets progressively worse, forming a blister, then an open sore, and finally a crater. The most common area for pressure ulcers to occur is over bony prominences (bones close to the skin) like the elbow, heels, hips, ankles, shoulders, back, and the back of the head (Lehrer and Zieve, 2008). In essence, elderly that are not mobile, are malnourished, have frail skin, mental disability along with urinary or bowel incontinence encompass an increased risk of having pressure ulcers.

2.3.1.3.9 Obesity

Samuel and Atinmo (2008) mentioned that obesity, once thought to be a problem of developed countries, the epidemic and its associated chronic diseases is now growing in the developing world. This is influenced by the dietary and lifestyle changes that accompany economic development which include less physically demanding manual labour, urbanisation, rising purchasing power and modernised food marketing. However, obesity is the major contributor to functional decline and disability in elderly people (Huan, Lee, Lee, Chang, Lin, Tu and Pan, 2005).

A study conducted by Bechtold *et al.* (2006), mentions that obesity is characterized by an increase in total body and or abdominal fat. However, fat tissue is not a simple energy storage organ, but has important endocrine and immune functions, producing regulatory and immunological molecules such as adiponectin, leptin, and cytokines; an imbalance of these molecules in obese subjects can affect vascular (endothelial) function, increasing the

production of vasoconstrictor proteins and causing oxidative stress (Montano Lera, Gottlieb, Schwanke, Da Rocha, Manica-Cattani, Dos Santos and Da Cruz, 2009). As suggested by Ridderstråle, Johansson, Rastam and Lindblad (2006) obesity is an important predictor and cause of type II diabetes and cardiovascular disease. Both lifestyle factors, such as energy expenditure associated with physical activity, and genetic factors play important roles in the development of obesity. Obesity is increasing due to alternations in dietary and occupational habits, including increased caloric intake and decreased physical activity (Bechtold *et al.,* 2006).

Elderly people have been found to present a progressive increase in fat depots in the trunk and abdomen, whereas the subcutaneous fat usually decreases, especially at the limbs as indicated by Chumlea and Baumgartner (1989). According to Ridderstråle *et al.* (2006), the intra-abdominal fat accumulation has been known to be intimately associated with insulin resistance and its related disorders, including type 2 diabetes, hypertension, and dyslipidemia.

2.3.1.3.10 Cancer

Cancer is known as any malignant growth or tumour caused by abnormal as well as uncontrolled cell division multiplying and invading other tissues to other parts of the body through the lymphatic system or the blood stream (Wellman and Kamp, 2008). The American Cancer Society (2007) reported that cancer is caused by both external factors (tobacco, chemicals, radiation, and infectious organisms) and internal factors (inherited mutations, hormones, immune conditions, and mutations that occur from metabolism). These causal factors may act together or in sequence to initiate or promote carcinogenesis.

Berger, Savvides, Koroukian, Kahana, Deimling, Rose, Bowman and Mille (2006) indicate that the incidence of cancer in those over 65 is 10 times greater than in those younger than 65 and the cancer death rate is 16 times greater in patients over 65 compared to younger patients. More than 70 percent of the mortality associated with many cancers including prostate, bladder, colon, uterus, pancreas, stomach, rectum and lung occurs in patients 65 and older.

The National Cancer Institute, (2009) have identified that the main categories of cancer include:

- Carcinoma - cancer that begins in the skin or in tissues that line or cover internal organs.
- Sarcoma - cancer that begins in bone, cartilage, fat, muscle, blood vessels, or other connective or supportive tissue.
- Leukemia - cancer that starts in blood-forming tissue such as the bone marrow and causes large numbers of abnormal blood cells to be produced and enter the blood.
- Lymphoma and myeloma - cancers that begin in the cells of the immune system.
- Central nervous system cancers - cancers that begin in the tissues of the brain and spinal cord.

2.3.1.3.11 Metabolic Syndrome

Metabolic syndrome has become a quandary globally largely affecting the elderly and is an entry to a multitude of chronic related diseases in addition to becoming increasingly important due to the worldwide epidemic of overweight and obesity (Wellman and Kamp, 2008). During the ageing process, diseases such as the metabolic syndrome will become increasingly apparent in the elderly due to obesity (Bechtold *et al.,* 2006). The metabolic syndrome is a constituent of fatal aspects, specifically diabetes, hypertension, hyperuricemia, lipid abnormalities, and alterations in thrombotic potential, that are associated with hyperinsulinemia and insulin resistance (Morley, 2004 and Bechtold *et al*., 2006).

Metabolic syndrome is directly related to an increased atherogenesis as well as death from myocardial infarction and is directly related to the accumulation of visceral adiposity in middle age associated with overeating and a decline in physical exercise (Morley, 2004). In addition to insulin as the main contributor, however, there are two other hormones that have been associated with the development of the metabolic syndrome, namely leptin and adiponectin, both of which are peptide hormones produced from adipose tissue (Bechtold *et al.,* 2006). A study conducted by Zuliani, Volpato, Galvani, Blè, Bandinelli, Corsi, Lauretani, Maggio, Guralnik, Fellin and Ferrucci (2009) indicates that metabolic syndrome is a typical condition of

middle-aged and older people; indeed, in Western countries, the prevalence of metabolic syndrome progressively increases with age ranging from 3 to 6 percent among subjects younger than 30 years to 25-40 percent among subjects aged over 70 years.

Misra, Wasir, Vikram and Sadikat *(*2005) reported on research conducted by several investigators; Asian Indians appear to have more severe insulin resistance than White Caucasians, even when adiposity is matched. Since then, insulin resistance, non-esterified fatty acids, and dyslipidemia have reported to be higher in Asian Indians at a lower waist circumference levels due to higher values of body fat, intra-abdominal fat and truncal fat (Banerji, Lebowitz, Chaiken, Gordon, Kral and Lebovitz*,* 1997 and Raji, Seely, Arky and Simonson, 2001). Figure 2.4 illustrates that the metabolic syndrome may possibly be conceived as the ‘‘couch potato’’ syndrome in the elderly due to the alternations in dietary and occupational habits, including increased caloric intake and sedentary behaviour.

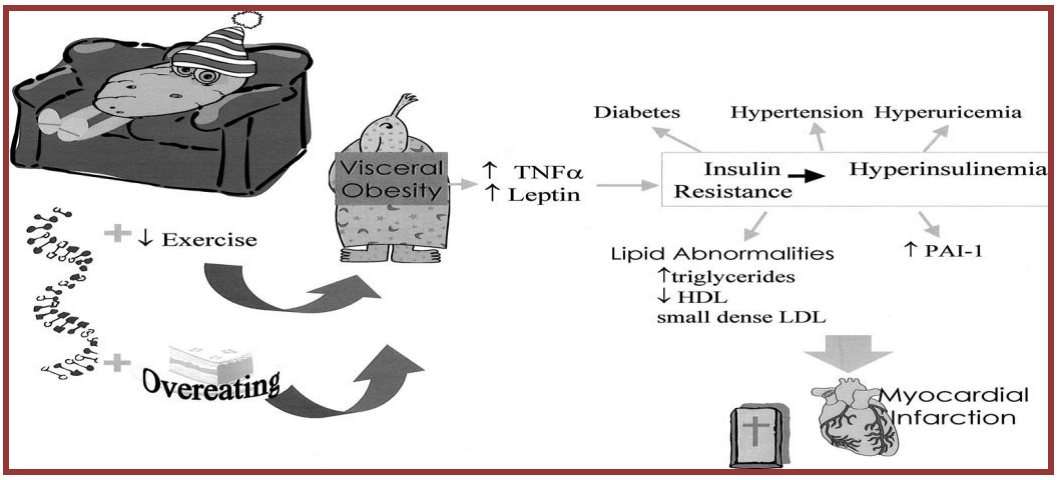

Figure 2.4 The components of the metabolic syndrome (Morley, 2004).

2.3.1.3.12 Smoking/Alcohol

Most elderly who smoke start from their teen years and, therefore, it becomes difficult to stop during adulthood. Smoking accelerates the ageing process and hastens death according to (Wellman and Kamp, 2008). Smoking has a negative impact on health status of the elderly, in addition to risks of lung cancer; smoking is also an independent predictor of cardiovascular morbidity, mortality and the development of myocardial infarction (Peters, Poulter, Warner,

Beckett, Burch and Bulpitt, 2008). However, Peters *et al.* (2008) further argues that the impact of smoking may also accelerate cerebral atrophy, perfusional decline and white matter; in contrast the lesions nicotine has plausible mechanisms for aiding cognitive function.

Marinho, Blay, Andreoli and Gastal (2007) reported that the use of tobacco has been principally associated with negative health events, thus contributing to mortality as well as morbidity due to many diseases such as lung cancer, respiratory diseases, cancers of the upper respiratory and digestive tracts, ischemic heart disease, stroke and peptic ulcer in the elderly. Additionally, the most important behavioural factor related to health in the elderly is smoking as stated by Riley and Williams (1989).

However, the effects of alcohol on the cellular and organ levels are altered by changes in physiology related to aging. Absorption of alcohol from the gastrointestinal tract is equally rapid among all age groups; nevertheless, the loss of lean body mass related to aging may reduce the volume of alcohol distribution, resulting in an increased peak ethanol concentration with any given dose of alcohol (Marinho *et al.,* 2007). A study conducted by the Institute of Alcohol Studies (2009) states the onset of elderly consuming alcohol and the disruption of lifestyle such as retirement and decreased social activity, are contributory factors among the elderly who develop a problem with consuming alcohol later. Isolation and loneliness, physical or emotional stress, insomnia and retirement in old age can lead to increased drinking. Illness and pain which might accompany old age may lead to the use or start of use of alcohol as an anesthetic (Mirand and Welte, 1996 and Rigler, 2000).

Alcohol reduces brain function to a greater extent in older people, impairing co-ordination and memory, which can lead to falls and general confusion. Simpson (1992) as well as Mirand and Welte (1996) state that it also heightens emotions leading to moodiness, irritability or even violence. Moreover, alcohol in excess affects digestion, making it more difficult to absorb vitamins and minerals. According to Rigler (2000), nutritional deficiencies, particularly of folate and thiamine, occur when food intake is reduced since calories are derived from alcohol, or when access to nutritious food is limited (Mirand and Welte, 1996 and Simpson, 1992).

2.3.2 SOCIOLOGICAL FACTORS

South African elderly are adapting to the transition from the Apartheid era that has implicated drastic changes on their lifestyle, thus impacting on their nutrient intake. An increase in family size due to illness and the HIV and AIDS epidemic has left the elderly as caregivers to their children and grandchildren (McCornack, 1997). Access to housing, water, electricity and sanitation has made the elderly more socially confident. Barasi (2003) stated that the lack of adequate nutrition education in addition to the existence of obsolete beliefs about food may prevent the elderly from having a healthy diet. Elderly that move from rural areas to urban areas have the ability to improve their lifestyle which in turn allows them to feel secure (Barasi, 2003).

2.3.2.1 Social Class and Isolation

Socialisation of food would impact on the nutrient intake and, therefore, the deterioration impinges social networks that can be attributed to death of spouse, siblings or friends, a disability or illness McCornack (1997). Davis, Randall, Forthofer, Les and Margen (1985) reported that the elderly living alone have a reduced nutrient intake compared to those who live in the company of others. Social networks provided partnerships associated with food, include shopping, meal preparation and companionship. According to McCornack (1997), the elderly in a higher class live longer and death rates are highest in the most deprived sections of the community. Barasi (2003) indicated that the nutritional status and food intake was poorer in an elderly group who were living on their own and this mostly affects married men and women rather than single men and women.

2.3.2.2 Economic Factors

The rich live longer than the poor due to better nutrition, medical resources, safer environment and less hazardous occupations which contribute to the lower death rate indicated by Haan (2000). According to Bohman, Vasuthevan, Van Wyk and Ekman (2007), the most important form of financial social support to elderly in South Africa is the old age grant provided by the government. Cherchye, De Rock and Vermeulen (2008) suggests that the issue of poverty is especially troublesome for the elderly since they have fewer

possibilities to recover from a reduced income, and find it difficult to re-enter the labour market due to their age. The decrease in income after retirement and a lower life expectancy including the lack of ways to return back on track to avoid poverty among the elderly tends to be more permanent (Bohman *et al.,* 2007). South African Social Security Agency (SASSA) (2010), indicated that the amount of the pension is relatively large, currently R1010.00 per pensioner each month. Rises in food prices cause an immense strain for the elderly when purchasing food, as they are restricted to buying the cheaper foods that are usually low in adequate nutrients (Bohman *et al.,* 2007 and Cherchye *et al.,* 2008).

2.3.2.3 Social Integration and Interaction

Pope (2008) suggests that strong social associates, through friends, family as well as community groups, can preserve elderly brain health and the implications of social isolation may be an important risk factor for cognitive decline in the elderly. Zunzunegui (2003) states that social relations, including social networks, social integration, and social engagement, impact significantly on the mental and physical health of elderly people. However, elderly who are socially active are less likely to suffer from depression along with the reoccurrence of cancer as indicated by (Zunzunegui, 2003). The adverse affects of social interaction may lead to an increased consumption of poor nutrient intake of foods, alcohol and cigarette smoking.

2.3.3 PSYCHOLOGICAL FACTORS

The nature of the health condition along with its effect on physiological function will drive the dietary change process (Charlton *et al.,* 2008). Hunger is generally observed as a psychological factor that drives eating in the elderly and a decline in responsiveness to hunger may reflect a physiological age-related impairment, with significant consequences for appetite and food intake as suggested by De Castro and Stroebele (2002), Morley (1997), Clarkston, Pantano, Morley, Horowitz, Littlefield and Burton (1997) and Hays and Roberts (2006). Depression is predominately caused due to loss of loved ones and significantly aids in poor food intake resulting in malnutrition. Memory loss may also include erratic eating behaviour (Barasi, 2003).

2.3.3.1 Personality

Haan (2000) states that old age is a true test of personality. However, personality does not change during ageing, but certain traits, or personality features become more pronounced. Optimism, enthusiasm as well as an interest in life will facilitate adaptation to the inevitable changes of ageing.

2.3.3.2 Motivation

Motivation is theoretically defined as an essential part of the change process that directs the construction of intention to initiate and maintain healthy behaviour change (Wellman and Kamp, 2008). Through intention individuals generate plans and strategies for goal achievement and determine commitment to valued outcomes. Motivation is merely related to those aged that are motivated to remain young and upon doing so, age much more slowly. This is due to mental and physical activity which contributes towards longevity (Haan, 2000).

2.3.3.3 Depression

Depression is the cause of mental impairment, which is not inevitable in the ageing process. The cause and risk factors of depression vary in each elderly person and is often caused by poor health conditions, grief, reduce sense of purpose, loneliness and isolation, medication that may trigger or exacerbate depression and stress (Ballmaier, Kumar, Elderkin-Thompson, Narr, Luders, Thompson, Hojatkashani, Pham, Heinz and Toga, 2007 and Wellman and Kamp, 2008). Evans and Mottram (2000) state that the tendency of depression is denied by the current generation of elderly population, many of whom were raised in an atmosphere where showing feelings were discouraged and this added towards the diagnostic difficulties. Ballmaier *et al.* (2007) further state that comorbid medical conditions, the tendency of elderly to sometimes display cognitive deterioration, along with multiple life events, often due to loss (e.g. bereavement, retirement, moving to smaller housing), all further complicate the diagnostic process aids. Depression was also shown to be associated with hypertension and to be an independent risk factor for coronary heart disease.

2.3.3.4 Dementia

Dementia is a brain condition characterized by progressive intellectual impairment and the symptoms caused by disorders that affect the brain in the elderly (Wellman and Kamp, 2008). Cognitive or intellectual functions are our "brain power" and consist of memory, sensory processing, motor control, planning and organisation, attention and concentration, and speech (Salzman, Jeste, Meyer, Cohen-Mansfield, Cummings, Grossberg, Jarvik, Kraemer, Lebowitz, Maslow, PollockRaskind, Schultz, Wang, Zito and Zubenko, 2008). Dementia affects mainly cognitive functions, but as the disease progresses it affects all aspects of brain functioning. Elderly with dementia may not be able to think well enough to do normal activities, such as getting dressed or eating. The elderly may lose their ability to solve problems or control their emotions, their personalities may change and they may become agitated or see things that are not there. The elderly who suffer from Alzheimer's disease and stroke are the most likely to be affected by dementia according to Salzman *et al.* (2008).

2.4 NUTRITIONAL REQUIREMENTS OF THE ELDERLY

Decline in organ function and changes in body mass and body composition including physical activity influences the nutrient needs of the elderly (Garrow, James and Ralph, 2000) and, therefore, there is a need for special nutrient requirements as ageing affects absorption, use and excretion (Wellman and Kamp, 2008). According to Garrow *et al*. (2000), current knowledge of the importance of diet and nutrition in maintaining health and preventing disease is an integral part towards the care of the elderly. Free living elderly as opposed to institutionalised elderly have a lower prevalence of malnutrition (Garrow *et al.,* 2000). The most important factor that contributes directly and indirectly to the quality of life of the elderly is nutrition, as overnutrition appears to be more of a problem for the health status of the elderly in South Africa than undernutrition.

A study conducted by Garrow *et al.* (2000) reported on the body changes that influence nutrient requirements of the elderly:

- Muscle mass decreases so energy requirements decline; physical activity requires fewer calories.
- Slower uptake of Vitamin A in peripheral tissues, so higher circulating levels.
- Decline in immune function with increased susceptibility to infection and malignancy; this may be counteracted with increased intake of vitamins and minerals.
- Skin synthesis of vitamin D diminishes.
- Vitamin B6 utilization diminishes.
- One third of elderly have a limited secretion of stomach acid which affects absorption of vitamin B12, folic acid, calcium, iron and zinc and partly explains the tendency for depletion and the possible need for supplements of these nutrients.

2.4.1 Recommended Dietary Intake (DRIs)

The Nutrition Information Centre of the University of Stellenbosch (NICUS) (2003) has reported on the DRIs established by the United States Food and Nutrition Board of the Institute of Medicine. To formulate the DRIs represents a paradigm change from preventing a deficiency condition, as resolute through scientific manifestation, to take complete advantage of health and thus improve quality of life. The final is determined by practical procedures thus incorporating the reduction of chronic disease risk by strategically directing for groups and individuals. However, a nutrient requirement is divergent as the lowest continuing intake level of a nutrient that, for a specified marker of adequacy, will maintain a defined level of nutrient in an individual.

The Nutrition Information Centre of the University of Stellenbosch (2003) indicated that the DRI framework incorporates the following into its objectives:

• To formulate recommendations to meet a variety of uses.

• The contribution by nutrients in the risk reduction of chronic disease.

• The inclusion and review of other food components.

• The use and the rationale for functional end points.

• The assessment of estimates of upper safe levels of nutrient intake.

The statistics used in support of formulating the DRIs have principally appeared from scientific, dose-response, balance, depletion-repletion, observational, and case-control studies and only publications in peer reviewed journals were used, NICUS (2003).

The DRI's are categorized into a set of four nutrient-based reference values, of which each type of DRI refers to the average daily nutrient intake and it is, therefore, the average mean intake over time that is the nutritionally important reference value (NICUS, 2003).

- Estimated Average Requirement (EAR) is the average daily dietary intake level estimated to meet the nutrient requirements of half of all healthy individuals in a particular life stage and gender group. The EAR is a dietary intake value and it includes an adjustment for an assumed bioavailability of the respective nutrient. The EAR is used as the basis in setting the RDA. If sufficient scientific evidence is not available to establish an EAR, no RDA is set.
- Recommended Dietary Allowance (RDA) is the average daily dietary intake level sufficient to meet the nutrient requirements of nearly all healthy individuals in that gender group, at the given life-stage.
- Adequate Intake (AI) is used in a case where the scientific evidence is inadequate to set an EAR. Therefore, in such cases, the AI reference is used instead of the RDA. The AI is based on experimentally resultant intake levels or approximations of observed mean nutrient intakes by a group of healthy people, who have normal circulating nutrient blood concentrations, growth, or other functional indicators of health. An AI is seen as an indication that substantially more research is required in order to have an EAR established and to have an RDA calculated.
- Tolerable Upper Intake Level (UL) is maximum level of daily nutrient intake likely to pose no risk of adverse health effects for almost all individuals in the general population (NICUS, 2003).

2.4.2 Macronutrients

Wellman and Kamp (2008) defined macronutrients as the nutrients which recommend calories or energy. Nutrients are substances essential for growth, metabolism, as well as for other body functions. Macronutrients are nutrients essential in large amounts and are carbohydrate, protein and fat. The functions of macronutrients in the elderly are acknowledged by Olivares, Hertramp, Capurro and Wegner (2000):

- Macronutrients are carbohydrates, proteins, fats and individual fatty acids which have been identified to reduce the risk of chronic disease.
- Macronutrients primarily provide the body with energy and, therefore, good nutrition from consuming a healthy diet, which is the foundation of the bio psychosocial model of natural health.

Olivares *et al.* (2000) explained that the elderly have decreased physical activity, changed dietary patterns and, in developing countries, a lowered food supply due to socio-economic factors. Wellman and Kamp (2008) further mention that these factors make the elderly more prone to developing anemia and micronutrient deficiencies which affect erythropoiesis. The principal nutritional causes of poor macronutrient intake of anemia are iron, folate, vitamin B12 deficiencies, and protein energy malnutrition (Olivares *et al.*, 2000).

2.4.2.1 Energy

Due to numerous age-related changes the energy requirements occur continually throughout the adult life cycle (FAO, 2001). However, it is most important that food must satisfy the energy requirements for the attainment and maintenance of optimal health in old age (Gaillard, Alix, Salle´, Berrut and Ritza, 2006). Moreover, it is important for the elderly to ensure energy balance is achieved with the amount of energy needed to match energy expenditure. However, the Estimated Energy Requirement (EER) is an average dietary energy intake that is predicted to maintain energy balance in a healthy adult of a given age, gender, weight, height and level of physical activity, consistent with good health (NICUS, 2003). Moreover, any energy intake above the EER would lead to undesirable and potentially hazardous gain in weight (IoM, 2000). Table 2.4 depicts the physical activity level categories which the elderly would follow. However, the elderly respondents in this study were low active

since the results in Chapter 4 illustrated that the majority of the elderly indicated physical activity at some level. Table 2.5 illustrates the calculations for the elderly respondents EER in this study.

Table 2.4 The categories of physical activity level (NICUS, 2003)

Physical Activity Level (PAL) Categories	
Sedentary	PAL ≥ 1.0 - < 1.4
Low active	PAL ≥ 1.4 - < 1.6
Active	PAL ≥ 1.6 - < 1.9
Very active	PAL ≥ 1.9 - < 2.5

Table 2.5 Calculation of the Estimated Energy Requirement (EER) for the elderly (NICUS, 2003).

Conversation: 1kcalorie = 4.184 Kilojoules For each above 30 years subtract 7 kcal/day for women and 10 kcal/day for men	
MEN (n=59)	**WOMEN (n=191)**
Average Age ➧ 70 years	Average Age ➧ 69 years
Average Weight ➧ 69.22 kg	Average Weight ➧ 67.83 kg
Average Height ➧ 1.66 m	Average Height ➧ 1.57 m
Average BMI ➧ 25.12 (kg/m²)	Average BMI ➧ 27.51 (kg/m²)
EER (Low Active, BMI 24.99 kg/m²) ➧ 2566	EER (Low Active, BMI 24.99 kg/m²) ➧ 2037
CALCULATION	**CALCULATION**
Every year above 30 = **40 years**	Every year above 30 = **39 years**
40 years x 4.184kj = **167.36 kJ**	39 years x 4.184kj = **163.17 kJ**
10 x 4.184 kj = **41.84 kJ**	7 x 4.184 kj = **29.28 kJ**
167.36 kj - 41.84 kj = **125.52 kJ**	163.17 kj - 29.28 kj = **133.89 kJ**
2566 x 4.184 kj = **10736.14 kJ**	2037 x 4.184 kj = **8522.80 kJ**
10736.14 – 125.52 kj = **10610.62 kJ** (EER)	8522.80 kj – 133.89 kj = **8388.91 kJ** (EER)

BMI - Body Mass Index
EER - Estimated Energy Requirement
kJ - Kilojoules

2.4.2.2 Carbohydrate

Energy needs of the elderly decrease with age and are due to a reduction in physical activity and a decrease in basil metabolism as stated by Shetty (2002). The Food and Nutrition Board, Institute of Medicine (2000) indicated the carbohydrate RDA/AI g/day is 100g per day for men and women aged 60+ years. Carbohydrate food sources include bread, pasta, rice and cereals. The lack of occupational activity on retirement and a reduced load of optional household activities and ageing disabilities may also influence the energy intake. A fine balance between food intake and energy expenditure permits the maintenance of energy homeostasis, optimal body weight, and body composition (NCUS, 2003 and Wellman and Kamp, 2008).

The regulation of food intake in addition to energy metabolism is dependent on a set of interrelated neuronal, hormonal, and metabolic signals sent by the central and peripheral nervous systems (Schwartz, Woods, Porte, Seeley and Baskin 2000 and Bray, 2000). However, the elderly mechanisms governing satiety as well as energy metabolism are impaired (Poehlman and Toth, 1996 and Poehlman, 1998). Additionally, this may possibly reduce normal short and long-term compensatory mechanisms for customary variations in energy intakes, with consequences for regulation of food intake (Donini, Savina and Cannella 2003 and Hays and Roberts, 2006).

2.4.2.3 Protein

The drastic loss of lean body mass that accompanies ageing, in the absence of sufficient amino acid ingestion or absorption, serves as the primary source of amino acids, which in turn preserves protein synthesis in vital tissues as well as organs (Dawson *et al.,* 2008). Inevitably adequate protein intake supports gluconeogenesis and ensures health maintaining systems such as immunity and wound healing (Wellman and Kamp, 2008). The RDA/AI g/day for protein is 56g per day for men and 46g per day for women (IoM, 2000). Food sources of animal protein include meat, dairy products, egg, poultry and fish, which contain balanced levels of amino acids (NICUS, 2003 and Wellman and Kamp, 2008) as well as from plant (vegetable) food items such as soya, legumes, lentils and nuts.

Animal protein is an excellent source of amino acids. The consumption of this protein in the elderly is limited due to cost and reduced mobility (eg. shopping, preparation, cooking). Supplying muscle emendation can, however, improve and counteract muscle weakness or physical frailty. The rise in decreased protein stores may occur from reduced intake of protein, exacerbated illness or prolonged hospital admission (Dawson *et al.*, 2008). The average loss of muscle in the elderly accounts to 250g every year after the age of 60 and by year 70 skeletal muscle accounts for only about 27 percent of total body weight, which may remain constant or increase (Dawson *et al.,* 2008).

Hickson (2006) further mentions that the release of cytokins assists in improving the resting energy expenditure, muscle breakdown and a shift from the production of albumin to acute phase proteins. There are various consequences related to reduced muscle mass which are greater than the simple loss of strength, and include an increased risk of dehydration, reduced metabolic rates and effect in lower energy needs and may be the grand result of an increased adiposity as well as impaired glucose tolerance. Inadequate intake of protein is a combination of poor dentition, lack of choice, poor appetite, early satiety, poor dexterity and the lack of awareness (Hickson, 2006 and Dawson *et al.,* 2008).

2.4.2.4 Fat

Fats provide the most concentrated source of energy of any food item and contribute significantly to the feeling of satiety after eating. It acts as carriers for fat-soluble vitamins, and enhances the palatability of other foods (Wellman and Kamp, 2008). Ritz (2001) noted that the elderly considered that healthy weight is associated with a reduction in muscle mass and strength and an increase in fat mass mainly in the central area, which will increase the risk of cardiovascular disease. The RDA/AI g/day for fat is 20-35 percent of men 2204 energy kcal and 1978 energy kcal for women as stated by the (IoM, 2000). Key sources of fat in the diet include butter, margarine, vegetable oils, whole milk, visible fat on meat and poultry products, invisible fat in fish, shellfish, some plant products such as seeds as well as nuts, and bakery products (Wellman and Kamp, 2008 and Ritz, 2001).

Ritz (2001) states that the body composition changes can be seen as a positive fat balance as fat requirements are reduced especially when physical activity is decreased. The most prevalent feature of the increase in fat mass is a rapid accumulation of intra abdominal fat which plays a major role in age-related metabolic changes, particularly insulin resistance which is a key factor in type II diabetes, and has been related to cardiovascular diseases (Wellman and Kamp, 2008).

2.4.2.5 Fibre

Remig (2002) in summary indicated that fibre is an important nutrient for the elderly, since their digestive systems becomes more sluggish, the gastrointestinal tract changes and constipation occurs. The Institute of Medicine (2000) indicates the RDA/AI g/day for men is 30g and 21g for women. Many elderly, especially those with dentures, prefer not to consume seed-filled or crunchy food that is typically an effort to chew as they instead favour soft, slippery food that is easy to chew, but is often high in fat (Wellman and Kamp, 2008).

The elderly must include fibre-rich foods in their diet, combined with regular activity and consuming plenty of water will assist regular bowel movement. Brauer, Slavin and Marleti (1981) further suggest consuming fibre from whole fruits, vegetables and grains assists in the avoidance of constipation, therefore 5 – 6 serving of fruit and vegetables are recommended per day (NICUS, 2003).

2.4.2.6 Water

Water is an important solvent, and is an ideal medium for transporting essential nutrients to the cells and for the chemical reactions of cellular metabolism to occur (NICUS, 2003). Wellman and Kamp (2008) indicate that 1500ml/day of water is required by the elderly. The maintenance of fluid balance is essential as hydration to prevent dehydration caused by decreased fluid intake, decreased kidney function, or increased fluid loss due to increased urine output from medication (Toffanello, Inelmen, Minicuci, Campigotto, Sergi, Coin, Miotto, Enzi and Manzato, 2010). The elderly limit their fluid intake because of impaired sense of thirst, fear of incontinence and dependence on others to get beverages. Symptoms of

dehydration in the elderly are electrolyte imbalance, altered drug effects, headaches, constipation, blood pressure change, dizziness, including dry mouth as well as nose.

2.4.3 Micronutrients

The World Health Organisation (2010e) defines micronutrients *as* the essential elements since they are required only in minuscule amounts; these substances are the "magic wands" that enable the body to produce enzymes and hormones in addition to other substances essential for proper growth and development.

Physiological modifications occurring throughout the lifetime along with environmental influences are significant factors contributing to the impairment of trace element status in the elderly (Richard and Roussel, 1999). Physiological modifications of the gastrointestinal tract, decreased pancreatic function, frequent lesions caused by gastritis, intestinal pH modifications resulting in decreased absorption, loss of appetite and selection of foods may be responsible for the deficiency. Richard and Roussel (1999) mentioned that the presence of chronic diseases significantly affects absorption and bioavailability of trace elements, mainly as a consequence of drug treatment. The Nutrition Information Centre of the University of Stellenbosch (2003) acknowledges that the micronutrient requirements that differ from the elderly as compared to the young adults are fibre as the elderly requirement is lower (men=30g per day, women=21g per day) and young adult is (men=38g per day and women 25g per day), calcium is higher in elderly (men and women 1200g per day) young adults (men and women=1000g per day), Iron is low for the elderly men (5.0g per day) and not women (6.0g per day), young adults (women 8.1g per day and men 6.0g per day), and chromium is lower in the elderly (men= 20g per day, women= 30g per day) and high in the young adults (women =25g per day and men= 35g per day).

Elderly people are generally considered at risk of developing vitamin in addition to trace element deficiencies, especially vitamins A, D, folate, iron and calcium (Biesalski, Brummer, König, O'Connell, Ovesen, Rechkemmer, Stos and Thurnham, 2003). The multifactorial causes of this health hazard among the elderly comprises of quantitative and qualitative decreased food intake, reduced energy expenditure due to sedentary life style along with loss

of metabolically active body cell mass, and the development of chronic age-associated disorders.

2.4.3.1 Minerals

The Institute of Medicine (2000) mentioned that minerals are inorganic compounds that originate in the earth and cannot be made by living systems and are divided into macrominerals known as bulk elements and microminerals known as trace elements. Minerals are essential in adequate amounts as they perform many vital roles in the body to maintain the structure of bones and teeth, to help control many of the body's processes, as parts of various compounds, and as dissolved ions in body fluids. Alterations in the diet are due to factors pertaining to various changes by medication, change in taste and smell sensitivity in the elderly (Wood, Suter and Rusell, 1995). However, macrominerals are required in larger amounts by the body than microminerals and Table 2.6 illustrates the differences between macrominerals and microminerals required by the elderly established by the (IoM, 2000).

Table 2.6 Mineral Requirements for the elderly (IoM, 2000).

NUTRIENT (g) p/day	REQUIREMENT		MAJOR FUNCTION IN THE BODY	FOOD SOURCE
	Men	Women		
MACROMINERALS				
AI Calcium (mg)	**1200**	**1200**	• Maintaining strength of bones and teeth. • Muscle contraction. • Nerve function. • Normal blood clotting. • May lower blood pressure.	Low fat dairy products, calcium fortified juice, dark leafy greens, broccoli
EAR Phosphorus (mg)	**580**	**580**	• Important role in energy metabolism, affecting carbohydrate, fat, and protein.	Red meat, poultry, fish, and dairy products and cereal grains
EAR Magnesium (mg)	**350**	**265**	• Energy utilization. • Muscle contraction. • Nerve function. • May lower blood pressure.	Whole wheat bread, low fat dairy products, lean meats, beans.
AI Sodium (g)	**1.3**	**1.3**	• Involved in body water balance and acid-base balance and is the major extracellular mineral.	Table salt
AI Chloride (g)	**2.0**	**2.0**	• Maintenance of fluid balance and normal cell function.	Table salt
AI Potassium (g)	**4.7**	**4.7**	• Water balance, nerve impulse transmission, and muscular contractions.	Citrus fruit, banana, potato, vegetable, milk, meat and fish

Table 2.6 (Continued) Mineral Requirements for the elderly (IoM, 2000).

NUTRIENT (g) p/day	REQUIREMENT		MAJOR FUNCTION IN THE BODY	FOOD SOURCE
	Men	Women		
MACROMINERALS				
EAR Iron (mg)	**6**	**5**	• Transport of oxygen and carbon dioxide. • Immune function.	Organ meats, shellfish, lean meats, poultry, fish, beans, egg yolks, whole grain and enriched breads and cereals
MICROMINERALS				
EAR Iodine *(u*g)	**95**	**95**	• Needed to make thyroid hormones, which are necessary for maintaining normal metabolism in all cells of the body.	Iodinised salt and seafood
AI Manganese (mg)	**420**	**420**	• Antioxidant properties (prevents peroxidation of lipids in the cells). • Essential component of the enzyme glutathione peroxidase. • Contributes to efficiency of the immune system - very wide variety of protective functions within the body.	Egg yolk; garlic; seafood; whole-grain flour.
EAR Zinc (mg)	**9.4**	**6.8**	• Immune function • Protein synthesis • Maintaining taste acuity	Lean meats, low fat dairy products, beans, peanut butter, grain products
EAR Selenium (ug)	**45**	**45**	• Mineral antioxidant in human nutrition. • Role in reducing muscular oxidative stress	Meat, fish, seafood, whole grain foods and nuts
EAR Copper *(u*g)	**900**	**900**	• Preventing oxidative damage to cells through the enzyme superoxide dismutase.	Meat, fish, shellfish, poultry, eggs, nuts, wholegrain, banana
AI Chromium (ug)	**30**	**20**	• Helping cells use glucose	whole grain breads and cereals, and meats

AI – Adequate Intake, EAR – Estimated Average Requirement

2.4.3.2 Vitamins

Vitamins are crucial nutrients required in very small amounts and serve as facilitators for normal metabolism, growth and physical well being (Wellman and Kamp, 2008). Most vitamins are not made in the body and, therefore, must be obtained from the diet. There are 13 major vitamins which are found in a wide range of foods and each has a specific function in the body. The Institute of Medicine (2000) mentions that many vitamins are essential for the biochemical processes within the cells and tissues. Vitamins are either fat soluble or water soluble. Fat-soluble means they dissolve in fat and unused supplies can be stored in the body. Water-soluble vitamins dissolve in water and cannot be stored in the body. Therefore, a daily supply of vitamins is required from the diet and Table 2.7 indicates the elderly vitamin requirement.

Table 2.7 Vitamin Requirements for the elderly (IoM, 2000).

NUTRIENT (g) p/day	REQUIREMENT		MAJOR FUNCTION IN THE BODY	FOOD SOURCE
	Men	Women		
WATER SOLUBLE VITAMINS				
EAR Vitamin B1	**1.0**	**0.9**	• Help the body convert food (carbohydrates) into fuel (glucose) • Help the body metabolize fats and protein • Necessary for healthy skin, hair, eyes, and liver • Help the nervous system function properly • Are necessary for optimal brain function.	Asparagus, lettuce, mushrooms, spinach, sunflower seeds, tuna, green peas, tomatoes, eggplant and Brussels sprouts.
EAR Vitamin B2	**1.1**	**0.9**	• Maintain the mucous membranes that are located throughout the digestive tract. • Necessary for proper formation of red blood cells. • Helps the body produce antibodies. • Benefits skin, hair, finger and toenails and the connective tissues.	Mushrooms, and calf liver, spinach, lettuce, asparagus, chard, mustard greens, broccoli, turnip greens, chicken eggs, yogurt and cow's milk.

AI – Adequate Intake, EAR – Estimated Average Requirement

Table 2.7 (Continued) Vitamin Requirements for the elderly (IoM, 2000).

NUTRIENT (g) p/day	REQUIREMENT		MAJOR FUNCTION IN THE BODY	FOOD SOURCE
	Men	Women		
WATER SOLUBLE VITAMINS				
EAR Vitamin B3	**12**	**11**	• 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. • It is used in the synthesis of sex hormones, treating schizophrenia and other mental illnesses.	Meat, poultry, fish, whole grain and enriched cereal grains.
EAR Vitamin B6 (mg)	**1.4**	**1.3**	• Nerve function • May help prevent heart disease	Lean meats , nuts, beans, bananas
EAR Folate (*u*g)	**320**	**320**	• Red blood cell formation. • Cell growth and division. • May help prevent heart disease.	Fortified cereals, green leafy vegetables, beans, beets, oranges, orange juice
EAR Vitamin B12 (mg)	**2.0**	**2.0**	• Cell growth and division. • Red blood cell formation. • Nerve function • May help prevent heart disease.	Lean meats , low fat milk , eggs
AI Pantothenic Acid	**5**	**5**	• Metabolism of carbohydrates, proteins and fats. • Supply of energy from foods. • Synthesis of essential lipids, sterols, hormones, neurotransmitters, and porphyrin. • Metabolism of drugs and alcohol detoxification.	Mushrooms, cauliflower, broccoli, calf's liver, turnip greens, sunflower seeds, tomato, strawberries, yogurt, eggs, winter squash, and sweet corn.
AI Bioin	**30**	**30**	• Used in energy and amino acid metabolism, fat synthesis and fat breakdown. • Helps the body use blood sugar.	Swiss chard, tomatoes, lettuce, and carrots, almonds, chicken eggs, onions, cabbage, cucumber, cauliflower, goat's milk, cow's milk, raspberries, strawberries, halibut, oats, and walnuts.
EAR Vitamin C (mg)	**75**	**60**	• Immune function • Wound healing • Antioxidant	Red peppers, oranges, orange juice, broccoli, sweet potatoes, tomatoes and tomato sauce

AI – Adequate Intake, EAR – Estimated Average Requirement

Table 2.7 (Continued) Vitamin Requirements for the elderly (IoM, 2000).

NUTRIENT (g) p/day	REQUIREMENT		MAJOR FUNCTION IN THE BODY	FOOD SOURCE
	Men	Women		
FAT SOLUBLE VITAMINS				
Vitamin A	**625**	**500**	• Helping the eyes adjust to light changes. • Plays an important 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.	Carrots, spinach, bell peppers, sweet potatoes, turnip greens, tomatoes, pumpkins, winter squash, apricots, green beans and beef liver.
Vitamin D	**10**	**10**	• Needed by the body for the 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.	Milk and other dairy products fortified with vitamin D, salmon, cod liver oil, mackerel, fortified breakfast cereals, eggs, milk, and tuna.
Vitamin E	**12**	**12**	• 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.	Vegetable oils and margarines, fruits and vegetables, grains, nuts, seeds and fortified cereals.
Vitamin K	**120**	**90**	• Used by the body for blood clotting and also to make bone and kidney tissues. • Essential for healthy bones, especially in the elderly.	Green vegetables such as turnip greens, spinach, cauliflower, cabbage and broccoli, and certain vegetables oils including soybean oil, canola oil and olive oil.

AI – Adequate Intake, EAR – Estimated Average Requirement

2.5 POPULATION NUTRIENT INTAKE GOALS FOR PREVENTING DIET-RELATED CHRONIC DISEASES

The World Health Organisation (2003b) set nutrient intake goals in constructing dietary recommendations for the prevention of diet-related chronic diseases. Principal risk factors for the development of non-communicable diseases include changing dietary patterns, a decline in energy expenditure associated with a sedentary lifestyle, an ageing population reciprocally consuming tobacco and alcohol. This poses an increasing challenge to public health (WHO, 2003b). The World Health Organisation, (2003b) recommends that total fat is formulated to include countries where the usual fat intake is typically above 30 percent as well as those where the usual intake may be very low, for example less than 15 percent. Total fat energy of at least 20 percent is consistent with good health. However, exceptionally active groups with diets rich in vegetables, legumes, fruits and wholegrain cereals may, however, sustain a total fat intake of up to 35 percent without the risk of unhealthy weight gain, and countries where the usual fat intake is between 15 percent and 20 percent of energy, there is no direct evidence for men that raising fat intake to 20 percent will be beneficial (Campbell, Parpia and Chen, 1998 and Stubbs, Ferres and Horgan, 2000).

The Food and Agriculture Organisation (1998) reported the minimum amount of carbohydrate in the human diet essential to avoid ketosis is 50 g/day in adults, however, additional energy needs are best met by nutrient-dense carbohydrate foods. Carbohydrate foods provide an assortment of nutrients and other substances fundamental for health in addition to energy and it is, therefore, essential to consume a diverse range of foods in order to derive the full benefits of a high carbohydrate diet and to recognize dietary goals of at least 55 percent of total energy from a variety of carbohydrate sources (FAO, 1998).

The World Health Organisation, (2007b) reported that the prevalence of nutrient inadequacy in a specific population requires a comparison of the intakes of the population with their protein requirements (10–12 percent). However, fruit and vegetable intake varies considerably among countries, since a large part reflecting the prevailing economic, cultural in addition to the agricultural environments may vary significantly (WHO, 2002a). There are several mechanisms noted by which fruit and vegetable protective effects may be mediated, involving antioxidants and other micronutrients, such as flavonoids, carotenoids, vitamin C

and folic acid, as well as dietary fibre (WHO, 2003b). Therefore, fruit and vegetable intake of a population includes a goal intake of a minimum of 400g fruit and vegetables per day which assists in the prevention of non-communicable disease, as well as for the prevention in addition to alleviation of several micronutrient deficiencies (WHO, 2002a). Table 2.8 depicts the percentage contribution from the macronutrient towards the elderly energy intake.

Table 2.8 Population nutrient intake goals. (WHO, 2003b).

Dietary Factor	Goal
Total fat	15-30%
Total carbohydrate	55-75%
Protein	10-15%
Fruits and vegetables	≥400g per day

2.6 FACTORS AFFECTING THE NUTRIENT INTAKE AND NUTRITIONAL STATUS OF THE ELDERLY

The nutritional status of the elderly results from a complex interaction between personal and environmental factors suggested in a study conducted by Oliveira, Fogaça and Leandro-Merhi (2009). The complexities between these factors are principally due to the occurrence of both physiological and pathological aspects as the intrinsic cause influencing the aging process. The indirect indicators that are likely to guarantee proper healthy eating are determined by factors such as economic, social, lifestyle and quality of life aspects that may represent important tools for assessing nutritional risk (Oliveira *et al.,* 2009).

2.6.1 Living Arrangements

Living arrangements in South Africa are determined to a large extent by sociocultural preferences and socio-economic factors, and vary across the ethno-racial groups suggested by Ferreira (2006). However, White older women are more likely than black, coloured and Indian older women to live independently either alone or with a spouse, or to live in a residential care facility (Ferreira, 2004a). The elderly in other ethnic groups in South Africa according to Ferreira (2006) and Ferreira (2004a) have revealed a preference to co-reside

with family in multigenerational households. Ferreira (2006) and Follentine (2006) further mentioned that only 8.1 percent of all older women live alone and predominantly White women and 72 percent black elderly co-reside with children and/or grandchildren, or their spouse, and head the household (United Nations, 2005). The majority of the elderly continue to reside in multi-generational households whereby 72 percent live with children whilst 20 percent live independently either alone or with a spouse and 8 percent live with others (Ferreira, 2006 and Follentine, 2006).

A study conducted by Charlton *et al.* (2008) indicated that traditionally the elderly in Sub-Saharan African countries were supported and cared for within extended family system structures, however urbanisation and the HIV and AIDS epidemic have immensely contributed to the changing family structures.

2.6.2 Ageing Gender Issues

In South Africa, a high prevalence of gender based violence renders poor older women especially vulnerable to abuse, violence and exploitation (Ferreira, 2004b; Keikelame and Ferreira, 2000). Elderly women were disadvantaged across the life course, as were black women under Apartheid and before that, the lack of power largely to assert their rights and to withstand abuse and exploitation (Ferreira, 2004a). Social, political and demographic developments in South Africa in recent years have provided ample opportunities to revisit the issue of family change and the consequent living arrangements, and a culturally diverse society exhibits different household formation rules that have an impact on the living arrangements (Amoateng, Heaton and Kalule-Sabiti, 2007). Makiwane *et al.* (2004) have indicated that population ageing in South Africa has been accompanied by declining sex ratios, whereby a larger percentage of females are reaching an old age than males (Makiwane *et al.,* 2004). This has caused a higher proportion of elderly households to be headed by women, who have not traditionally had to shoulder such a responsibility.

Ferreira, Keikelame and Mosaval (2001) have noted that elderly men and women are frequently among the most susceptible members of society and in addition and they are persistently among the poorest of the poor. Older people who are routinely excluded from

credit and other development programmes find it hard to survive in an increasingly competitive and non supportive environment. In addition, the impact of ageing attitudes not only denies older people their rights but also serves to exacerbate their vulnerability (Peachey, 1999).

Patterns of health and illness are directly related to gender (Hudson-Rodd; 2001). Women live longer but are more likely to experience chronic illness as reported by the WHO (1999b). The prevalence of disability is higher for older men than women. Men are more likely to report cancers, disease of the nervous system and sense organs, respiratory and digestive disease. Women are more likely to report circulatory system and genitor-urinary disease. Elderly women in Africa face the stress of having to play multiple roles and make numerous contributions to family, community, society and development as stated by Hudson-Rodd (2001). In South Africa, roles played and contributions made by black older women, in particular, include supporting households, raising grandchildren, caring for sick and disabled family members, caring for persons infected with or affected by HIV and AIDS, engaging in livelihoods to augment household income, and participating in activities of community organisations and in political processes (Ferreira, 2004a and Ferreira *et al.,* 2001).

2.6.3 Food Security

Food security is defined basically from access by all people at all times to the food needed for a healthy life. Achieving food security has three dimensions (FAO, 1999 and WHO, 1999c). At the household level, food insecurity leads to disproportionately elevated health as well as medical costs, high funeral expenses and low labour productivity. Moreover, within the household food insecurity often affects the more vulnerable members of the family, specifically children and women (WHO, 2003b).

Household food security is the underlying determinate of undernutrition in the elderly; however, its effect on dietary intake is one of the major causes of undernutrition in Africa (Charlton and Rose, 2001). Charlton and Rose (2001) state that there is food poverty, increased unemployment and a scarcity of resources in large sections of South Africa and that numerous households may experience food poverty. Therefore, household food poverty or an inability to provide food to ensure a basic sustenance diet, has indicated to be the

greatest in the household in which the elderly resides, despite receiving state income. In addition, people who do not have enough to eat are unlikely to pay attention to educational messages about healthy food consumption behaviour. Food security is essential before particular food consumption patterns can be promoted in a population group (WHO, 1999c).

Hunger is a potential consequence of food insecurity amongst the elderly especially when hunger is recurrent; it results in undernutrition as suggested by Sherry, Tanumihardjo, Anderson, Kaufer-Horwitz, Bode, Emenaker, Haqq, Satia, Silver and Stadler (2007). However, most South African pensioners whether residing in urban or non urban areas, live in three generation households where the social pensions contribute a large proportion to the household budget (Charlton, 2000). The elderly indicated that the state pensions are insufficient to meet their basic needs (Charlton, Wolmarans, Marais and Lombard, 1997).

2.6.4 Urbanization

Charlton (2000) mentions that the incidence of urbanisation over the past four decades has become predominant in the South African culture and has influenced dietary habits. Urbanisation has been greatly influenced by the environmental changes such as improved infrastructure including socio-economic circumstances created by employment opportunities in urban areas. A move forward to Westernised eating habits has hindered the intake of indigenous foods amongst the Indian and black communities (Viljoen, Botha and Boonzaaier, 2005).

2.6.5 Poverty and Economic Uncertainty

In the South African environment poverty plays a major role amongst the elderly population as food choices are restricted due to the lack of finance (Charlton, 2000). Case and Deaton (1998) elaborated on political forces following social pension's provisions in South Africa that differ from other developing countries, and have been driven by poverty among the elderly as multi-generation living arrangements are no longer willing to care for the elderly.

Lack of money in particular, is a major difficulty faced by the elderly who may have no income other than State pensions and may lead the elderly to skimp on important food like fresh fruits, vegetables and meat because of higher costs and fear of waste (Case and Deaton, 1998). However, the elderly may avoid cooking or baking foods example: meats, stews and casseroles because recipes for these foods usually capitulate large quantities. In summary, financial problems also may cause the elderly to delay medical and dental treatments that could correct problems that interfere with good nutrition.

2.6.6 Physical Activity and Mobility

Elderly people who are physically active are expected to live longer than the elderly who are not physically active (Nordqvist, 2006 and Manini, Everhart, Patel, Schoeller, Colbert, Visser, Tylavsky, Bauer, Goodpaster and Harris, 2005). Physical activity is not a single entity but rather a variety of leisure time, occupational, and self-care activities which, if performed routinely, result in biochemical along with physiologic adaptations that improve the body's functional capacity, efficiency, muscular endurance, and range of motion. Elderly individuals who have remained active throughout their lives maintain to a large extent their physical strength, endurance and stamina, relative to the sedentary elderly, whereas the individual who is habitually active has greater lean body tissue (Benedetti, Borges, Petroski and Gonçalves, 2008) a lower percentage of body fat and greater bone density (Nordqvist, 2006).

The elderly individual who is physically active is better able to perform activities of daily living and, in general, has a better quality of life. The Agency for Healthcare Research and Quality and the Centre for Disease Control (CDC) (2002) acknowledged physical activity to be capable of a significant fraction of managing problems that might already be present in the elderly, such as diabetes, high blood pressure, or elevated cholesterol, however, physical activity can improve the ability to function well and remain independent in spite of health problems.

2.6.7 Drug Nutrient Interaction

The elderly in addition expect to experience adverse effects from medication, not only the number of drugs that they use, but also age related changes that affect the body's use of these drugs (Brown and Dickerson, 1999). Most drugs that are taken by the elderly are taken by mouth and are absorbed primarily in the small intestine. The medication is transferred across the membrane of the small intestine into the blood stream since this is usually done by special transporters found in the small intestine, then distributed throughout the body (Weimer, 1998). The medication is then metabolized and the liver, which usually inactivates the medication and turns it into forms that can be eliminated from the body along with the kidney as the main tissue that eliminates the drug from the body (Genser, 2008).

Genser (2008) and Bobroff, Lentz and Turner (2009) suggest that drugs can affect the nutritional well being by causing changes in food intake and the manner in which the body utilizes nutrients. Vitamin and mineral deficiencies can result from inadequate nutrient absorption due to the binding of nutrients to the medication, from higher rates of nutrient excretion, or from impaired use of a vitamin or mineral medication that can affect the amounts or type of foods consumed. However, certain drugs may increase appetite along with weight gain, whilst others may decrease appetite resulting in critical weight loss. Certain medication may alter the taste of food as stated by Brown and Dickerson (1999), such as imparting a metallic taste. Changes in taste or smell, dry mouth, oral ulcers, difficulty swallowing, nausea and vomiting affect food intake in the elderly as well as cause an unusual desire for certain foods.

In addition, medication may limit the elderly's abilities to shop for food due to side effects from the medications which include dizziness, sleepiness, lightheadedness, confusion and imbalance, and discomfort with increased urination (Genser, 2008). Medication can affect the nutrient utilization and can alter nutrient absorption in many ways by binding with nutrients, by changing the acid content of the stomach, changing the rate of absorption, reducing bacterial flora, and irritating or damaging the lining of the digestive tract. The effect can be limited to just one nutrient, or it can be more general and affect an entire class of nutrients such as the fat–soluble vitamins A, D, E, and K (Brown and Dickerson, 1999 and Weimer, 1998).

2.6.8 Elderly Food Choices

Adequate nutritional intake is an imperative function in the maintenance of health and in increased longevity in the elderly and, therefore, appropriate food choices are an essential factor in maintaining body functioning, health and influences the velocity of physiologic along with the functional decline associated with the aging process (Souter and Keller, 2002 and Herne, 1995). Age-related sensory impairments have been shown to decrease the appeal and enjoyment of foods and, therefore, contribute towards reduced food consumption (Fillion and Kilcast, 2001). Poor food choices inhibit adequate nutrient intake and, therefore, are a risk factor for malnutrition in the elderly.

Herne (1995) states the following factors which have an influence on the elderly food selection:

- Personal factors such as expectation of food, familiarity, personality, influence of others, appetite, moods and emotions and meanings attached to food.
- Socio-economic factors include household income, cost of food, meaning and status of food, security and society.
- Educational factors associated with general education as well as nutrition education.
- Biological, physiological and psychological factors.
- Cultural origins, religious background, beliefs, tradition and geographical region.
- Extrinsic factors that include the environment, advertising, merchandising, time and seasonal variation.
- Intrinsic factors consist of the appearance, odour, texture, colour, flavour, quantity, quality, preparation and presentation.

2.6.9 Elderly Abuse

The elderly are especially vulnerable to abuse and neglect from family members and caregivers (Steyn and Temple, 2008). However, the Older Persons Act 13 of 2006 protects the rights of the elderly. Frail elderly are most at risk of abuse as they are unable to defend

themselves. Steyn and Temple (2008) further suggest that withholding food from the elderly and failing to ensure an adequate intake of food constitute a violation of their rights. Elderly abuse may bring about depression, loss of self esteem and isolation which may affect the appetite, eating behaviour and their nutritional status negatively (Steyn and Temple, 2008).

2.6.10 Income Status

Bohman *et al.* (2007) have indicated that the elderly in South Africa attain the most important source of financial social support in the form of the Old Age Grant, which is non contributory and fully funded by the state. The elderly eligible to receive these social old aged grants are women aged 50 and older and men aged 65 and older with strict test that administers assets and income. According to Ferreira (1999), in black households especially the women are responsible to share pension income with family members or to pool the income. Studies conducted by Barrientos, Ferriera, Heslop, Legido-Quigley and Lloyd-Sherlock (2003) and Moller and Ferreira (2003) further discuss that job opportunities in the cities have caused a migration of young and middle-aged people, thus leaving the aged behind to care for the younger generations and the elderly pension benefits are used on a monthly basis to pay for household food, rent and utilities, including grandchildren's education.

Thus, income intended to sustain individuals in their old age is instead used to maintain households (Bohman *et al.,* 2007; Ferreira, 2004b; Ogunmefun, 2008; Ogunmefun and Schatz, 2009). This should be the point of departure in addressing the issue of elderly headship in the context of HIV and AIDS (Schatz and Madhava, 2009).

2.6.11 Effect of HIV and Aids on the Elderly

The devastation caused by HIV and AIDS is unique since it is depriving families, communities and entire nations of their young and most productive people and has placed the burden upon the elderly (WHO, 2002b). The HIV and AIDS epidemic in Southern Africa has been most affected, therefore creating a negative impact on development, social cohesion, life expectancy and human dignity and imposes social and economic burdens on societies (Steyn and Temple, 2008). The elderly are affected as they become the primary caregivers to sick

adult children and experience increased emotional, economic and physical strain with vulnerable and orphaned grandchildren (Kinsella and Phillips, 2005 and Ferreira, 2004b). Grandmothers especially face this issue and lack family support (Steyn and Temple, 2008).

A study conducted by the World Health Organisation (2002b) in Zimbabwe established that over 70 percent of caregivers of individuals living with HIV-related illnesses are over 60 years of age. Mall (2005) acknowledges that the elderly are vulnerable towards infection, and they are largely invisible in international data on HIV and AIDS. Data on infection rates do not include over-50s, despite the fact that older men and women continue to engage in sexual relations into old age (Mall, 2005), however, their understanding of the nature, cause and transmission of HIV can be limited, as they seldom have access to information, and awareness campaigns typically target the young and not the old (Mall, 2005).

Mall (2005), further illustrates the significant areas the elderly require support:

- In their role as caregivers for individuals living with AIDS, and for orphans and vulnerable children.
- Access to information on the risk of HIV and AIDS, so that they can protect themselves and others against infection.
- Emotional support to help older people deal with the stigma and discrimination that results from having a child or grandchild with HIV and AIDS.
- Psychosocial coping mechanisms to deal with stress, illness and grief.
- Treatment and support for older people with HIV and AIDS.

HelpAge International (2004) articulated a study in Cambodia, which found that many older people in HIV-affected households suffer from poor physical and mental health through increased care-giving workloads and also suffer feelings of blame, shame and guilt about their children's situation.

2.7 MALNUTRITION IN THE ELDERLY

Hickson (2006) defines malnutrition as a state of being inadequately nourished as a result of lacking of one or more nutrients (undernutrition) or an excess of nutrients (overnutrition). A high prevalence of malnutrition (15–60 percent) in older people has been reported worldwide according to Marais and Labadarios (2007). South Africa is currently experiencing a nutrition transition which embraces the coexistence of under and overnutrition which is apparent between and within populations and across age groups (Steyn *et al.,* 2006a).

The World Health Organisation (2002a) has reported that various aspects influence elderly nutritional status and, therefore, predisposes them to infection, malnutrition and chronic disease. In the ageing population of South Africa malnutrition has been seen as the underlying problem related to various diseases and deficiencies (Charlton *et al*., 2001). According to Hickson (2006), malnutrition is a negative inevitable side effect of ageing, but many changes associated with the process of ageing can ultimately promote malnutrition.

Many studies have found a direct relation between the degree of malnutrition and increased length of stay, treatment cost, and return to usual life (Mcwhriter and Pennington, 1994). In order to achieve the ultimate goal of healthy and active ageing, the WHO (2007a) has developed a policy framework, which focuses on such areas as malnutrition in the elderly. The health of elderly is frequently affected by inadequate nutritional intake from the diet. However, psychosocial determinants in addition to the higher prevalence of acute and chronic illnesses are risk factors for nutritional deficiencies in the elderly (Salva and Pera, 2001). The majority of the diseases suffered by the elderly are the result of dietary factors, some of which have been operating since infancy and these factors are then compounded by changes that naturally occur during the ageing process.

In summary, Salva and Pera (2001) indicated that the most predominant aspect continuously raised within the elderly is the price of foods rich in micronutrients, which further discourages their consumption. Compounding this situation is the fact that the elderly often suffer from decreased immune function, which contributes to increased morbidity and mortality. Other significant age-related changes include the loss of cognitive function and deteriorating vision,

all of which hinder good health and dietary habits in old age. Dietary changes affect the risk-factor levels throughout life and have an even greater impact on the elderly (Hickson, 2006).

2.7.1 Causes of Malnutrition

Wakimoto and Block (2001) noted that the causes of malnutrition are varied and are divided into three main types: medical, social and psychological. Poor appetite or anorexia nervosa is the major cause of malnutrition and is mediated by a variety of factors; the main contribution is the decrease in energy intake and micronutrient deficiencies likely to occur due to aging (Hickson, 2006). However, taste as well as smell are also implicated in loss of appetite through a perceived decline in the pleasantness of food (Hetherington, 1998). In addition, taste is the most significant element of the cephalic phase response that prepares the body for digestion. Taste also aids modulate food choice and meal size by increasing satiety and the pleasure of eating (Schiffman, 1997). Loss of taste and smell is most common in the elderly and can be exacerbate by disease and drugs.

According to Drewnowski and Shultz (2001), the elderly may also decrease the consumption of meat, fat, and dairy foods, with negative consequences for intakes of calcium, iron, zinc, B vitamins, and vitamin E, therefore these latter changes can lead to malnutrition and in addition can result in decreased muscle mass, metabolic abnormalities, and compromised immunity (Rudman, 1989; Fischer and Johnson, 1990 and Morley, 1986). Moreover, the decline in average food intake in the elderly is attributed to both physiological in addition to social factors. As requirements are unchanged or increased for most of the nutrients, the elderly are at higher risks for malnutrition and nutritional related acute or chronic illnesses as suggested by Mathey, Zandstra, Graaf and Staveren (2000). The quality of life in the earlier years of life is to some extent seen in the quality of life in later years as positive, proactive living in the early years of life and tends to promote positive proactivity in later life and is an important aspect of successful ageing (Rudman, 1989).

Subsequently, physiological changes associated with aging, decline in the vital feeding force, and a variety of social (poverty, loneliness, and social isolation) in addition to other factors (depression, poor dentition, gastrointestinal disease, malabsorption syndromes, acute and

chronic infections, medication use, and hyper metabolism) may result in deficient food consumption and low energy intakes, which leads to an increased risk of involuntary weight instability (Roberts, 2000), culminating, in extreme cases and the physiological ‘‘anorexia of aging’’ stated by Morley and Thomas (1999) and Morley (2001). Physical impairments and chronic illness have a dampening impact on food consumption, affect energy and specific nutrient intakes (Dontas, Moschandreas and Kafatos 1999), and may lead to protein-energy malnutrition, weight loss, and loss of fat mass in late life (Roberts and Rosenberg, 2006).

2.7.2 Undernutrition

The World Health Organisation (2000a) states that nearly 30 percent of the elderly in the developing world are currently suffering from one or more form of malnutrition. Anorexia and weight loss are most common among the elderly, and a number of risks may prevent them from getting enough of the right foods (National Institute on Ageing, 2007). A study on the elderly in South Africa conducted by Charlton *et al*. (2008) acknowledged that the elderly are unable to taste in addition to smell and this may reduce the appetite for necessary foods, and they may have dental problems that make it difficult to eat. Reduced physical activity minimizes the need for energy and food consumption. In addition, the elderly may face difficulties due to being socially isolated, loss of spouse, or mobility problems. Clinical features of protein energy malnutrition include reduced body weight, muscle wastage and decreased strength, reduced respiratory and cardiac muscular ability, skin thinning, decreased metabolic rate, hypothermia, apathy, oedema and immunodeficiency (Charlton *et al*., 2008).

Calcium, vitamin D, vitamin B12 and folate are micronutrients frequently under-consumed in older people and these deficiencies encourage a decreased immune response that could negatively impact on quality of life and health status (Lesourd, 1997). A review by Holick (2006) indicated that in the absence of adequate dietary calcium, vitamin D will mobilise skeletal stores of calcium and phosphorous to ensure that serum levels are maintained, at the expense of bone health.

The National Institute on Ageing (2007) states the risk factors that may affect intake, digestion, absorption, utilisation and metabolism of food and nutrients as follows:

- Oral
  - Swallowing problems from a stroke, Parkinson's disease or other neurological disorder.
  - Worsening dentition and periodontal disease, ill fitting dentures
  - Candida.
- Manual dexterity
  - Frail skin on hands.
  - Peripheral vascular disease.
  - Osteo and rheumatoid arthritis.
  - Loss of use of hands from a stroke, Parkinson's disease or other neurological disorder.
- Socio-economic
  - Isolation - limited access to shops.
  - Bereavement.
  - Poverty.
  - Institutionalisation.
- Malabsorption
  - More prone to infection and thus bacterial overgrowth.
  - After previous surgery.
  - Achlorhydria.
- Diminished sensory ability
  - Taste changes.
  - Less smell perception.
  - Hard of hearing.
  - Reduced appetite.
- General Health
  - Drugs and alcohol.
  - Chronic disease and disability.

Similarly, malnutrition increases one's susceptibility to and severity of infections, and is thus a major component of illness and death from disease (Charlton *et al.,* 2008).

2.7.3 Overnutrition

An increase of abdominal along with central obesity indicates overweight and obesity as a common problem faced by the elderly (Charlton *et al.,* 2008); consequently the percentage of intra-abdominal fat, which is related to increased morbidity and mortality, progressively increases with age (Elia, 2001). According to the World Health Organisation (2005), the prevalence of obesity among women older than 30 was about 44 percent in Mexico and 49 percent in the United States; among men older than 30, these levels were 30 percent in Mexico and 42 percent in the United States. Additionally, there are many factors that have evolved as the contributing factors to the obesity epidemic that have affected the elderly, including snack food, cars, television, fast food, computer use, vending machines, suburban housing developments, portion sizes and female participation in the labour force (Sturm, 2008). However, Eckel, Grundy and Zimmet (2005) further mention that morbidity, the deliberation to be caused by obesity, is the metabolic syndrome, which involves a cluster of metabolic abnormalities which include hypertension, glucose intolerance, insulin resistance, central obesity, dyslipidaemia and hypertension.

Normal ageing is associated with a progressive increase in fat mass, which normally peaks at about age 65 years in men and later in women, therefore, body fat distribution also changes with age, with visceral abdominal fat increases and subcutaneous abdominal fat decreases (Zamboni, Mazzali, Fantin, Rossi and Di Francesco, 2008). There are no significant changes in body mass index consecutively for these body changes to occur, thus ageing involves body fat and muscle shifting to more fat and less muscle. Consequently, age-related body composition changes and the increased prevalence of obesity in the elderly produces a combination of excess weight and reduced muscle mass and/or strength, which has recently been defined as sarcopenic obesity (Zamboni *et al*., 2008).

Figure 2.5 illustrates the various influences on physical activity, nutrition behaviour and consequently, the risk of the elderly becoming overweight or obese due to excess body weight resulting when energy intake exceeds energy expenditure. However, interventions to create residential environments that support physical activity are an important part of the solution to prevent and control obesity at the population level (Gebel, King, Bauman, Vita, Gill, Rigby, and Capon, 2005).

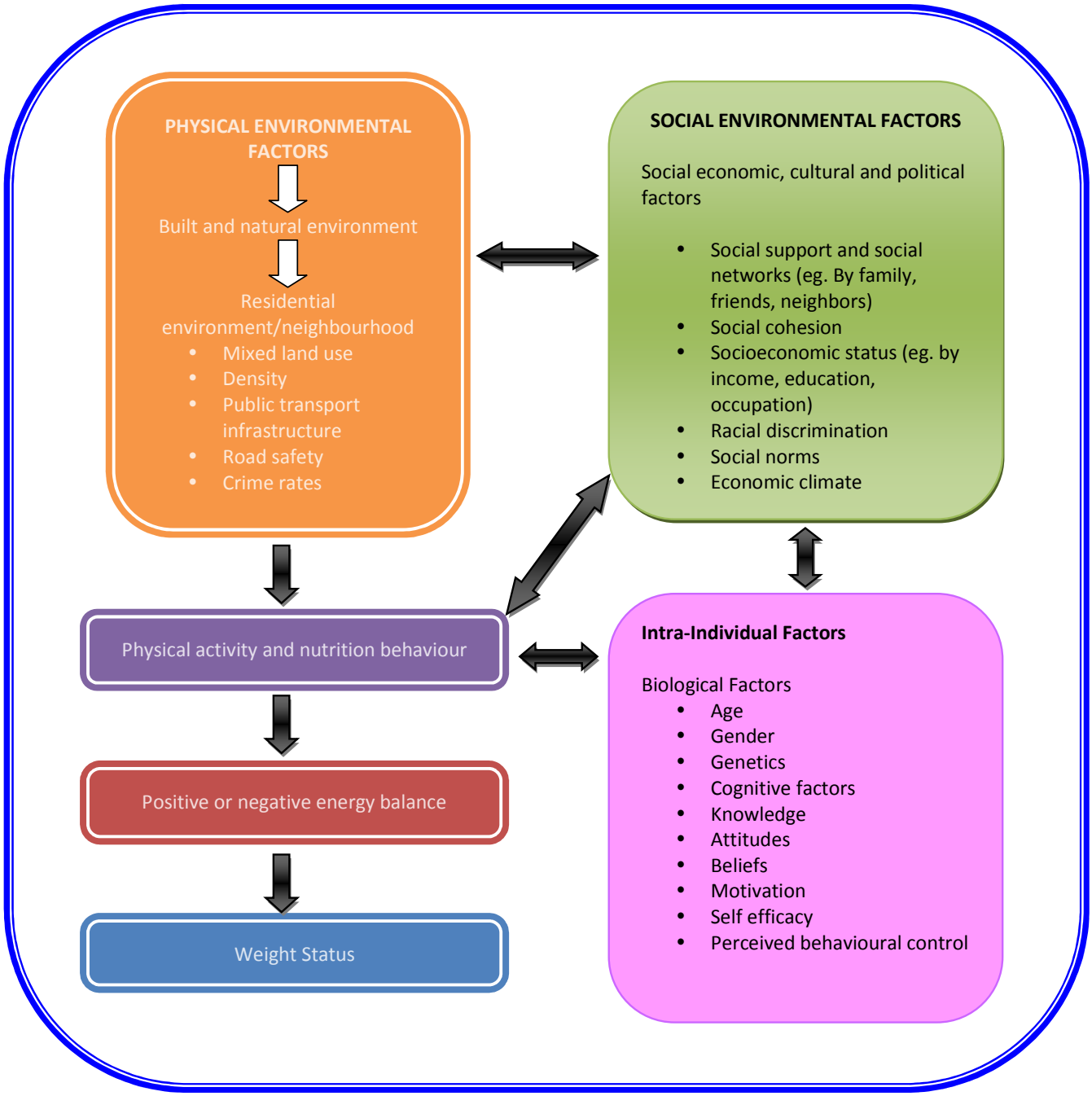

Figure 2.5 Social ecological model to illustrate the influences of the residential environment on physical activity and obesity**,** (Adapted from Gebel *et al.*, 2005).

2.8. IMPACT OF MALNUTRITION ON THE COUNTRIES HEALTH SYSTEM AND ECONOMY

The World Bank (2006) has indicated that malnutrition undermines the economic development and perpetuates poverty within the country. Bowely (2010) further discusses that the existing levels of malnutrition are clearly linked to poverty and food insecurity, and seriously impair the economic development of South Africa. According to the Department of Health (2010), the nutrition situation in South Africa is exacerbated by a lack of nutritional information and knowledge. Added to this are undesirable dietary habits as well as nutrition-related practices, attitudes, perceptions and socio-cultural influences that could adversely affect nutritional status. Therefore, to attain good health and nutritional status, individuals need sufficient knowledge and skills to grow, purchase, process, prepare, eat and feed their families a variety of foods in the right quantities and combinations (DoH, 2010).

Besides improving the quality of foods through appropriate fortification, food companies should invest in better quality control processes and assist government agencies that monitor quality. However, international communities as well as most governments in developing countries have failed to tackle malnutrition over the past decades, even though well-tested approaches for doing so exist. The consequences of this failure to act are now evident in the world's inadequate progress toward the Millennium Development Goals (MDGs) and toward poverty reduction more generally. However, the Integrated Food Security Strategy aim is to reach worldwide physical, social and economic access to sufficient, safe and nutritious food by all South Africans at all times to meet their dietary and food preferences for an active and healthy life (Department of Agriculture, 2002). The South African government has adopted this broad-based approach to address food security problems at both household and national levels in recognition of the multidisciplinary nature of food security problems.

A Community-Based Nutrition Programme (CBNP) has the aim of strengthening household food security in addition to improving knowledge about nutrition, supporting the care of women and children and promoting a healthy environment (DoH, 2008). The CBNP involves the community and social mobilization for services of which a key factor for success involves the community workers for households. The focus of the CBNP in South Africa is due to the rising epidemic of diet related chronic disease and obesity, evidently experienced by the poor.

There is an immense need to incorporate health promotion activities to influence health lifestyle (Puoane, Sanders and Mason, 2008). One of the strategies of the CBNP was to involve the food shop owners or vendors who are responsible for providing fast food within the community to provide healthy foods, which in turn will influence the consumption of healthy food (Puoane, Sanders and Mason, 2008). Puoane, Sanders and Mason (2008) further discuss that the importance of improving nutrition specifically in the poor communities, requires a combination of community and facility based activities.

Additionally, persistent malnutrition is contributing not only to widespread failure to meet the first MDG to halve poverty and hunger but to meet other goals in maternal and child health, HIV and AIDS, education, and gender equity. The unequivocal choice now is between continuing to fail, as the global community did with HIV and AIDS for more than a decade, or finally to make nutrition central to development so that a wide range of economic and social improvements that depend on nutrition can be realized (STATSSA, 2010).

2.9 NUTRITIONAL ASSESMENT IN THE ELDERLY

A comprehensive assessment of nutritional status includes anthropometric measurements, laboratory values, physical examination, as well as patient history. Nutritional assessment aids in the planning for the prevention or solution of a specific nutrition related health problem.

2.9.1 Anthropometric Measurements

The ageing process engages modifications in nutritional and physiological status, such as a decrease in body weight and height (Dey, Rothenberg, Sundh, Bosaeus and Steen 1999), as well as a reduction in fat-free mass associated with an increase in fat mass. Moreover, a redistribution of adipose tissue occurs with an accretion in the trunk in addition to the visceral sites (Steen, 1988 and Schwartz, 1998). However, body composition changes occur differently in men and women and in the various phases of ageing, influencing anthropometry. Sánchez-García, García-Peña, Duque-López,, Juárez-Cedillo, Cortés-Núñez and Reyes-Beaman, (2007) reported on anthropometric and nutritional characteristics that

are interrelated with genetic, environmental, socio-cultural conditions and to lifestyle, health and functional status.

Anthropometric measurements are now considered as significant indicators of an individual's nutritional status and are widely used, inexpensive and non-invasive measures of the general nutritional status of an individual or a population group to identify the nutritional status and individuals at risk for certain diet related diseases. Malnutrition, either undernutrition or overnutrition gives rise to detrimental alterations of body composition (Perissinotto, Pisent, Sergi, Grigoletto and Enzi, 2002). The four building blocks or measures used to undertake anthropometric assessment are: age, gender, height as well as weight (Perissinotto *et al.,* 2002, Dey *et al*., 1999 and Schwartz, 1998), and to attain further nutritional information, mid-arm circumference and triceps skinfold thickness can be measured (Blackburn, Bistrian and Maini, 1977).

2.9.2 Circumferences

If more complete information on body composition is required, additional anthropometric data can be obtained, which include circumference as well as skinfold measurements (Wellman and Kamp, 2008 and Tayie, Adjetey-Sorsey Armah Busolo and Imaya, 2004).

2.9.2.1 Waist Circumference

Waist circumference (WC) has been understood as a simple, reliable and cost-effective measure to understand an individual's cardio-metabolic risk (WHO, 2000b). Waist circumference evaluates the distribution of abdominal fat content in adults (Gibson, 1990). The indication of body fat content is an improved predictor of cardiovascular risk, diabetes, and other endocrine abnormalities other than BMI measurements (Charlton *et al*., 2008). Waist circumference is achieved by measuring the distance around the smallest area below the rib cage and above the navel with the use of a non-stretchable tape measure (Han, Van Leer, Seidell and Lean, 1995).

Han *et al.* (1995) stated that a man's body is typically apple shaped, since there is a greater accumulation of fat around the waist and stomach area, as contrasted to a women's body which is more pear shaped as the accumulation of fat is on their hips, buttocks and thighs. However, research has indicated that individuals with apple body shapes are more prone to develop diabetes and heart disease than those with pear body shapes (Han *et al.,* 1995). Table 2.9 illustrates waist circumference values for healthy and central obesity for both Asian and European men as well as women.

Table 2.9 Reference Values for waist circumference (cm), World Health Organisation (2000b) and National Cholesterol Education Programme Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (2001).

	Healthy	Central Obesity
Non Asian Men	<102cm	>102 cm
Asian Men	< 90cm	> 90cm
Non Asian Women	<88cm	> 88cm
Asian Women	< 80cm	> 80cm

2.9.2.2 Mid-upper Arm

Mid-upper arm circumference is measured between the acromion process of the shoulder and the tip of the elbow. The mid-upper arm circumference measurement along with the tricep skinfold measurement indicates the fat distribution in the body and is useful in the diagnosis of protein-energy malnutrition (Gibson, 1990). Mid-upper arm circumference is appropriate for individuals who cannot be weighed and especially for elderly suffering from severe oedema where the BMI or percentage of weight loss is misleading (Charlton *et al.,* 2008).

2.9.2.3 Head

The head circumference measurement is useful in children younger than 3 years of age, primarily as an indicator of non nutritional abnormalities. However, should undernutrition be extremely severe then only will the head circumference be affected. This measurement is more satisfactory if taken with the infant lying on his back (Charlton *et al.,* 2008).

2.9.2.4 Leg

The calf muscle circumference is measured in combination with other anthropometric measurements to determine body weight in the elderly (Hammond, 2004). The large circumference of the calf is measured with the knee and ankle bent to a 90 degree angle (Charlton *et al.,* 2008).

2.9.2.5 Waist-to-Height Ratio (WHtR)

An individual's health is not only affected by the amount of body fat, but also by where most of the fat is situated on the body. However, the elderly who tend to gain weight mostly on their hips as well as buttocks generally encompass a pear body shape, while people who tend to gain weight mostly in the abdomen have more of an apple body shape. In addition, an apple shaped body rather than a pear shaped body is an increased risk for the health problems associated with obesity, such as diabetes, coronary heart disease and high blood pressure which may be inherited (Gibson, 1990).

The WHtR is used as an indicator or measurement that is most frequently used for the nutritional assessment of adults to identify central obesity patterns and an increased risk of cardiovascular disease (Gibson, 1990 and Perry, Miller, Allison, Jackson and Applegate, 1998). WHtR has been found to be a more efficient predictor of mortality in older people than waist circumference or BMI (Wellman and Kamp, 2008). The WHtR can be measured more preciously than skinfold, and provides an index of both subcutaneous and intra abdominal adipose tissue. The WHtR is calculated by dividing waist size by height. The WHtR indicates an accurate assessment of health. A WHtR <0.5 is generally considered healthy.

2.9.2.6 Waist/Hip Ratio (WHR)

The (WHR) is one of the most frequently used anthropometric measures to identify a central obesity pattern and an increased risk of cardiovascular disease. The elderly with elevated waist-hip ratios (WHRs) have a higher mortality risk than those with a high body mass index, or BMI (Perry *et al.,* 1998). The WHR ratio measures the body fat distribution; with a higher

ratio indicating abdominal fat patterns in addition to a higher waist-to-hip ratio is associated with high risk of chronic disease (Tayie *et al.,* 2004).

2.9.3 Body Mass Index (BMI)

The Body Mass Index is a simple index of weight-for-height that is clinically and most frequently used to classify underweight, overweight and obesity in adults as well as a validated measurement tool to assess nutritional status (Wellman and Kamp, 2008). BMI cut-off points are also used to categorize high-risk individuals for screening; identify individuals for absolute risk assessment; determine the type and intensity of treatment; monitor individuals for effects of treatment over time; determine institutional policies on individuals, for example, insurance reimbursement; and increase awareness of risk for individuals (WHO, 2000c). However, the BMI is calculated using the following metric formulae where the calculations require both weight and height measurements, based on the BMI result overnutrition and undernutrition can be identified (Wellman and Kamp, 2008).

- **BMI = Weight (kg) ÷ Height (m)²**

The World Health Organisation (2000c) indicates that Asian populations encompass different associations between BMI, percentage of body fat, as well as health risks when compared to European populations. However, Asian populations have advanced proportion of body fat in comparison to people of the same age, gender and BMI in the general European populations. Consequently, the proportion of Asian people with a high risk of type 2 diabetes, stroke, dyslipemia, osteoarithis, cardiovascular disease and some cancers (Anuurad, Shiwaku, Nogi, Kitajima and Enkhmaa, 2003) is substantial even at BMIs lower than the existing World Health Organisation cut-off point for overweight (≥25.00) (WHO, 2000c). However, levels of morbidity vary between different Asian populations and for this reason it is difficult to identify one clear BMI cut-off point (WHO Expert Consultation, 2004a).

According to the World Health Organisation (2000c), abdominal obesity is progressively more recognized as a major risk factor for cardiovascular disease in the elderly. In addition, when compared with body mass index (BMI), anthropometric measures of abdominal obesity e.g. waist circumference (WC), waist-to-hip ratio (WHR), sagittal abdominal diametre appear to be more strongly associated with metabolic risk factors, incidental CVD events, along with

death. The cardio-metabolic risk associated with abdominal obesity is attributed to the presence of visceral adipose tissue (VAT), which promotes insulin resistance, dyslipidaemia, and hypertension. Table 2.10 indicates the BMI cut-off points used for non Asian populations classified from severely underweight (<18.50) to morbidly obese (≥40.00), whereas Table 2.11 illustrates the Asian population BMI cut off points classified from underweight (<18·5 kg/m2) to obese II (>30).

Table 2.10 BMI classifications, WHO (1995).

Classification	BMI(kg/m)	
	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
Obese class I	**30.00 - 34-99**	30.00 - 32.49
		32.50 - 34.99
Obese class II	**35.00 - 39.99**	35.00 - 37.49
		37.50 - 39.99
Obese class III	**≥40.00**	≥40.00

Table 2.11 Asian BMI classification, WHO Expert Consultation (2004a).

Classification	BMI (kg/m) Principal cut-off points	Risk of Co-morbidities
Underweight	<18.5	Low
Ideal BMI	18.5-22.9	Average
Overweight	>23	Increased
Obese I	>25	Moderate
Obese II	>30	Severe

The World Health Organisation (2000c) reported that the ethnic differentiation in body build, fat patterning, in addition to muscularisation may all contribute to differences in the relationship between BMI and body fat between ethnic groups. However, Asian Indians have a more central distribution of body fat than Europeans, which is strongly associated with increased risk of diabetes type II and ischaemic heart disease (Rush, Plank, Chandu, Laulu, Simmons, Swinburn and Yajnik, 2004). A study conducted by Rush *et al.* (2004) indicated a proportion of total body fat and abdominal fat that was significantly higher for Asian Indians than Europeans ($p<0.0001$) or Pacific Islanders ($p<0.0001$), whilst thigh fat was significantly lower than Europeans ($p=0.037$) or Pacific Islanders ($p=0.015$). After adjustment for weight, height, and percentage body fat, the ratio of abdominal to thigh fat was significantly higher for Asian Indians than Europeans ($p=0.022$) and Pacific Islanders ($p=0.002$).

A report by Simmons and Powell (1993) suggests that young Asian Indians are relatively hyperinsulinaemic compared to their European counterparts with the same BMI, while a study by Vikram, Pandey, Misra Sharma, Devi and Khanna (2003) has revealed that Asian Indians with normal BMI (<25 kg/m2) contain elevated cardiovascular disease risk and Pacific Islanders in New Zealand, by contrast, are not hyperinsulinaemic relative to Europeans of the same BMI, and whilst they have a high prevalence of type 2 diabetes, they are believed to have a lower rate of cardiovascular disease.

2.9.4 Biochemical Analysis

Biochemical tests generally are the most objective and sensitive measures of nutritional status (Wellman and Kamp, 2008), however, not all are appropriate. Caution is used when interpreting results because they can be affected by the state of disease and therapy. Nutrient and enzyme levels, DNA characteristics, and other biological markers are components of a biochemical assessment of nutritional status (Brown, 2008). Laboratory tests based on blood and urine can be important indicators of nutritional status, but they are influenced by non nutritional factors as well. Laboratory results can be altered by medications, hydration status, and disease states or other metabolic processes, such as stress (Gibson, 1990, Brown, 2008 and Wellman and Kamp, 2008).

2.9.5 Skinfold Thickness

The skinfold thickness measurement method is used for assessing the amount of body fat an individual contains. The skinfold thickness measurement is based on the total body fat estimates on the assumption that 50 percent of body fat is subcutaneous (Wellman and Kamp, 2008). The overall skinfold thickness is based upon two assumptions that the thickness of the subcutaneous adipose tissue reflects a constant proportion of the total fat and the skinfold thickness selected for measurement either singly or in combination represents the average thickness of the entire subcutaneous adipose tissue (Gibson, 1990).

2.9.6 Evaluation of Dietary Intake Data

Diet surveys are an important tool for measuring the prevalence of malnutrition (Wellman and Kamp, 2008 and Gibson, 1990). Dietary evaluation is a strategic tool use to identify nutrient consumption and dietary habits. Dietary intake is assessed by collecting, analysing and interpreting nutrition data, consequently developing strategic nutrition interventions to assist in the nutrition related outcomes of the individual or sample population (Wellman and Kamp, 2008 and Gibson, 1990). Wellman and Kamp (2008) stated the following objectives of a nutritional assessment:

- Identify individuals who may require aggressive nutritional support.
- Restore or maintain an individual's nutritional status.
- Identify the appropriate Medical Nutrition Therapy (MNT).
- Monitor the efficiency of the interventions.

2.9.6.1 24-Hour Recall

Clausen *et al.* (2005) states that the 24-Hour Recall questionnaire is used to identify usual food intake and meal patterns of the elderly. The questionnaire consists of open-ended questions (24-Hour Recall) to provide a summary of foods typically consumed at each mealtime 24 hours before the examination. However, the main purpose of administrating the 24-Hour Recall is to assess the sample population's overall diet quality in order to identify the deficient nutrient intake and, therefore, make recommendations to improve health status

(Brown, 2008). The questionnaires are administered by a trained interviewer who should be knowledgeable on the terminology as well as locally available, traditional foods and beverages for the successful output of the nutrient analysis completed using the MRC Food finder version 3®.

Rankin, Hanekom, Wright and MacIntyre (2010) reported one advantage of the 24-Hour Recall is that it is applicable to populations of different ethnicities. Moreover, the 24-Hour Recall is a rapid, non-invasive dietary tool, and one with the ability to quantify daily intakes for populations in developing countries such as South Africa. However, a disadvantage of this method includes the respondent's memory to recall portion sizes which are difficult to estimate and, therefore, trained interviewers are required. The questionnaire is used in a one on one interview with the respondent, with the aid of food models, food pictures, real food items and household utensil measure to verify the type of food consumed and the amount (Katzenellenbogen, Joubert and Abdool Karim, 1997). According to Gibson (1990), the 24-Hour Recall data are compared with the food frequency data as an elementary method to assess its content validity of the elderly diet.

Two 24-Hour Recalls are recommended to analyse the average food consumption patterns and estimate the nutrient intake compared to the sample population DRI's (Rankin *et al.,* 2010 and Gibson, 1990). However, negative aspects of the method include the respondent forgetting, deliberate misreporting, need for a trained fieldworker to administer the questionnaire, need for several days of intakes to obtain estimates of usual diet, and finances associated with computerized analysis of dietary data. However, the 24-Hour Recall methodology attempts to quantify portion sizes correctly for each eating occasion, and findings from Rankin *et al.* (2010) demonstrate strong as well as consistent relationships for the majority of food items and food groups examined between the reported frequency of consumption based on a FFQ and the probability of consumption on four 24-Hour Recalls.

2.9.6.2 Food Frequency

The food frequency questionnaire is used to estimate the nutrient intake of a sample population (Brown, 2008). Specific food items included in the food frequency check list are

selected on the basis of elderly information obtained from a qualitative dietary assessment on traditional foods. Specific traditional food items that were consumed by the sample population over a period of seven days were determined, however, the quantities were not required. The food frequency organises food into the nine food groups namely: cereal, 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, as well as eggs (Oldewage-Theron and Kruger, 2008). Food frequency questionnaires are used to compose information on the frequency of a specific food or category of food that is consumed per day, per week or per month.

Moreover, the positive aspects of the Food Frequency questionnaire include ease of administration, low expense data analysing, respondent less forgetful because of prompts provide by food lists and to some extent an accurate estimate of usual food intake. However, negative aspects of the Food Frequency questionnaire include incomplete reporting of food items not included in food lists, over reporting, incomplete or inaccurate response, inaccurate translation of food and food groups to nutrients, and imprecise estimates of nutrient intake. Dietary diversity is usually measured by determining the number of individual foods, regarded as the food variety score (FVS) and the number of food groups used as the food group diversity score (FGDS) from the Food frequency data (Oldewage-Theron and Kruger, 2008 and Ruel, 2003).

2.9.6.3 Quantitative Food Frequency (QFFQ)

The Quantitative Food Frequency is the longest structured food recall questionnaire, whereby the respondent recalls the frequency and quantities of food consumed in the past month or three to six months or even the last year (Wellman and Kamp, 2008 and Gibson, 1990). The QFFQ presents a clearer indication of the customary food intake rather than the 24-Hour Food Recall. However, visual aids of food models, food pictures, real food items in addition to household utensil measures are used to determine the type of food consumed and the amount (Katzenellenbogen *et al.,* 1999). A disadvantage using the QFFQ with the elderly is the poor attention span.

2.9.6.4 Nutritional Knowledge

The nutritional knowledge questionnaire is an excellent tool used to assess the relationship between individual or sample population exposure to nutrition information or knowledge and dietary behaviour (Parmenter and Wardle, 1999), which may have an influence on the dietary decisions. The nutrition knowledge questionnaire focuses on the nutritional aspects, thus investigating the level of knowledge that individuals attain (Parmenter and Wardle, 1999).

2.9.6.5 Food Diary

The food diary documents daily dietary intake and is the most accurate if the food consumed is documented correctly (Gibson, 1990). The food diary is documented by the respondent between three to six days and then compared to the individual dietary reference intakes/allowances. The food diary determines the respondent's dietary habits (Wellman and Kamp, 2008). The food diary is the most accurate if the respondent documents the correct food and amounts consumed at the time. The nutrient intake is then analysed and then compared with the DRI's.

The respondent reports all food and beverages consumed on a usual day to a trained interviewer. The interviewer subsequently probes further on the frequency amount and portion size consumed. Diet diaries are occasionally used to assist respondents in recalling their daily food and beverage intakes. Moreover, the positive aspect of this method relates to the respondent's burden presenting low in addition to complete intakes. In addition, negatives include high cost, need for trained interviewers, and lack of standardisation (Gibson, 1990).

2.9.6.6 Health Survey

The health survey is used to identify the health status including the prevalence of health-related problems, behaviours/lifestyle factors, and the service needs and interests (Puoane, Steyn, Bradshaw, Laubscher, Fourie, Lambert and Mbananga, 2002). The health survey is analysed data by the researcher who designs programmes and strategies for improving health status of the sample population indicating the health status of the sample population.

2.9.6.6.1 Blood Pressure (BP)

Blood pressure refers to the pressure of the circulating blood as blood travels through arteries, arterioles, capillaries and veins. The term blood pressure generally refers to arterial pressure, i.e., the pressure in the larger arteries, arteries being the blood vessels which take blood away from the heart (Steyn and Temple; 2008, Swales, 1999 and WHO, 1999a). According to the Sekokotla, Steyn, Bradshaw and Mbananga (2003), high blood pressure is a very common condition in modern society as the majority of the elderly with high blood pressure experience no symptoms, but if left untreated can lead to major health problems. Consequently the monitoring of blood pressure is vitally important in order to detect cases of high blood pressure and conduct treatment before health problems develop (Steyn and Temple, 2008 and WHO, 1999a).

2.10 METHODS TO ADDRESS MALNUTRITION

2.10.1 Dietary Diversification

Dietary diversification is an important factor to improve the intake of critical nutrients in the elderly. Maunder, Matji and Hlatshwayo-Molea (2001) state that the dietary patterns during the last few decades have undergone a general change towards high energy density and fatty foods combined with a low proportion of plant components. Consuming a wide variety of foods is considered one of the key components of dietary adequacy. Sherry *et al.* (2007) suggest the elderly tapered food choices may result in inadequate intake of essential nutrients, micronutrients, and phytochemicals, a particular concern that aids in improved nutritional status. However, an increased food variety is regarded to be essential for an adequate nutrient intake, to minimize the chances of deficient or excessive intake of single nutrients, and to diminish exposure to food contaminants (Maunder *et al.,* 2001). Adequacy of nutrient intake has been positively associated with the number of different foods consumed and is, therefore, for essential adequate metabolic maintenance.

2.10.2 Fortification

The World Health Organization and Food and Agriculture Organization of the United Nations (2006) defines fortification as the practice of purposely increasing the content of important micronutrients that are vitamins and minerals (including trace elements) in a food, so as to develop the nutritional quality of the food supply and provide a public health benefit with minimal risk to health.

Impaired nutritional status is a frequent problem in the elderly. Causes of reduced food intake are various: disease, physical impairment, age-related physiologic changes, and psychological and psychosocial issues. Research has shown that elderly individuals often have problems in managing an intake of adequate amounts of food due to several reasons (e.g., loss of appetite, poor dentition, etc.). Various studies have investigated the use of nutritional support (WHO/FAO, 2006).

The daily meals of most South Africans are deficient in micronutrients necessary for excellent health. Charlton (2000) further mentions the possibility of fortifying the most commonly eaten foods: maize meal and white and brown bread flour (bread baked with this flour). However, food fortification restores micronutrients to both white as well as brown bread flour in addition to maize meal that may be lost during the manufacturing process, as well as adding additional vitamins and minerals. The addition of Vitamin A which is not naturally present in the food is an important aspect since Vitamin A deficiency is most prevalent in South Africa (Charlton, 2000). In essence, the consumption of fortified foods is a safe and cost-effective way of adding vitamins and minerals to a family's daily meals (Christine, Kristina, Ramona, Wolfgang, Matthias and Herbert, 2008).

2.10.3 Supplementation

Supplementation is the addition of nutrients that are not available in food products (NICUS, 2003) and offers an additional protein source to improve nutritional status of the elderly (Dawson *et al*., 2008). Dietary supplementation bridges the nutritional needs caused by aging since supplements can compensate for poor nutrient absorption, offset poor dietary habits

and help prevent or delay the onset of many chronic diseases associated with aging (Wellman and Kamp, 2008). Wellman and Kamp (2008) further mention that many elderly exhibit poor immune responses and are at a high risk of infection, therefore, enhancing their diets with supplements results in improvement in both quantity and quality of the nutritional status. The Nutritional Supplementation Programme in South Africa supplements at least one brand of staple food, which will provide specifically nutritionally vulnerable groups with enriched food nutrients (Charlton *et al.,* 2008). Dean (2008) further mentions that supplemental food programmes, home-delivered meals, as well as institutional based programmes moreover offer significant opportunities to assist and ensure that low-income seniors have access to adequate nutrition.

2.10.4 Food Stamp Programme

The Department of Health and Senior Services (2010) have developed the Food Stamp Programme, known in New Jersey as the Supplemental Nutritional Assistance Programme (SNAP), which is a nutrition programme that is designed to increase the food purchasing power of low-income households. According to Dean (2008), the food stamp programme is the American's most efficient and effective anti-hunger programme, and provides assistance every month to more than 2 million seniors. Its benefits are well-targeted towards the people who have the greatest difficulty affording an adequate diet. However, in South Africa, the food stamp programme is available at Shoprite and Checkers stores.

2.10.5 Feeding Programmes

Hunger and malnutrition are key predicators pertaining to nutrient inadequacies in the elderly and, therefore, feeding programmes are a support for the elderly that do not have access to food. Charlton *et al.* (2008) mentioned that non-governmental organisations are actively involved in implementing food based programmes eg: soup kitchens and food parcels to the elderly in rural communities. The South African INP feeding schemes have been dedicated to children, pregnant and lactating mothers with very little attention to the elderly.

2.10.6 Vegetable Gardens

The main focus for the development of vegetable gardens is to provide the elderly with nutrition that is easily accessible and uses light physical activity. A basic gardening skill thus empowers the elderly to enable them to be food secure. Community based nutrition programmes performed by the Institute of Nutritional Programme are implementing development projects that consist of bread baking, food preserving, vegetable gardening and animal husbandry (Charlton *et al.*, 2008).

A significant symbol of hope for the elderly community is to encourage them to be economically sustainable with the transfer and knowledge of vegetable gardens specifically in a dry environment (Charlton *et al.*, 2008). The elderly can gather at local communities assisting in preparing, planting and harvesting of vegetables and packaging of vegetables for selling. In addition, the encouragement of vegetable gardens is important to alleviate food security and malnutrition, as the gardens can be made in even the smallest space or vegetables can be planted in a container to provide food and even an income for the whole family. Vegetable gardens also beautify and protect the environment and offer recreational benefits for the family. Facilitate a community gardening project for the elderly if home gardening is not working well and encourage planting of fruit trees (e.g. orange trees) in the community (Puoane *et al.,* 2008).

2.10.7 Nutrition Education

Nutrition education provides knowledge of basic nutrition science and relationships between health in addition to diet with the intention that informed dietary decisions can be made to encourage the elderly to alter their dietary habits (Francis, Taylor and Haldeman, 2009). It is an important preventive measure of malnutrition, as it empowers them to be less of a burden to themselves and family members and, incidentally, to the welfare of the state (Davies, 1976 and Mbhenyane, Makuse, Ntuli, Mbhatsani and Sayed, 2008). Behaviour change results from multifaceted decision-making processes, including an individual perception of ability to change, social and or environmental influences, and coping skills that may negatively influence or change their nutrient intake. Francis *et al.* (2009) further suggests that educating the elderly on basic nutrition concepts allows them to adapt, including food patterns, in spite

of physical, psychological and social changes and is effective in contributing to the elderly person's quality of life, particularly the morale and self-efficacy. Education on the food stamp programme may alleviate the incidence of malnutrition that is obtainable from franchise retail stores (Davies, 1976).

Nutrition education can improve intra household food distribution and caring behaviour, as well as nutrition efficiency at the aggregate household level (Engesveen and Shrimpton, 2007). Mbhenyane *et al.* (2008) further indicated that nutrition education involves motivating and support to adapt to healthy eating practises as well as promoting a variety of foods that are rich in macronutrients and micronutrients. The giving of nutrition advice on adopting healthy eating supported by advice on how to plant, protect, store, process and prepare foods, can be done by the use of a variety of channels and adaptations of messages to target vulnerable groups (Mbhenyane *et al.*, 2008).

2.10.8 Food Based Dietary Guidelines

Food based dietary guidelines incorporate the nutrient composition of foods, as well as the non-nutrient components of food and provide advice on consumption of the types of food components for which there are related community health concerns (Labadarios and Steyn, 2001). The food based dietary guidelines include locally available foods, sustainable food production; food patterns (e.g. traditional diets and cuisine, and the influence on morbidity and mortality levels in populations (WHO, 1999b). Traditionally, the elderly food intake tends to decrease with advancing age to compensate for the diminished energy needs associated with lower energy expended in physical activity and basal metabolic rate (Lichtenstein, Rasmussen, Yu, Epstein and Russell, 2008).

The food based dietary guidelines for South Africa were adapted to suite consumer groups of different ethnic backgrounds over the age of 7 years in both rural and urban areas, (Vorster, Love and Browne, 2001), and include the following guidelines:

- Enjoy a variety of foods.
- Be active.
- Make starchy foods the basis of most meals.

• Eat plenty of fruit and vegetables.

• Eat dry beans, peas, lentils and soya often.

• Meat, fish, chicken, milk and eggs can be eaten every day.

• Eat fats sparingly.

• Use salt sparingly.

• Drink lots of clean, safe water.

• If you drink alcohol, drink sensibly.

The basis of the food based dietary guideline centres on the available evidence that dietary variety is associated with longevity (Vorster *et al.,* 2001). Evidence shows that for a number of nutrients and food groups, a dietary imbalance can increase the risk of obesity and diet-related diseases (e.g. cardiovascular disease, cancer, diabetes mellitus, osteoporosis and dental disease) that are of importance for public health (Alasfoor, Rajab and Al-Rassasi, 2009).

2.10.9 Mediterranean Diet Plan

The Mediterranean diet is known to be one of the healthiest dietary patterns in the world due to its relation with a low morbidity and mortality for some chronic diseases (Roman, Carta, Ángel, González and Serra-Majem, 2008 and Panagiotakos, Polystipioti, Papairakleous and Polychronopoulos, 2007)). A study conducted by Haveman-Nies, De Groot, Wija and Van Staveren (2003), indicated that there is escalating evidence that following a Mediterranean style diet, correlates with higher longevity and delays the onset of the deterioration in health. The Mediterranean dietary patterns consists of abundant plant foods, minimally processed foods, seasonally fresh and locally grown foods; fresh fruits as the typical daily dessert with sweets made from nuts, olive oil and concentrated sugars or honey that are consumed during feast days; olive oil as the principal source of dietary lipids; dairy products mainly cheese and yoghurt consumed in low to moderate amounts; fewer than four eggs consumed per week; red meat consumed in low frequency and amounts; wine consumed in low to moderate amounts, and generally taken with meals (Panagiotakos *et al.,* 2007 and Haveman-Nies *et al*., 2003).

However, such a dietary pattern assures a sufficient intake of certain nutrients that have been related in some way to a reduced risk of several chronic diseases (Roman *et al*., 2008). Therefore, the Mediterranean diet is most suitable for this community to assist with the reduction of risks factors for cardiovascular disease such as lipoprotein levels, endothelium vasodilatation, insulin resistance, the prevalence of the metabolic syndrome, antioxidant capacity, the incidence of acute myocardial infarction, cardiovascular mortality, hypertension, hypercholesterolemia, diabetes and obesity in elderly people (Roman *et al.,* 2008 and Panagiotakos *et al.,* 2007).

The following recommendations suggested by the World Health Organisation, (2010d) in order to improve cardio respiratory and muscular fitness, bone and functional health, reducing the risk of NCDs, depression and cognitive decline are as follows:

- Older adults should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity.
- Aerobic activity should be performed in short phases of at least 10 minutes duration.
- For additional health benefits, older adults should increase their moderate intensity aerobic physical activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate-and vigorous-intensity activity.
- Older adults, with poor mobility, should perform physical activity to enhance balance and prevent falls on 3 or more days per week.
- Muscle-strengthening activities, involving major muscle groups, should be done on 2 or more days a week.
- When older adults cannot do the recommended amounts of physical activity due to health conditions, they should be as physically active as their abilities and conditions allow.

2.10.10 Government Initiatives

Poverty and poor nutritional intake can contribute to the high levels of nutrient related deficiencies experienced by elderly individuals (Charlton, 2000). Malnutrition is one of the most devastating problems worldwide and is inextricably linked with poverty. The South African Department of Agriculture (2002) indicated that the SA Reconstruction and Development Programme (RDP) in 1994, ensured pension funds for the elderly and provincial community food garden initiatives like Kgora and Xoshindlala, land reform and farmer settlement, production loans scheme for small farmers and the infrastructure grant for smallholder farmers (South African Department of Agriculture, 2002).

The South African Integrated Nutrition Programme (INP) is one of the key strategic health programmes to decrease morbidity and mortality rates in South Africa (Department of Health (DoH), 2010). In addition, malnutrition is manifested in both undernutrition as well as overnutrition and the INP targets nutritionally vulnerable communities, groups and individuals and the emphasis of the programme is on building the long term capacity of communities to be self-sufficient in terms of their food and nutrition needs, while at the same time protecting and improving the health of the most vulnerable parts of the population (DoH, 2010).

The Millennium Development Goals (STATSSA, 2010) is an integrated approach to poverty, food security, education, gender, health, access to services and environmental sustainability in South Africa. The first MDG is to eradicate extreme poverty and hunger, in essence the MDGs targets as provided for at a $2.50 per day measure of which poverty remains a reality in South Africa. An improvement in the current food security interventions, which include food parcels, soup kitchens and social grants constantly monitor usage and impact on the vulnerable recipients (STATSSA, 2010).

2.11 CONCLUSION

The literature has indicated a combination of interrelated variables such as the nutritional transition factors that influence the ageing process and the dietary patterns of the elderly. The integrated impact of these variables has been clearly indicated by the use of Figure 1.3 as the

conceptual framework of the dietary impact experienced by the elderly. The basis of understanding the literature has thus created a foundation and support for the objective goal of the research, to improve the dietary habits and nutrition intake of the elderly in Verulam.

The challenges of the research objective are to ensure that the nutrient requirements are achieved as an integrated nutrition education programme based on the food based dietary guidelines for South Africans. However, the literature suggested that malnutrition in the elderly population of South Africa is evidently related to a combination of food security and urbanisation thus leading to inadequate nutrient intake.

CHAPTER 3 – METHODOLOGY

3.1 INTRODUCTION

The ageing population is poised to become a major concern in developing countries, which are projected to age rapidly in the first half of the twenty-first century as stated by the United Nations (2002) and the proportion of elderly is expected to increase from 8 to 19 percent by 2050 noted by (Ferreira and Kowal, 2006 and Marais, Marais and Labadarios, 2007). The historical inequalities such as land deprivation and limited access to education, which manifest through high levels of unemployment and underdevelopment in all the regions of South Africa (Makiwane and Kwizera, 2007) leave the elderly with social, economic and medical challenges that affect their current nutritional status for the future. Research conducted by Charlton (2000) and Makiwane and Kwizera (2007) on the elderly in South Africa indicated that the nutritional status in both elderly men and women was reduced due to poor financial security.

The rationale of the study was to determine the nutritional status and dietary intake patterns of a group of elderly at a day and frail care centre in Verulam. The main objective of this part of the study is to determine the socio-demographic background, nutritional status as well as dietary intake patterns of n=250 free living elderly that attended the Verulam Day and Frail Care Centre. The measurements chosen for this study included a socio-demographic questionnaire, anthropometric measurements, health questionnaire, food frequency questionnaire and two 24-Hour Recall questionnaires. This chapter focuses on the study design, planning, including the administration of the study, data analysis and statistics.

3.2 PLANNING AND ADMINISTRATION

The researcher approached the senior social worker at the Verulam Day and Frail Care Centre, a Non-profitable organisation and briefed her with the objectives of the research proposal. The senior social worker was in agreement with the benefits of the research project for the community centre. A meeting was then scheduled with the senior committee members, from whom permission was granted to pursue the research. Refer to Annexure A

for the letter of permission. Once permission was granted, verbal announcements were made by the senior social worker addressing the elderly regarding the project. Ten randomly selected elderly participated in the pilot study to ensure they were comfortable with the questions, questioning process and that the questions were easy to comprehend. The respondent's participation was entirely voluntary. Figure 3.1 illustrates the process of the research project.

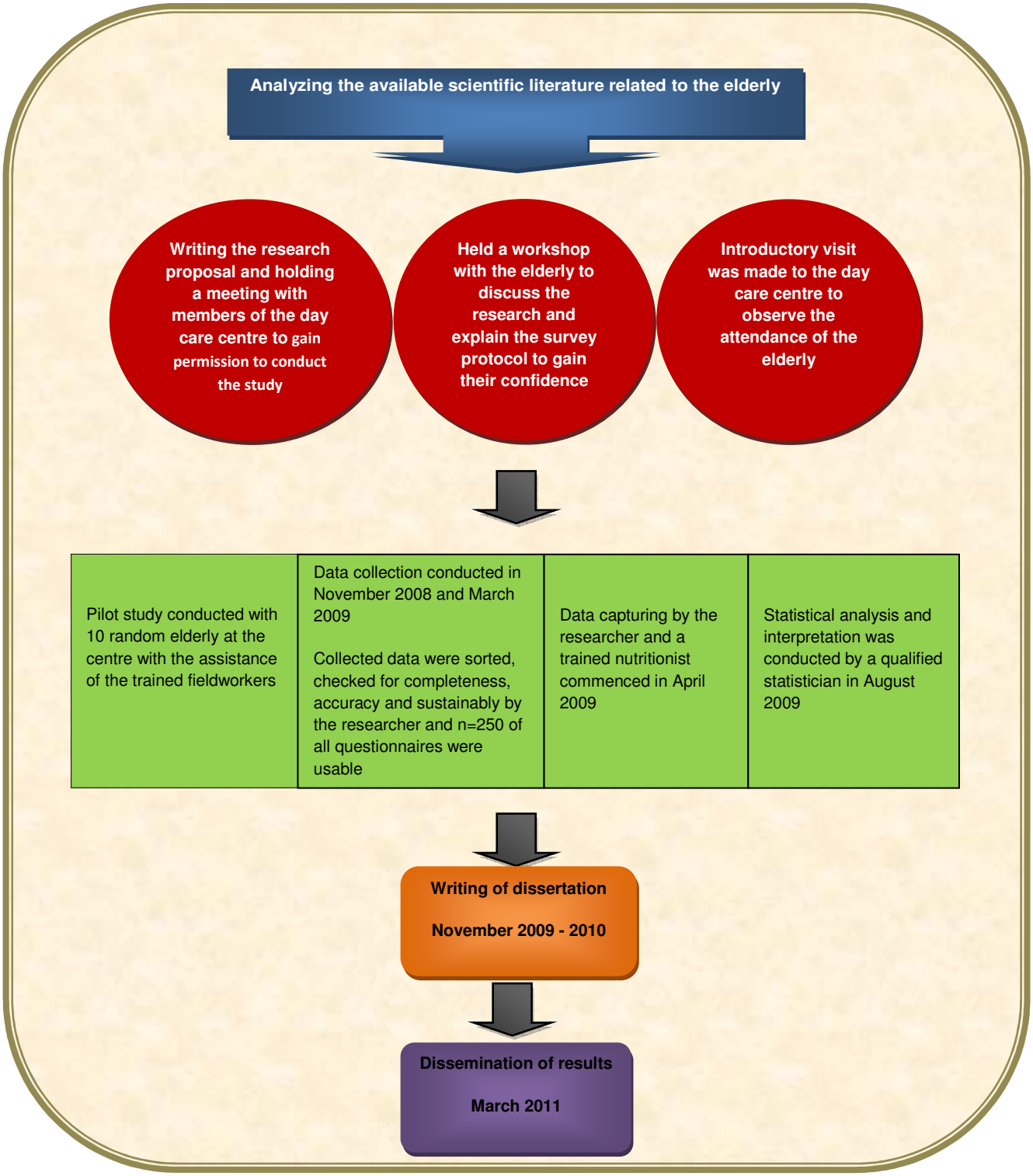

Figure 3.1 Planning and administration process of the research project.

3.3 RESEARCH DESIGN

South Africa has nine official provinces one of which is KwaZulu-Natal and the capital is Pietermaritzburg. The research project took place in a small town called Verulam. Verulam is a town situated 28km north of Durban in KwaZulu-Natal, South Africa and is now part of the eThekwini Metropolitan Area (Verulam Information, 2010). The town has a population well over 63,000. Verulam contains densely populated residential and industrial areas, which include a multitude of shopping centres, mosques, temples and churches. At the outskirts are large farming areas, several "suburbs" which are mostly rural and 12 surrounding urban areas where there are middle to lower income status households. Verulam is mainly inhabited by Indians whose ancestors were brought to South Africa by the British to cultivate sugarcane. There has been a slow but steady progress in modernising the town by providing adequate infrastructure to the rural areas. The highlight of Verulam is the morning market where people from all around Kwa-Zulu Natal come to obtain their fresh fruits and vegetables as there is a large variety at affordable prices.

This study was conducted in a day and frail care centre in Verulam, where 700 elderly attend social gatherings and activities on a daily basis. The elderly day care was contacted in May 2008 to obtain permission for the research and to determine the number of elderly to include in the study.

The inclusion criteria were the following:

- All men and women above the age of 60.
- All respondents who were mobile and free living in the Verulam district of Kwa-Zulu Natal.

The exclusion criteria were the following:

- All men and women under the age of 60.
- All men and women under the age of 60 who are not permanent residents of the Verulam district.
- Men and women (60+) Relatives/helpers of the elderly.
- Disabled elderly.

The management of the day care centre provided the researcher with a name list of the free-living elderly frequently attending the centre. The researcher then randomly selected respondents that met the inclusion criteria and approached these respondents, who then completed a letter of informed consent to participate in the study.

Figure 3.2 Map of Verulam (Google Map, 2011)

3.4 ETHICAL CONSIDERATION

The Verulam Day and Frail Care Centre management team granted permission on behalf of the elderly for the study to be conducted. A meeting was held with the elderly at the Verulam Day and Frail Care Centre to explain the research project and included the signing of an informed consent agreement (Annexure B). Participants were informed about confidentiality of all information and data collection. The study was approved by the Faculty Research Committee of the Durban University of Technology (DUT), and the data were collected in November 2008 and February 2009. The researcher followed the SA Medical Research Council ethical guidelines for research on human beings throughout the study.

3.5 FIELDWORKERS

The Durban University of Technology, Department of Food and Nutrition Consumer Sciences trained the 3rd year Food and Consumer Science students to conduct the fieldwork. Ten of these trained students, who were familiar with the local language, were recruited to assist the researcher with fieldwork. English was the language medium of instruction for the fieldworker. Training session and fieldworker guidelines were printed in English (Annexure C). The fieldworker training included how to approach the respondents, code of conduct, and administration of the health, 24-Hour Recall and FFQ questionnaires. A demonstration was given on how to obtain correct anthropometric measurements and the use of food models to demonstrate correct portion sizes and to assist the respondents identify unfamiliar foods. An assortment of participatory facilitating methods was used in the training which included case studies, role-play, and communication skills allowing the fieldworkers to capture the correct data as well as to make them feel confident when collecting data. The significance of the research was discussed with the fieldworkers to inform them of the objectives and importance of the research.

3.6 STUDY POPULATION AND SAMPLING

The researcher applied simple random sampling. The care centre was identified in this community as the area where the elderly congregated, and the elderly who participated in the study were randomly selected. The majority of the sample population were categorized according to the WHO (2008), young elderly aged (≥60≤69) that formed 55 percent of the population, the old old (≥70≤79) formed 36 percent of the sample and the very old (≥80) were 9 percent of the sample. The sample population consisted of 23.6 percent (n=59) men and 76.4 percent (n=190) women.

3.6.1 Sampling Strategy

The sample was calculated using a power calculation and 248 subjects out of a population base of 700 elderly attending the day care centre in Verulam were required to obtain statistically significant results. The sample size was rounded off to 250 to account for possible dropouts (Cole, 2006).

Sample Size:

$$ss = \frac{Z^2 * (p) * (1-p)}{c^2}$$

Where:

Z = Z value (e.g. 1.96 for 95% confidence level)

p = percentage picking a choice, expressed as decimal (0.5 used for sample size needed)

c = confidence interval, expressed as decimal = 0.04 (three units on both sides of the normal).

The sample consisted of 60 men and 190 women aged 60-91years in Verulam in Kwa-Zulu Natal.

Figure 3.3 An illustration of the sample population at the Verulam Day Centre.

3.7 STUDY DESIGN AND MEASURING INSTRUMENT

The study design for the survey was a cross sectional, analytical design whereby a variety of variables were measured. Different types of questionnaires were used in the study. The fieldwork was conducted in an open meeting room at the care centre. There were different activity stations set up to streamline the data collection process as represented by Figure 3.2.

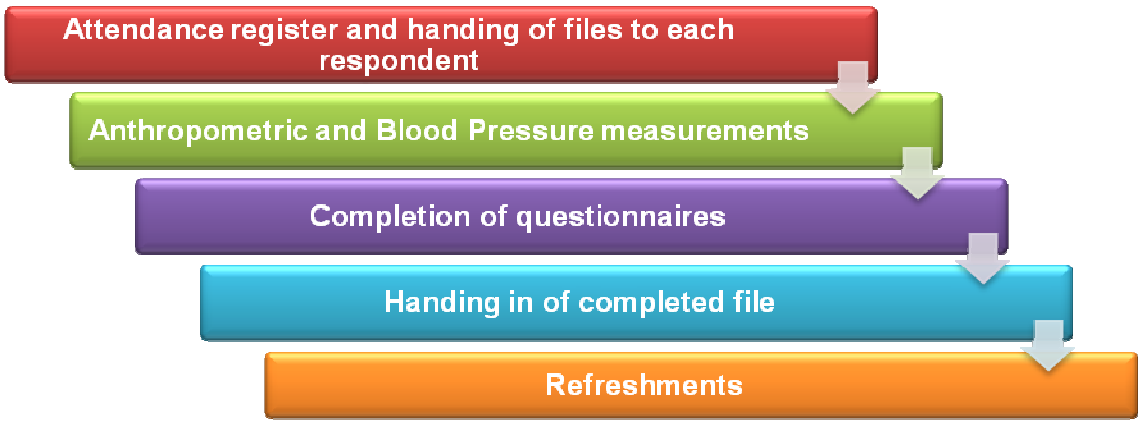

Figure 3.4 Data collection process.

3.7.1 Anthropometric Measurements

Anthropometric measurements used were weight, height and waist circumference.

3.7.1.1 Weight

Two fieldworkers were responsible for measuring and recording weight and height measurements. All respondents wore light clothing with shoes and socks removed. The body weight was measured to the nearest 0.1kg using a standardised collaborated scale. All measurements were taken twice and the average recorded.

Weight measurement adapted by Tolonen, Kuulasmaa, Laatikainen and Wolf (2002) was conducted as follows:

- A calibrated electronic scale 2000, Model: Portable Physician Scale (PPS) was used to measure weight.
- The scale was placed on an even uncarpeted surface, with the spirit level indication in the middle.
- The scale was switched on and the fieldworker waited until the zero indication (0, 0) appeared on the display panel.
- The respondent was placed on the scale standing upright on the middle of the scale platform, facing straight ahead and their feet had to be flat and slightly apart.
- The respondents had to stand still until the measurement was recorded.
- The respondents then step down and repeat the process for the second recording.
- The two weight readings had to be within the nearest 0,1 kg and an average of the two measurements was recorded if the same reading had not been obtained.

Figure 3.5 Elderly participant weight measure recorded by a trained fieldworker at the Day Care Centre.

3.7.1.2 Height

The height measurements adapted by Tolonen *et al.* (2002) were conducted as follows:

- A stadiometer was used to measure height.
- The respondents had to remove their shoes.
- The respondent was positioned facing the fieldworker with shoulders relaxed, arms relaxed at the sides, legs straight and knees together, buttocks and heels touching wall, feet flat with heels touching each other.

- The respondents had to look straight ahead before the headpiece was slid down on to their head. The headpiece was placed in the center of the crow of the head.
- The fieldworker recorded the reading in metres.
- The procedure was repeated, the readings were taken to the nearest 0,5cm and an average of the two measurements was recorded if the same reading had not been measured.

Figure 3.6 Elderly participants height measure recorded by a trained fieldworker at the Day Care Centre.

3.7.1.3 Waist Circumference Measurement

One fieldworker was responsible to take all the respondents waist circumference measurements. Waist circumference was measured with a non stretchable steel tape measure. Waist circumference was measured at a level midway between the lower rib margin and iliac crest with the tape all around the body in a horizontal position.

The waist circumference measurements adapted by Tolonen *et al.* (2002) were conducted as follows:

- Respondents were asked to remove coats and other excessive clothing, tight clothing, including the belts, should be loosened and the pockets emptied.

- The fieldworker stood at the side of the respondent in order to have a clear view of the measurement.
- Respondents stood with their feet fairly close together (about 12-15 cm) with their weight equally distributed to each leg. Respondents were asked to breathe normally; the reading of the measurement should be taken at the end of gentle exhaling. This will prevent respondents from contracting their abdominal muscles or from holding their breath.
- The measuring tape is held firmly, ensuring its horizontal position. The tape should be lose enough to allow the observer to place one finger between the tape and the respondent's body and the measurement was recorded.
- This procedure was conducted twice and the average of the two measures was recorded.

Figure 3.7 Elderly participants waist circumference measurement recorded by a trained fieldworker at the Day Care Centre.

3.7.1.4 Waist to Height Ratio (WtHR)

A non stretchable steel measuring tape was used to measure waist circumference on all respondents by a trained fieldworker to determine the risk of metabolic syndrome (Tayie,

Adjetey-Sorsey, Armah, Busolo and Imaya, 2004). The waist circumference measurements were used with the height of the respondent to determine the WtHR.

3.7.2 Health Assessment

Health assessments provide a snapshot of the elderly's current health status, therefore, used to monitor respondent's health needs over time and assist in lifestyle changes.

3.7.2.1 Health Questionnaire

A validated health questionnaire developed by General Practice Alliance (GPA) and adapted by Oldewage-Theron *et al.* (2008) was used in the study. The questionnaire was completed in a one on one interview by a trained fieldworker. The health questionnaire was completed in English and focused on the health conditions the elderly experienced. The questionnaire included a detailed coverage of the nature and severity as well as the duration of illness, change in appetite, weight loss, following a special diet, food allergy, level of physical activity, use of alcohol and smoking, type of medication used and any operations.

3.7.2.2 Blood Pressure

A sphygmomanometer was used to measure blood pressure in all respondents by a trained, registered nurse at the Verulam Day and Frail Care Centre to determine the prevalence of hypertension. Blood pressure was measured with the respondents in a seated position, the left arm was used. Two measurements were recorded and an average was used.

3.7.3 Socio-Demographic Questionnaire

The socio-demographic questionnaire developed by Oldewage-Theron *et al*. (2008) was adapted for the community and used in the study. The questionnaire was completed in a one on one interview by a trained fieldworker. The socio-demographic questionnaire was completed in English and used to collect the following data: age, gender, number of people per household, living situation, water supply, toilet facilities, environmental sanitation, problems with pests, highest education, employment status, household individuals that contribute to income to purchase food, money to purchase food, frequency of purchasing

food, meals consumed per day, where most of the meals are consumed, cooking activities and ownership of stove and TV. Two hundred and fifty questionnaires were successfully completed, forming an essential part of socio-demographic data.

3.7.4 Food Frequency Questionnaire

The food frequency questionnaire was selected as the dietary variety assessment tool for the current study since it is less time consuming and has a reduced respondent burden and cost compared to other dietary assessment tools (Willet, 1990; Block, 1982). A validated food frequency questionnaire used by Oldewage-Theron *et al.* (2008) was implemented in the study to determine the food variety of the sample population. The questionnaire was completed in a one on one interview by a trained fieldworker. Furthermore, a study conducted in another South African elderly community found that dietary diversity, specifically (Food Variety Score) FVS and (Food Group Diversity Score) FGDS, are good indicators of dietary adequacy in elderly people and can thus successfully be used as reference measurement for dietary intake assessments (Oldewage-Theron and Kruger, 2008).

3.7.5 24-Hour Recall

Two 24-Hour Recall questionnaires were used to determine the actual food items that were consumed including the portion sizes during the previous 24 hours. Food models were simultaneously used to determine accurate portion sizes. The 24-Hour Recall questionnaire was completed twice with a week interval which comprised of one week day and one week end recall, to get a clear indication of food consumption. The top 20 food items were determined from both 24-Hour Recalls and were compared to determine the reliability of data.

3.8 DATA ANALYSIS AND STATISTICS

The socio-demographic questionnaire, health questionnaire, food frequency questionnaire and anthropometric measurements were captured on an Excel® spread sheet by the researcher and analyzed 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. The ANOVA tests the significance designed to determine whether a significant difference exists among multiple

sample means (Nordness, 2006). The Pearson's correlation coefficient puts into quantitative terms the association implied by scatter plots of the two variables. A value $r = 0$ implies no association whatsoever, whereas the values $r = 1$ and $r = -1$ imply perfect positive and negative associations, respectively (Jan, 2006). However, statistical significance testing, the p-value, is the probability of obtaining a test statistic at least as extreme as the one that was actually observed, assuming that the null hypothesis is true. However, the null hypothesis is rejected when the p-value is less than 0.05 or 0.01. When the null hypothesis is rejected, the result is said to be statistically significant (Naito, 2006).

3.8.1 Anthropometric Measurements

The BMI categories for the African respondents were according to World Health Organisation BMI classification (WHO, 1995). The Asian BMI classification World Health Organisation Expert Consultation (2004a) was adapted for the respondents. The average height, weight and waist circumference were captured on an Excel® spread sheet and the body mass index (BMI) was calculated as the weight (kg) divided by height squared (m^2). The data captured were analyzed on the SPSS for windows version program with the assistance of a statistician.

3.8.1.1 Waist to Height Ratio

The waist circumference and height measurement cut-off points described by Gibson (1990) were used and were captured on and Excel® spread sheet by the researcher and then analyzed by using the SPSS for windows version 17 programme with the assistance of a statistician. The data analyzed identified respondents with risk for metabolic syndrome.

3.8.2 Health Assessment

3.8.2.1 Health Questionnaire

The completed health questionnaire data was sorted and checked for completeness and accuracy by the researcher and n=250 were usable. The data were captured on an Excel® spread sheet by the researcher and then analyzed by utilizing the SPSS version 17 for windows program with the assistance of a statistician. 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.

3.8.2.2 Blood Pressure Measurement

Blood pressure measurement data were captured on and Excel® spread sheet by the researcher and then analyzed by the utilizing the SPSS for windows version 17 program with the assistance of a statistician. The data analyzed identified respondents with the prevalence to hypertension according to the World Health Organisation cut-off points (WHO, 2005).

3.8.3 Socio-Demographic Questionnaire

All the data completed on the socio-demographic questionnaire were sorted and checked for completeness and accuracy by the researcher and n=250 were usable. 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.

3.8.4 Food Frequency Questionnaire

The completed food frequency questionnaire data was sorted and checked by the researcher for accuracy and completeness and (n=250) were usable. The data were captured on an Excel® spread sheet by the researcher and then analyzed by using the SPSS for windows

version 17, 0 software program with the assistance of a statistician. The different DD measures, referred to as dietary variety, were calculated as follows: (1) overall variety score (simple count of food items), (2) variety score between all nine food groups and (3) a variety score within every food group (Hatloy, Torheim and Oshaugh, 1998). These scores were calculated for a reference period of seven days for this study, and were used together to reflect DD in different ways. The dietary diversity score (DDS) consisted of a simple count of single foods and food groups, similar to previous studies in developing countries (Krebs-Smith, Smiciklas-Wright, Guthrie and Krebs-Smith, 1987 and Clausen *et al*., 2005).

The nine nutritious food groups recommended by the FAO were used for the classification of broad food intakes. A low variety was indicated when less than 30 foods were consumed in a period of 7 days, compared to a medium variety with 30 to 60 foods or high variety with more than 60 foods consumed in the same period (Matla, 2008). All the dietary diversity scores (FVS, FGDS and DDS) were calculated from the seven-day FFQ (n=250). 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.

3.8.5 24-Hour Recall

The data were captured and analyzed by a nutrition professional using the MRC Food Finder® version 3.0 software, based on the South African Food Composition Tables of South Africa (Langenhoven, Kruger, Gouws and Faber, 1991). This program was developed to analyse the nutrient content of food items consumed. The nutrient intake and top 20 food items most commonly consumed by the sample for one week end and one week day were recommended. Statistical analysis was performed by the researcher, correlations were drawn with certain variables, tables and graphs illustrated the results by means and standard deviation for interpretation of the prevalence of nutrient deficiencies that could be deducted from the questionnaire. The association of the nutrient intake and nutritional status were compared to 100 percent of the DRIs (IoM, 2003) for elderly older than 51 years.

3.9 Conclusion

This chapter has presented an overview of action research as a methodological approach to identifying the nutritional status and dietary intake patterns encountered by the elderly in the community of Verulam. The principles and procedures of this study, and epistemological underpinnings, were described, along with the evolution of the practice. Details of a conference with the day care centre management as well as all respondents indicating the measuring apparatus were given, as was an indication of the roles and ethics involved in the research study. The next chapter will disclose the interpretation of results of the study.

CHAPTER 4 – RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter reports on the results of the processed data as tabulated, interpreted and evaluated. Only the imperative hypotheses are dealt with. The sample techniques resulted in n=250 respondents forming part of the sample population with a total of 100 percent response.

4.2 STUDY RESULTS SOUTH AFRICA:

4.2.1 Socio-Demographic

The socio-demographic results present the study population categorized in percentages according sample size, accommodation and family composition, work status, income, education, language as well as assets.

4.2.1.1 Sample Size

Figure 4.1 illustrates that a large number of the sample were Indian respondents (82.4%, n=206), of which the majority of the respondents were Indian women (62.0%, n=155) and Indian men (20.4%, n=51), whereas the African women comprised 14.4% percent (n=36) and 3.2 percent men (n=8), the mean (±SD) sample age of men were 70 (±7.14) and women 69 (±6.9). A large percentage of the sample were of Hindu faith (60%, n=151).

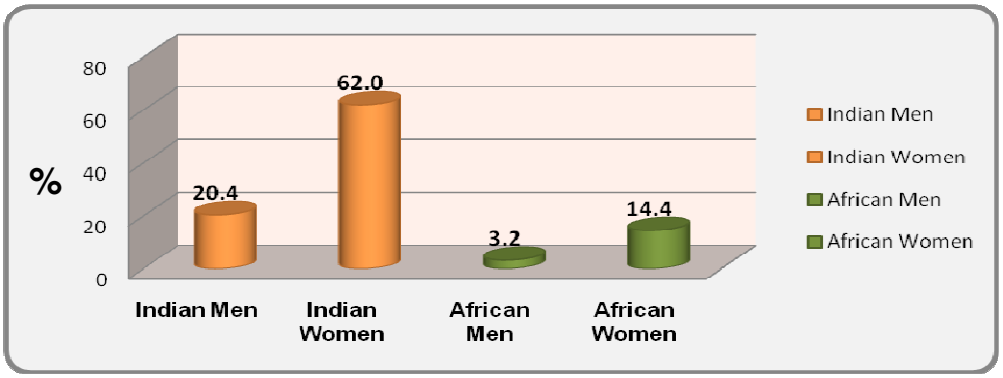

Figure 4.1 Sample distribution according to gender and race.

4.2.1.2 Accommodation and Family Composition

The results presented in Table 4.1 indicate that 70.8 percent of the respondents who completed the questionnaires role in the family were mothers, followed by fathers (20.0%, n=50). It can thus be seen that the majority of respondents (68.8%, n=172) lived in the urban area whereas a small percentage (31.2%, n=78) lived in a rural village. However, most of the respondents shared the house with one to five people (73.2%, n=183) and 74.4 percent (n=186) lived in a brick house with more than 3 rooms (74.0%, n=185) as indicated in Table 4.2.

Table 4.1 Role in family and living area type.

Variables	Number (n=250)	Percentage (%)
Role In Family		
Mother	**177**	**70.8**
Grandmother	13	5.2
Father	**50**	**20.0**
Grandfather	10	4.0
Living Area Type		
Town/City	**143**	**57.2**
Farm	18	7.2
Squatter Camp	58	23.2
Rural village	2	0.8
Day Care Centre	25	10.0
Township	4	1.6

Table 4.2 Family size, type of house and number of rooms per household.

Variables	Number (n=250)	Percentage (%)
Household size		
One – Five	**183**	**73.2**
Six – Ten	67	26.8
Ten and above	0	0.0
Type of house		
Brick	**186**	**74.4**
Clay	18	7.2
Zinc/Shack	46	18.4
Number of Rooms		
< 2 Rooms	65	26.0
3-4 Rooms	**98**	**39.2**
> 4 Rooms	87	34.8

According to Table 4.3, a large percentage of the respondents live in a rented house (42.3%, n=108) and the majority have access to clean safe water (80.0%, n=200). In addition 75.2 percent (n=188) had access to hygienic flush/sewage toilets (see Table 4.4). The results reported in Table 4.5 indicate that a large number of the problems experienced in households were too small houses to accommodate family members (67.6%, n=169), along with the presence of household pests especially ants (17.6%, n=44), however, 42.4 percent (n=106) are not affected by household pests.

Table 4.3 Living Status

Variables	Number (n=250)	Percentage (%)
Living Status		
Homeless	2	0.8
Living with relatives	28	11.2
Squatter home	58	17.0
Rented house/flat	**108**	**42.3**
Own house/flat	54	28.7

Table 4.4 Access to facilities

Variables	Number (n=250)	Percentage (%)
Water Supply		
Tap in House	**180**	**72.0**
Tap outside the yard	20	8.0
Spring/River/Dam water	36	14.4
Fetch water from elsewhere	14	5.6
Toilet facility		
None	2	0.8
Pit Latrine	58	23.2
Flush/Sewage	**188**	**75.2**
Bucket System	2	0.8

Table 4.5 Problems with housing and pests

Variables	Number (n=250)	Percentage (%)
Problem with housing		
None	17	6.8
Too small	**169**	**67.6**
cracking	15	6.0
Repairs	10	4.0
Gezer is leaking	3	1.2
Roof leaking	8	3.2
Toilet leaking	2	0.8
Damp	26	10.4
Problem with household pests		
Mice/Rats	36	14.4
Cockroaches	38	15.2
Ants	**44**	**17.6**
Flees	3	1.2
Mosquitoes	21	8.4
Geckos	1	0.4
Snakes	1	0.4
None	**106**	**42.4**

4.2.1.3 Work Status and Income

The results in Table 4.6 represent the work status and income as the majority of the sample were pensioners and, therefore, received state grants (76.0% n=190). Moreover the sample total household income ranged between R1001-R1500 in 35.2 percent (n=88) which is in line with the SA state grants. As indicated in Table 4.7 there is a possibility of food insecurity in the sample as (28.4 percent(n=71) never and 18.8 percent (n=47) seldom had enough money to purchase food. The majority of the sample population (86.9%, n=216) purchase food once a month and food was purchased from wholesalers due to affordability. Fourty seven point percent (n=118) and 40.4 percent (n=101) spent more than R500 on purchasing food although the rest spent less than R500 (55.6%, n=139).

Table 4.6 Work Status and Income

Variables	Number (n=250)	Percentage (%)
Current Status		
Retired	45	18.0
Employed	15	6.0
Pensioner	**190**	**76.0**
Total Household Income		
<R500	11	4.4
R501-R1000	61	24.4
R1001-R1500	**88**	**35.2**
R1501-R2000	39	15.6
R2001-R2500	42	16.8
R>R2500	9	3.6

Table 4.7 Food Security

Variables	Number (n=250)	Percentage (%)
Frequency of money to purchase food		
Always	35	14
Often	27	10.8
Sometimes	70	28.0
Seldom	47	18.8
Never	**71**	**28.4**
Frequency to purchase food		
Everyday	8	3.2
Once a week	23	9.2
Once a month	**216**	**86.4**
Other	3	1.2
Where food is purchased		
Tuck shop	13	5.2
Street Vendor	44	17.6
Wholesalers	**118**	**47.2**
Supermarket	73	29.2
Other	2	0.8
Frequency of money spent of food per month		
R0-R50	1	0.4
R51-R100	6	2.4
R101-150	3	1.2
R151-R200	15	6.0
R201-R250	41	16.4
R251-R500	73	29.2
>R500	**101**	**40.4**
Do not know	10	4.0

4.2.1.4 Education and Language

The results presented in Table 4.8 indicate that 52.4 percent (n=131) of the sample completed primary school as their highest level of education and English is spoken by 74.0 percent (n=185) of the sample population.

Table 4.8 Level of education and language

Variables	Number (n=250)	Percentage (%)
Level of Education		
None	69	27.6
Primary School	**131**	**52.4**
Standard 8	31	12.4
Standard 10	15	6.0
College/FET	3	1.2
Other Post school	1	0.4
Language		
Hindi	15	6.0
Tamil	7	2.8
English	**185**	**74.0**
IsiXhosa	1	0.4
IsiZulu	41	16.4
Sesotho	1	0.4

4.2.1.5 Food Security and Household Assets

A large number of the respondents (35.2%, n=88) were responsible for their own food preparation, decision of the type of food purchased and the amount of money spent on food (refer to Table 4.9). According to Table 4.10, the majority of the respondents consumed 3 or more meals per day (57.2%, n=143) and most of the meals were consumed at home by 92.4 percent (n=231).

Table 4.9 Food preparation

Variables	Number (n=250)	Percentage (%)
Responsible for food preparation in household		
Daughter	28	11.2
Daughter-in-law	49	19.6
Sister	22	8.8
Cousin	12	4.8
Self	**88**	**35.2**
Wife	31	12.4
Relative Living with	20	8.0
Who decides the type of food purchased in household		
Son	20	8.0
Daughter	28	11.2
Son-in-law	2	0.8
Daughter-in-law	49	19.6
Cousin	12	4.8
Self	**88**	**35.2**
Wife	31	12.4
Relative Living with	20	8.0
Who decides the money spent on food		
Son	20	8.0
Daughter	28	11.2
Son-in-law	2	0.8
Daughter-in-law	49	19.6
Cousin	12	4.8
Self	**88**	**35.2**
Wife	31	12.4
Relative Living with	20	8.0

Table 4.10 Meals Consumed

Variables	Number (n=250)	Percentage (%)
Number of meals consumed per day		
0	0	0.0
1	47	18.8
2	60	24
3	**77**	**30.8**
>3	66	26.4
Where most meals are consumed		
Home	**231**	**92.4**
Friends	5	2.0
Work	2	0.8
Day care centre	12	4.8

Table 4.11 indicates that 85.2 percent (n=213) of the sample population owned an electric stove, 69.2 percent (n=173) a microwave, 87.6 percent (n=219) a radio, 92.4 percent (n=231) a television, 87.6 percent (n=219) a refrigerator, 58.4 percent (n=146) a freezer, 84.0 percent (n=210) a bed base and mattress, 87.6 percent (n=219) an electric iron and 89.2 percent (n=223) an electric kettle. However, the results presented in Table 4.12 report that 87.2 percent (n=218) of the elderly use electricity to prepare food and 66.0 percent (n=165) use aluminum pots to cook food.

Table 4.11 Personal Assets

Variables	Number (n=250)	Percentage (%)
Electrical stove		
Yes	**213**	**85.2**
No	37	14.8
Gas stove		
Yes	59	23.6
No	**191**	**76.4**
Primus or paraffin stove		
Yes	41	16.4
Not	**209**	**83.6**
Microwave		
Yes	**173**	**69.2**
No	77	30.8
Hot plate		
Yes	71	28.4
No	**179**	**71.6**
Radio		
Yes	**219**	**87.6**
No	31	12.4
Television		
Yes	**231**	**92.4**
No	19	7.6
Refrigerator		
Yes	**219**	**87.6**
No	31	12.4
Freezer		
Yes	**146**	**58.4**
No	104	41.6
Bed base with mattress		
Yes	**210**	**84.0**
No	40	16.0
Mattress only		
Yes	48	19.2
No	**202**	**80.8**

Table 4.11 Personal Assets (Continued)

Variables	Number (n=250)	Percentage (%)
Lounge suite		
Yes	120	48.0
No	**130**	**52.0**
Dining room suite		
Yes	80	32.0
No	**170**	**68.0**
Electrical iron		
Yes	**219**	**87.6**
No	31	12.4
Electrical, kettle		
Yes	**223**	**89.2**
No	27	10.8

Table 4.12 Fuel and pots used to cook food.

Variables	Number (n=250)	Percentage (%)
Type of fuel used for food preparation		
Wood fire	3	1.2
Paraffin	27	10.8
Electricity	**218**	**87.2**
Gas	2	0.8
Coal/Charcoal	0	0.0
Other	0	0.0
Type of pots used to cook food		
Cast iron	5	2.0
Aluminium	**165**	**66.0**
Stainless steel	79	31.6
Clay	1	0.4
Other	0	

Table 4.13 illustrates that 69.2 percent (n=173) of the sample used salt in the food while cooking, whereas 39.6 percent (n=99) do not add salt to food after being cooked and 51.2 percent (n=128) enjoy consuming salty foods.

Table 4.13 Use of salt

Variables	Number (n=250)	Percentage (%)
Use salt in food while been cooked		
Yes	**173**	**69.2**
No	25	10.0
Maybe	14	5.6
Do Not know	38	15.2
Use salt after food cooked		
Yes	59	23.6
No	**99**	**39.6**
Maybe	59	23.6
Do Not Know	33	13.2
Like salty foods		
Yes	**128**	**51.2**
Not	24	9.6
Sometimes	95	38.0
Do Not Know	3	1.2

4.2.2 Anthropometric and Health Indicators

4.2.2.1 Anthropometric Indices

The BMI of the Indian women reported in Table 4.14 indicated that the majority of the sample (77.4%, n=120) were overweight and obese, only 7.7 percent (n=12) confirmed to be underweight. Likewise, 74.5 percent (n=38) of the Indian men ranged in the overweight and obese category. When compared with the Indian women, most of the African women (75.0%, n=27) were overweight or obese, none were underweight. The African men had a mean (±SD) BMI of 15.63 (±1.06), with 25.0 percent being underweight and 75 percent being of normal weight. None of the African men were overweight or obese when compared to the Indian men, but this may be due to the small sample size (n=8) compared to the (n=51) Indian men in the sample.

Table 4.14 Summary of Body Mass Index.

Parameter	Indian Men (n=51)	(Mean±SD)	Percentage (%)	Indian Women (n=155)	(Mean±SD)	Percentage (%)
Asian BMI classification, WHO (2000)						
Underweight <18.5	6	15.93 ± 1.46	11.76	12	16.03 ± 1.89	7.74
Normal 18.5 - 22.9	7	20.83 ± 1.36	13.73	23	21.47 ± 1.59	14.84
Overweight 23 - 24.9	10	23.73 ± 0.78	19.61	22	54.48 ± 0.95	14.19
Obesity Class I 25.0 - 29.9	**16**	**27.15 ± 1.09**	**31.37**	**53**	**27.22 ± 1.36**	**34.19**
Obesity Class II ≥30	12	34.51 ± 3.54	23.53	45	33.43 ± 2.80	29.03
Parameter	**African Men (n=8)**	**(Mean±SD)**	**Percentage (%)**	**African Women (n=36)**	**(Mean±SD)**	**Percentage (%)**
BMI classifications, WHO (1995)						
Underweight <18.50	2	15.63 ± 1.06	25.0	0	0 ± 0	0.0
Normal 18.50 - 24.99	**6**	**20.78 ± 1.16**	**75.0**	9	22.09 ± 2.68	25.0
Overweight ≥25.00	0	0 ± 0	0.0	**13**	**27.20 ± 1.52**	**36.11**
Obesity Class I 30.00 - 34-99	0	0 ± 0	0.0	4	31.36 ± 1.07	11.11
Obesity Class II 35.00 - 39.99	0	0 ± 0	0.0	4	36.56 ± 0.57	11.11
Obesity Class III ≥40.00	0	0 ± 0	0.0	6	44.06 ± 2.46	16.66

Blood pressure measurements indicated in Table 4.15 reported that 43.1 percent (n=22) of the Indian men had normal blood pressure (120 mmHg /<80 mmHg) compared to 25 percent of the Black men. However, 37.5 percent (n=3) of the African men presented with prehypertension (120-139 mmHg /80-89 mmHg) compared to 29.4 percent (n=15) of the Indian men. High blood pressure class 1 (140-159 mmHg /90-99 mmHg) and 2 (≥ 160 mm Hg/≥ 100mm Hg) was found in 23.5 percent (n=12) and 3.9 percent (n=2) of Indian men respectively. None of the African men had hypertension class 2, but 37.5 percent (n=3) had hypertension class 1. The majority of the Indian women (59.3%, n=92) had either prehypertension (120-139 mmHg /80-89 mmHg), high blood pressure class 1 (140-159 mmHg /90-99 mmHg) or high blood pressure class 2 (160> mmHg /100> mmHg). A similar trend was observed in the black women (66.6%, n=24).

Table 4.15 Blood Pressure Categories according to the (WHO/ISH, 2003).

	Normal BP SBP/DPB <120 mmHg /<80 mmHg	Prehypertension SBP/DPB 120-139 mmHg /80-89 mmHg	High BP 1 SBP/DPB 140-159 mmHg /90-99 mmHg	High BP 2 SBP/DPB ≥160 mmHg /≥100 mmHg
Indian Men (n=51)				
n	**22**	15	12	2
%	**43.1**	29.4	23.5	3.9
African Men (n=8)				
n	2	3	3	0
%	25.0	37.5	37.5	0.0
Indian Women (n=155)				
n	**63**	48	39	5
%	**40.6**	31.0	25.2	3.2
African Women (n=36)				
n	12	**13**	9	2
%	33.3	**36.1**	25.1	5.5

BP – Blood Pressure, SBP – Systolic Blood Pressure, DBP – Diastolic Blood Pressure

Table 4.16 indicates normal Systolic blood pressure (<120mmHg) mean (±SD) was recorded by 43.1 percent of the Indian men 108.62 (±6.40) and 68.6% normal Diastolic blood pressure (<80mmHg). However, 58.9 percent (n=30) of the Indian men were reported with systolic prehypertension (120-139 mmHg), systolic high blood pressure stage 1 (140-159mmHg) and high blood pressure stage 2 (160>mmHg) in addition 31.3 percent (n=16) had diastolic prehypertension (80-89mmHg), high blood pressure stage 1 (90-99mmHg) and high blood pressure stage 2 (100>mmHg). Seventy five percent (n=6) of the African men fell in the systolic prehypertension (120-139 mmHg) as well as the high blood pressure stage 1 (140-159mmHg). In addition, 38.0 percent (n=59) Indian women reported normal systolic blood pressure (<120 mmHg) and 65.8 percent (n=102) recorded the highest in the diastolic normal blood pressure (<80mmHg). However, 61.9 percent (n=96) Indian women further displayed systolic prehypertension (120-139 mmHg), systolic high blood pressure stage 1 (140-159mmHg) and high blood pressure stage 2 (160>mmHg) and a further 34.3 percent (n=53) of the Indian women reported diastolic prehypertension (80-89mmHg), high blood pressure stage 1 (90-99mmHg) and high blood pressure stage 2 (100>mmHg). Whereas the African women 63.8 percent (n=23) reported the highest in the systolic prehypertension (120-139 mmHg), systolic high blood pressure stage 1 (140-159mmHg) and high blood pressure stage

2 (160>mmHg). A small percentage of the African women 36.1 percent (n=13) reported normal systolic blood pressure (<120 mmHg). African women 58.3 percent (n=21) further reported the highest diastolic normal blood pressure (<80mmHg) compared to a small percentage 41.7 percent (n=15) reported prehypertension (80-89mmHg) and high blood pressure stage 1 (90-99mmHg). Although the black men had a lower BMI, compared to the Indian men, this, however, was not reflected in the prevalence of hypertension in this group. This may be due to the small sample (n=8). The majority of the respondents in the sample have indicated using salt while the food is being cooked (69.2%, n=173) and 23.6 percent (n=59) added more salt after the food is cooked. This is directly linked to the relatively high incidence of prehypertension and hypertension.

Table 4.16 Blood Pressure Indicators for Systolic and Diastolic Blood Pressure.

Blood Pressure Cut-off points (WHO, 2005)	Indian				African			
	Men (n=51)		Women (n=155)		Men (n=8)		Women (n=36)	
	(Mean±SD)	(%)	(Mean±SD)	(%)	(Mean±SD)	(%)	(Mean±SD)	(%)
Systolic Blood Pressure								
Normal (<120 mmHg)	108.62 ± 6.40	**41.1**	96 ± 22.12	**38.0**	107.50 ± 6.36	25.0	98 ± 17.89	**36.1**
Prehypertension (120-139 mmHg)	128.63 ± 6.20	31.3	129 ± 8.65	32.9	130.00 ± 8.54	**37.5**	129 ± 8.10	33.3
High Blood Pressure Stage 1 (140-159mmHg)	149.55 ± 3.91	21.8	151 ± 5.87	24.5	151.33 ± 2.31	**37.5**	150 ± 5.47	25.0
High Blood Pressure Stage 2 (160>mmHg)	164.00 ± 5.29	5.8	171 ±16.90	4.6	0.00 ± 0.00	0.0	188 ± 24.75	5.5
Diastolic Blood Pressure								
Normal (<80mmHg)	67.83 ± 9.18	**68.6**	65 ± 14.13	**65.8**	64.67 ± 11.96	**75.0**	66 ± 11.37	**58.3**
Prehypertension (80-89mmHg)	85.36 ± 2.58	21.5	83 ± 4.19	18.0	87.00 ± 0.00	12.5	85 ± 2.86	25.1
High Blood Pressure Stage 1 (90-99mmHg)	92.60 ± 3.29	9.89	93 ± 3.41	12.5	90.00 ± 0.00	12.5	92 ± 2.42	16.6
High Blood Pressure Stage 2 (100>mmHg)	0.00 ± 0.00	0.0	89 ± 43.36	3.7	0.00 ± 0.00	0.0	0.00 ± 0.00	0.0

Figure 4.2, presents the results of the frequency distribution of waist circumference (WC), for women, the cut-off point is 88cm and for men it is 102 cm (WHO, 1997). In this group of elderly people, 73.56 percent of the Indian women, 70.31 percent of the African women, 68.64 percent of the Indian men and 25.0 percent of the African men had a WC higher than the cut-off point, and thus confirm the BMI results for obesity.

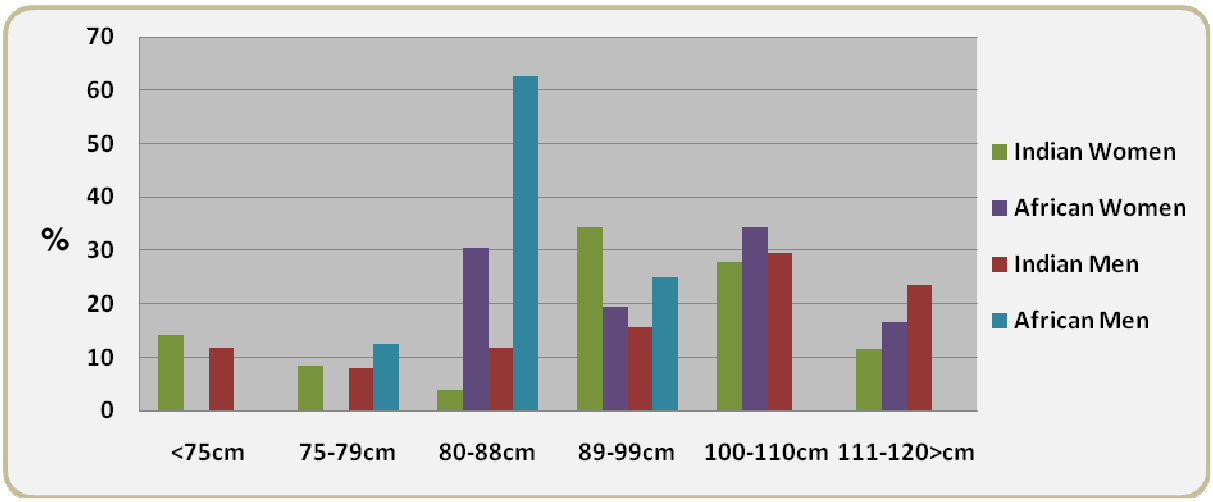

Figure 4.2 Frequency distribution of waist circumference

4.2.3 Health Assessment

The history of health associated diseases is summarized in Table 4.17, showing that 84.2 percent (n=32) of the African Women experienced skin disease, 100.0 percent of the African men and women suffered with affection of the skeleton and or joints, 96.0 percent (n=49) of the Indian men indicated affected eyes, ears, nose and teeth. African women 52.6 percent (n=20) suffered with affection of the heart or circulatory system. However, affection of the digestive system was experienced by 71.0 percent (n=27) of the African women, 43.1 percent (n=22) Indian men indicated affection of the urinary system and or genital organs. Moreover, a small percentage of the Indian women (4.5%, n=7) did suffer with nervous affection or mental abnormality. A large proportion of the Indian women (68.3%, n=106) were suffering of headaches. Other illnesses were reported by 33.5 percent (n=52) of the Indian women.

Table 4.17 History of Disease

Variables	Indian Men		Indian Women		African Men		African Women	
	n=51	%	n=155	%	n=8	%	n=38	%
History of Disease								
Skin disease	12	23.5	28	18.0	**6**	**75.0**	**32**	**84.2**
Affection of the skeleton and or joints	25	49.0	105	67.7	**8**	**100.0**	**38**	**100.0**
Affection eyes, ears, nose, teeth	**49**	**96.0**	96	61.9	5	62.5	**32**	**84.2**
Affection of the heart or circulatory system	5	9.8	40	25.8	1	12.5	**20**	**52.6**
Affection of the chest and or respiratory system	2	3.9	49	31.6	0	0.0	**30**	**78.9**
Affection of the digestive system	20	39.21	15	9.6	2	25.0	**27**	**71.0**
Affection of the urinary system and or genital organs	**22**	**43.1**	28	18.0	**3**	**37.5**	9	23.6
Nervous affection or mental abnormality	0	0	**7**	**4.5**	0	0	0	0
Headaches	31	60.7	**106**	**68.3**	0	0	18	47.3
Other illness	12	23.5	**52**	**33.5**	0	0	2	5.2

A large percentage of the respondents reported to be physically inactive (n=115, 46%), however, 54.0 percent (n=135) indicated activity at some level (Refer to Table 4.18).

Table 4.18 Physical Activity

Variables	Number n=250	Percentage %
Physical Activity		
Heavy/rigorous	3	1.2
Moderate	29	11.6
Light	103	41.2
None	**115**	**46**

With regards to substance abuse Table 4.19 indicates a large percentage of the sample population reported the use of tobacco (35.2%, n=88) and snuff (23.2%, n=58%), and 47.2 percent (n=118) consumed alcohol.

Table 4.19 Substance Usage and Patterns

Variables	Number n=250	Percentage %
Tobacco use		
Yes	88	35.2
No Never smoke	**106**	**42.4**
No Stopped	56	22.4
Number of cigarettes per day		
1-10 per day	12	4.8
10-20 per day	**34**	**13.6**
20-30 per day	28	11.2
More than 30 per day	14	5.6
Snuff		
Yes	58	23.2
No Never used snuff	**190**	**76.0**
No Stopped	2	0.8
Alcohol use		
Yes	118	47.2
No Never used alcohol	**132**	**52.8**
No Stopped	0	0
Frequent alcohol use		
Everyday	**58**	**23.2**
Once a Week	27	10.8
Occasionally	33	13.2
Type of alcohol consumed		
Commercial Beer/ cider	8	3.2
Home brewed beer	22	8.8
Strong liquor	**76**	**30.4**
Wine	12	4.8

Table 4.20 presents the results of the usage of chronic medication as the majority of the sample population (84.8%, n=212) reported the use of chronic medication. In addition, 54.0 percent (n=135) of the respondents indicated frequenting the clinic as the type of health facility utilized and 35.6 percent (n=89) traveled by taxi to the health facility.

Table 4.20 Use of medication and health facility.

Variables	Number n=250	Percentage %
Use of medication		
Yes	**212**	**84.8**
No	38	15.2
Type of health facility		
Private Doctor	31	12.4
Clinic	**135**	**54.0**
Hospital	58	23.2
Traditional Healer	23	9.2
Other	3	1.2
Travel to health facility		
On foot	47	18.8
Taxi	**89**	**35.6**
Bus	65	26.0
Own Transport	19	7.6
Other	30	12.0

4.2.4 Food Variety Score, Dietary Diversity Score and Nutrient Adequacy

The nine nutrition food groups with a count of the single foods within the groups were reported in the food variety score summarized in Table 4.21. In total, 66 different individual food items were consumed in seven days by all the respondents. However, the total range of individual food items consumed by an individual during the seven-day data collection period was between 4-66 foods. The highest consumption was four food items by 23.0 percent (n=19-34) of the respondents, respectively. The mean Food Variety Scores (FVS) (±SD) for all foods consumed from the food groups during seven days was 33.32 (±15.20), indicating a medium food Variety. The food groups with the most variety were the vegetable and fruit groups with 21 and 14 food items respectively. This was followed by the flesh group with 11 food items. The least popular food group was the egg group with 31.7 percent (n=79) not consuming eggs during the seven-day period. In the egg group, a large number of respondents consumed one (68.3%, n= 170), followed by the dairy (55.0%, n=138) and legumes (49.0%, n=123) group; some also only consumed only one food type in seven days.

4.21 Household Food Access as Measured by the Food Variety within the Food Consumed over a period of One Week (n=249).

Cereal Group n = 9	Legumes Group n = 4	Flesh Products n = 11	Egg Group n = 1	Dairy Group n = 2	Vegetable Group n = 21	Fruit Group n =14	Vitamin A Rich Group n = 4	Fat Group n = 5	Total Individual Food Items Eaten from all Groups n =66
0 = 0	0 = 15	0 = 20	0= 79	0 = 11	0 = 13	0 = 21	0 = 19	0 = 10	0 - 6 = 2
1 = 6	1 = 123	1 = 15	1= 170	1 = 138	1 = 4	1 = 21	1 = 56	1 = 25	7 - 12 = 10
2 = 11	2 = 81	2 = 48		2 = 100	2 = 4	2 = 46	2 = 73	2 = 141	13 - 18 = 32
3 = 36	3 = 29	3 = 48			3 = 12	3 = 39	3 = 48	3 = 55	19 - 24 = 57
4 = 51	4 = 1	4 = 43			4 = 18	4 = 25	4 = 53	4 = 14	25 - 30 = 38
5 = 48		5 = 26			5 = 13	5 = 16		5 = 4	31 - 36 = 25
6 = 45		6 = 11			6 = 21	6 = 4			37 - 42 = 21
7 = 25		7 = 10			7= 14	7 = 10			43 - 48 = 14
8 = 16		8 = 14			8 = 10	8 = 6			49 - 56 = 24
9 = 11		9 = 12			9 = 14	9 = 5			57 - 62 = 17
		10 = 1			10 = 14	10 = 7			63 - 66 = 9
		11 = 1			11 = 7	11 = 9			
					12 = 17	12 = 3			
					13 = 9	13 =13			
					14 = 10	14 =24			
					15 = 7				
					16 = 10				
					17 = 7				
					18 = 6				
					19 = 10				
					20 = 20				
					21 = 9				

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).

A summary of the food variety within food groups is presented in Table 4.22. for this community Mean (±SD) of 33.32 (±15.20) for all the foods consumed from all the food groups in a period of seven days, indicating a high dietary diversity. The other vegetable group reported the highest individual mean FVS (±SD) of 10.86 (±5.82), followed by other fruit, cereal, flesh and Vitamin A rich groups with 5.73 (±4.41), 5.03 (±1.85), 4.08 (±2.23) and 2.43 (±1.09) respectively.

Table 4.22 Summary of Food Variety Score within the Food Groups (n=249).

Food Group	Mean	SD	Range of Scores
Cereals, Roots and Tubers	5.03	1.85	1 – 9
Other Vegetables	**10.86**	**5.82**	**0 – 21**
Vitamin A Rich Fruit and Vegetables	2.43	1.09	0 – 4
Flesh Foods meat, poultry, fish	4.08	2.23	0 – 11
Fats and Oils	2.29	0.79	0 – 5
Dairy	1.42	0.49	0 – 2
Other Fruit	5.73	4.41	0 – 14
Legumes and Nuts	1.16	0.71	0 – 4
Eggs	1	0.00	0 – 1
Total Food Items	**33.32**	**15.20**	**4 -66**

In Table 4.23 the food group diversity is summarized as the majority of the respondents (97.5%, n=243) could be classified with a good dietary diversity score using 6-9 food groups, followed by medium dietary diversity score (2.0%, n=5) consuming four to five food groups and a low dietary diversity score (0.4%, n=1) consuming 0-3 food groups, respectively. However, in this sample, none of the respondents consumed all nine nutritious food groups during the seven day data collection period.

Table 4.23 Summary of Food Group Diversity (n=249).

Number of Food Groups Consumed n=9	Frequency	Percentage
1	0	0
2	0	0
3	1	0.4
4	2	0.8
5	3	1.2
6	11	4.4
7	26	10.4
8	75	30.1
9	131	52.6
Total	**249**	**100.0**

4.2.5 Dietary Intake Nutrient Analysis and Top 20 food items

The mean of two 24-Hour Recall nutrient analysis indicated a deficient intake by both men and women of all the nutrients, except for the mean (±SD) total protein in the women 45.10 (±12.55) and carbohydrate 212.83 (±36.97) in the men as indicated Table 4.24. The energy contribution indicated 98.3 percent (n=58) men and 85.72 percent (n=158) women consumed <100 percent of the EER for energy. Although the mean intake of carbohydrates in both the men and the women indicated sufficient intakes, significantly higher than the EAR, of which only 0.52 percent (n=1) women consumed <100 percent of the EARs compared to 100 percent (n=59) of the men consuming >100 percent of the EARs. Furthermore, the mean intake of iron was higher than the EAR for women, but a large percentage (40.83%, n=78) of the women did not meet the EAR for dietary iron. None of the women met the EAR for dietary zinc. More than 90.0 percent of the women did not meet the EAR for total dietary fibre (99.47%, n=190), calcium (97.38%, n=186), phosphorus (91.09%, n=174), selenium (95.81%, n=183), iodine (90.57%, n=173), vitamin A (90.05%, n=172), vitamin E (97.38%, n=186) and vitamin K (93.71%, n=179). A similar trend was observed for the men, however, more than 90% did not meet the EAR for fewer nutrients than the women and these include total dietary fibre (100.0%, n=59), calcium (93.22%, n=55), magnesium (91.52%, n=54) and vitamin E (94.91%, n=56), as indicated in Table 4.24. The food variety score within the food consumed over a period of one week indicated a medium food variety and although the majority of the respondents consumed 3 meals per day (30.8%, n=77); the nutrient intake when compared according to the EAR indicated that both women and men consumed deficient intakes for the majority of the nutrients. Nutrients that had an overall mean nutrient adequacy ratio of 100 percent for the total group included carbohydrate, total dietary fibre, choline and vitamin C.

Table 4.24 Dietary Intake Nutrient Analysis**,** measured using the average of two 24 Hour Recall (IoM, 2003).

Nutrients p/day	Women (n=191) mean ± SD	Women <100% of DRI	Men (n=59) mean ± SD	Men <100% of DRI	DRI'S
Energy (KJ)	6489.09 ± 2302.58	**82.72**	6218.42 ± 1709.74	**98.30**	♀ 8388.91 EER ♂ 10614.81 EER
Carbohydrate (mg)	213.88 ±53.72	**0.52**	212.83 ± 36.97	**0.00**	♀♂ 100mg/day
Total protein (g)	45.10 ± 12.55	**57.06**	49.60 ± 14.09	**67.79**	♀ 46 ♂ 56
Total Dietary Fiber (g/day)	11.74 ± 4.00	**99.47**	11.25 ± 4.31	**100.00**	♀♂ 21 g/day ≈
Calcium (mg)	623.49 ± 285.72	**97.38**	831.47 ± 253.13	**93.22**	♀♂1200 mg ≈
Iron (mg)	5.47 ± 1.89	**40.83**	4.11 ± 1.25	**79.66**	♀ 5 ♂ 6
Magnesium (g)	198.12 ± 42.56	**88.48**	233.68 ± 55.25	**91.52**	♀ 265 ♂ 350
Phosphorus (mg)	409.01 ± 131.72	**91.09**	282.90 ± 106.27	**72.88**	♀♂ 580
Zinc (mg)	4.17 ± 1.21	**100.00**	6.01 ±1.66	**79.66**	♀ 6.8 ♂ 9.4
Chromium (mg)	14.79 ± 14.34	**89.00**	21.11 ± 8.12	**77.96**	♀ 20 ≈ ♂ 30 ≈
Choline (µg/day)	305.75 ± 96.63	**86.91**	348.75 ± 91.02	**86.44**	♀ 425 ≈ ♂ 550 ≈
Selenium (µg/day)	28.79 ± 10.45	**95.81**	26.27 ± 10.27	**79.66**	♀♂ 45.00
Iodine (µg/day)	64.82 ± 25.64	**90.57**	72.28 ±16.29	**74.57**	♀♂ 95.00
Vitamin A RE (µg/day)	271.26 ± 107.52	**90.05**	433.34 ± 135.13	**40.67**	♀ 500 ♂ 625
Thiamin (mg)	0.60 ± 0.18	**84.81**	0.64 ± 0.24	**86.44**	♀ 0.9 ≈ ♂ 1.0 ≈
Riboflavin (mg)	0.62 ± 0.19	**87.43**	0.99 ± 0.73	**67.79**	♀ 0.9 ♂ 1.10
Niacin (mg)	7.73 ± 2.53	**85.86**	9.59 ± 4.74	**72.88**	♀ 11.00 ♂ 12.00
Vitamin B6 (mg)	0.93 ± 0.29	**84.81**	0.94 ± 0.52	**69.49**	♀ 1.30 ♂ 1.40
Folate (µg/day)	257.76 ± 69.90	**72.25**	234.61 ± 88.18	**76.27**	♀♂ 320.00
Vitamin B12 (µg/day)	1.86 ± 0.53	**58.63**	1.92 ± 0.75	**52.54**	♀♂ 2.00
Pantothenate (mg)	3.97 ± 1.20	**76.43**	3.76 ± 1.20	**79.66**	♀♂ 5.00 ≈
Biotin (µg/day)	19.07 ± 5.29	**83.76**	20.61 ± 7.30	**79.66**	♀♂ 30.00≈
Vitamin C (mg)	44.31 ± 14.45	**73.82**	45.42 ±15.58	**66.10**	♀ 60.00 ♂ 75.00
Vitamin D (µg/day)	6.46 ± 2.94	**83.24**	5.80 ± 3.02	**88.13**	♀♂ 10.00 ≈
Vitamin E (mg)	6.63 ± 2.84	**97.38**	7.01 ± 2.99	**94.91**	♀♂ 12.00
Vitamin K (mcg)	60.39 ± 20.73	**93.71**	70.08 ± 42.03	**86.44**	♀ 90.00 ≈ ♂ 120.00≈

♀***Women,*** ♂***Men***

∗ **Estimated Energy Requirements (Institute of Medicine, 2003)** for low active men mean age 70 years, mean height =1.66m and mean weight =69.22 kg and women mean age of 69 years, mean height =1.57 m and mean weight 67.83kg.

≈ AI (Adequate Intake, used where EAR (Estimated Average Requirement) not available

The main source of food intake was from the carbohydrate food group. Table 4.25 indicates the top 20 most popular food items and the average daily intake of the sample population who consumed these foods on one weekday and one weekend included in the 24-Hour Recall. The majority of the respondents consumed carbohydrate based foods items, the first 24-Hour Recall indicated that the first animal protein food source was chicken briyani which ranked 6th on the first 24-Hour recall and the mean consumption was (240.00g) consumed by (n=14), followed by mutton briyani which ranked 7th and the mean consumption was (238.24g) although the respondents consumed these food items were a small number (n=17), a large portion was consumed. The second 24 Hour Recall confirms samp and beans as the first plant protein ranking 6th consumed by (n=18) followed by beef stew (n=24) as the first animal protein, however, a small number of respondents consumed these food items, however a large portion was consumed (235.56g and 202.92g), respectively. However, milk (mean±SD) was ranked 17th and was consumed in very small amounts in both days by all the respondents, the first 24-Hour Recall 88.42ml (±77.82), and the second 24hour food recall 84.25ml (±75.60), which did not meet the daily calcium requirements of elderly at 1200mg AI. On both top 20 food lists fruit and vegetables did make an appearance as oranges and apples consumed by the sample population, and the only vegetable that appeared on the second top 20 food list was braised cabbage ranking 14th consumed by (n=25) respondents.

Table 4.25 Top 20 food items ranked by the mean intake portion size by the number of respondents as measured by two 24-Hour Recall (n=250).

1st 24 Hour Food Recall				2nd 24 Hour Food Recall			
Rank	**Food Item**	**Mean±SD**	**n=250**	**Rank**	**Food Item**	**Mean±SD**	**n=250**
1	Coffee	317.31±113.09	26	**1**	Mahewu	400.00 ± 129.10	10
2	Maize Meal,	280.76 ± 95.19	66	**2**	Coffee	288.46 ± 78.81	26
3	Tea, brewed	252.00±39.35	250	**3**	Tea, brewed	262.29 ± 42.86	250
4	Diluted Juice	250.52 ± 6.58	20	**4**	Maize Meal	250.39 ± 82.38	77
5	Cold Drinks	249.33 ± 30.58	15	**5**	Diluted Juice	244.32 ± 26.65	22
6	Chicken Briyani	240 ± 62.26	14	**6**	Samp and Beans	235.56 ± 129.31	18
7	Mutton Briyani	238.24±123.15	17	**7**	Beef Stew	202.92 ± 77.53	24
8	Rice	188.70 ± 51.22	193	**8**	Chicken Briyani	201.54 ± 61.76	13
9	Chicken Stew	182.35 ± 66.00	17	**9**	Orange, Raw	187.50 ± 49.45	24
10	Oats	178.67 ± 61.86	15	**10**	Rice	186.84 ± 64.68	198
11	Orange, raw	165.24 ± 76.98	21	**11**	Roti	162.50 ± 41.90	48
12	Roti	164.05 ± 44.67	42	**12**	Breakfast Cereal	122.44 ± 73.47	41
13	Breakfast Cereal	140.43 ± 55.19	35	**13**	Chicken Curry	128.82 ± 52.68	60
14	Chicken Curry	138.68 ± 59.10	68	**14**	Cabbage Braised	113.20 ± 62.50	25
15	Mutton Curry	126.95 ± 46.77	59	**15**	Bean Curry	110.24 ± 50.89	83
16	Apple, raw	109.17 ± 35.25	24	**16**	Dhal	97.65 ± 61.84	34
17	Milk	88.42 ± 77.82	250	**17**	Milk	84.25 ± 75.60	250
18	Potato Curry	75.88 ± 27.62	34	**18**	Potato chips, fried	70.58 ± 33.50	52
19	Bread	65.63 ± 26.74	250	**19**	Bread	64.76 ± 21.73	250
20	Sugar	12.75 ± 7.90	250	**20**	Sugar	13.24 ± 9.08	250

Table 4.26 presents the fruit and vegetable intake, as mean (±SD) of both 24-Hour Recall indicates that the sample is consuming far less than the ≥400g per day recommended by the World Health Orgaisation. The overall frequency of the fruit and vegetable was too low and the portion size of the fruit and vegetable of both 24-Hour Recall was too small (101.85g and 90.44g) respectively, however, the consumption did not meet the recommended intake of at least 400g, or five or more portions, of fruit and vegetables a day (WHO, 2003b, Polidori, Carrillo, Verde, Sies, Siegrist and Stahl, 2009, Salehi *et al*., 2010 and South African Department of Health Services and Welfare, 2010).

Table 4.26 Fruit and Vegetable Intake measured by two 24-Hour Recall (WHO, 2003b).

1st 24 hour Recall (n= 250)		2nd 24 hour Recall (n= 250)	
Mean ± SD	**Frequency consumed**	**Mean ± SD**	**Frequency consumed**
101.85 ± 40.83	222	90.44 ± 38.90	236

In Table 4.27, the results of the energy distribution of the macronutrients from the 24-Hour Recalls according to the World Health Organisation dietary factor goals (2003b) indicates that both men and women are in range of 15-30 percent total fat intake, protein 10-15 percent and carbohydrate 55-75 percent. Thus, although the diet intakes were deficient, the meals were balanced.

Table 4.27 Percentage of energy distribution of the macronutrients from the average of two 24-Hour Recalls (WHO, 2003b).

Macronutrients	Mean ± SD	Mean % Energy	WHO Goal
Men (n=59)			
Total fat (g)	42.36 ± 12.00	25.20	15-30%
Protein (g)	49.60 ± 14.09	13.55	10-15%
Carbohydrate (g) & Fibre (g)	224.08 ± 41.28	61.25	55-75%
Women (n=191)			
Total fat (g)	50.98 ± 14.77	29.07	15-30%
Protein (g)	45.10 ± 12.55	11.82	10-15%
Carbohydrate (g) & Fibre (g)	225.6 ± 57.72	59.11	55-75%

Figure 4.3 and 4.4 illustrates the women's relationship between the dietary diversity score and nutrient adequacy ratios and energy, protein, selected minerals and vitamins shows an increase in nutrient adequacy ratio for all these nutrients as dietary diversity score increase. The nutrient energy, nutrient ratio reached 100 percent with a dietary diversity score of 4, were as protein reached a diversity score of 3. Nutrient adequacy ratio increased above 100 percent at a dietary diversity of 4 for Iron. However, Zinc and calcium remained below 100 percent. Folate and Vitamin B6 reached 100 percent nutrient adequacy whereas Vitamin A, C and Riboflavin remained below 100 percent of the nutrient adequacy ratio.

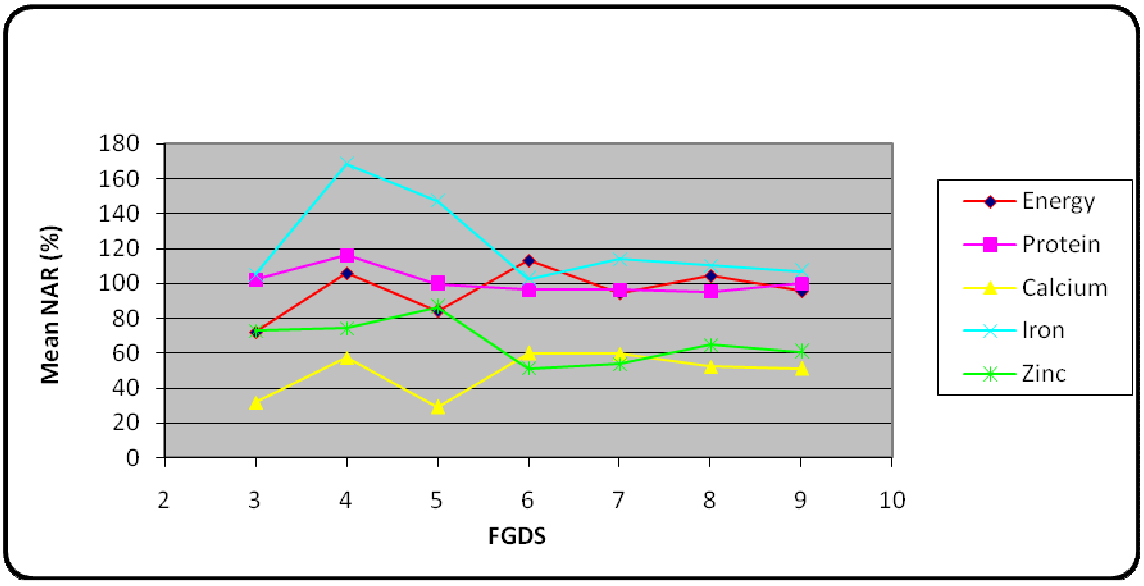

Figure 4.3 Women Mean Nutrient Adequacy ratio (NAR Expressed as %) of Energy and Nutrients at Different Levels of Dietary Diversity Score (DDS)

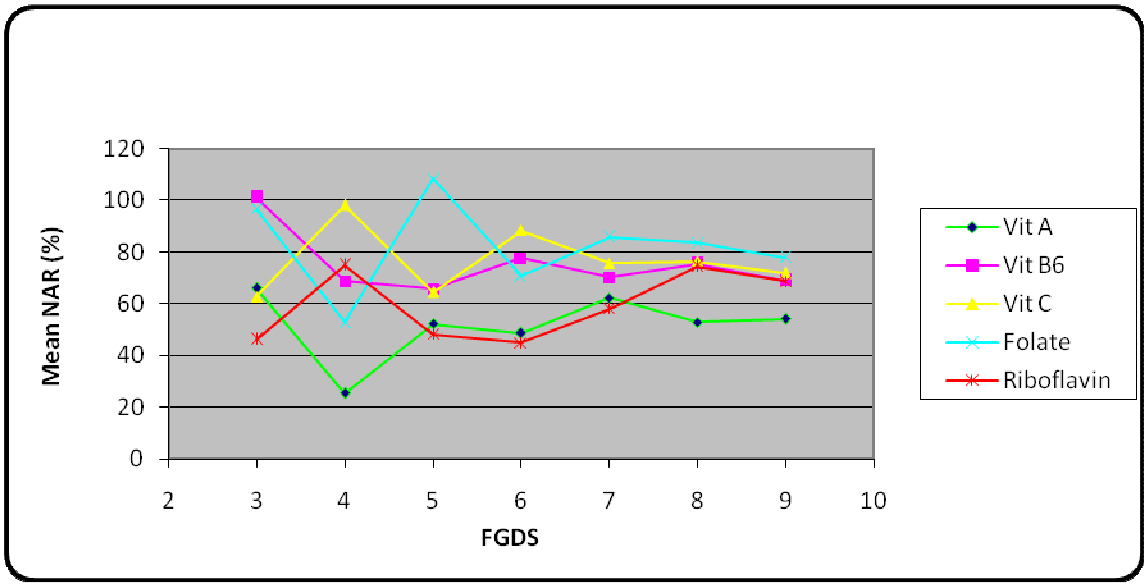

Figure 4.4 Women Mean Nutrient Adequacy Ratio (NAR Expressed as %) selected Vitamins at Different Levels of dietary Diversity score (DDS)

Figure 4.5 and 4.6 illustrates the relationship between dietary diversity score and nutrient adequacy ratios and energy, protein, selected minerals and vitamins show an increase in nutrient adequacy ratio for all these nutrients as dietary diversity score increases. The

nutrient energy, nutrient ratio reached 100 percent with a dietary diversity score of 4, were as protein reached a diversity score of 5. Nutrient adequacy ratio increased above 100 percent at a dietary diversity of 9 for Riboflavin. Calcium, Iron, Zinc, Vitamin A, B6, C and Folate remained below 100 percent nutrient adequacy ratio.

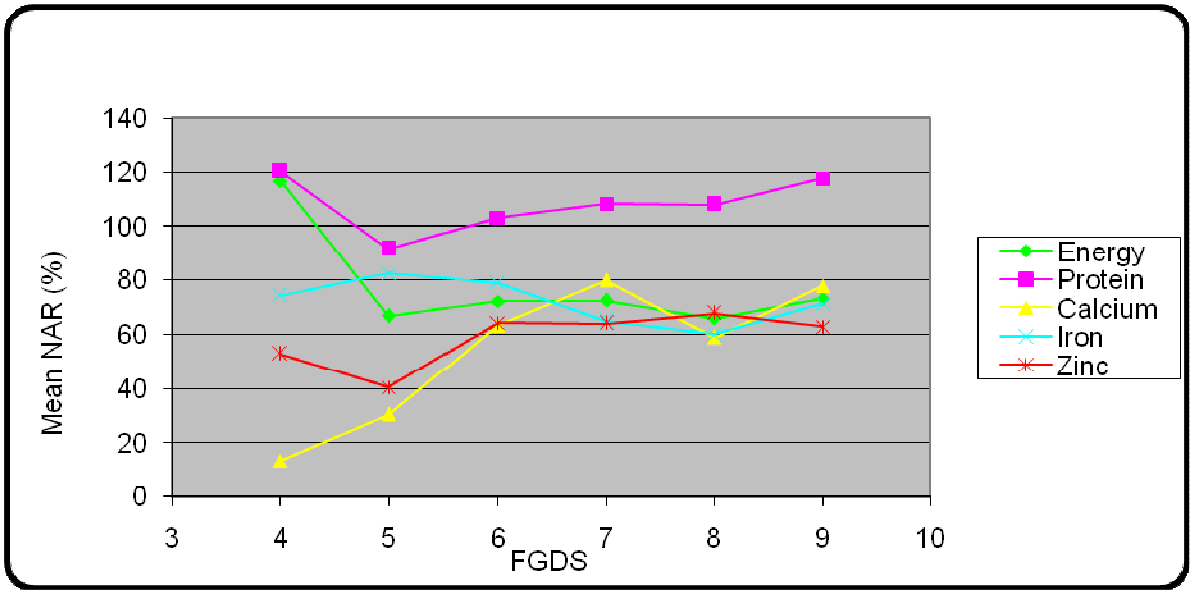

Figure 4.5 Men Mean Nutrient Adequacy ratio (NAR Expressed as %) of Energy and Nutrients at Different Levels of Dietary Diversity Score (DDS)

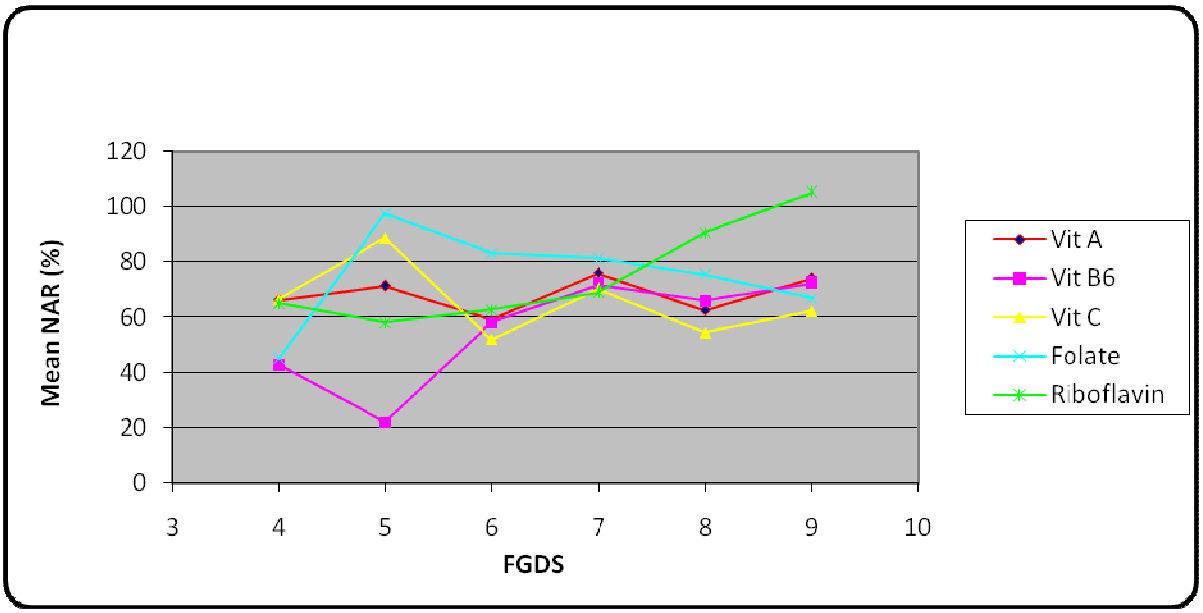

Figure 4.6 Men Mean Nutrient Adequacy Ratio (NAR Expressed as %) selected Vitamins at Different Levels of Dietary Diversity score (DDS)

4.3 CORRELATIONS

The correlations were conducted using the ANOVA statistical test. The ANOVA tests the significance designed to determine whether a significant difference exists among multiple sample means (Nordness, 2006). The Pearson's correlation coefficient puts into quantitative terms the association implied by scatter plots of the two variables. A value r= 0 implies no association whatsoever, whereas the values r= 1 and r= -1 imply perfect positive and negative associations, respectively (Jan, 2006). However, statistical significance testing, the *p*-value is the probability of obtaining a test statistic at least as extreme as the one that was actually observed, assuming that the null hypothesis is true. However, the rejection of the null hypothesis occurs when the *p*-value is less than 0.05 or 0.01. When the null hypothesis is rejected, the result is said to be statistically significant (Naito, 2006).

4.3.1 BMI for Blood Pressure

Figure 4.7 represents the systolic and diastolic increases with BMI amongst the African women, however, this relationship is not statistically significant for either systolic blood pressure (p=0.222) or diastolic blood pressure (p = 0.419).

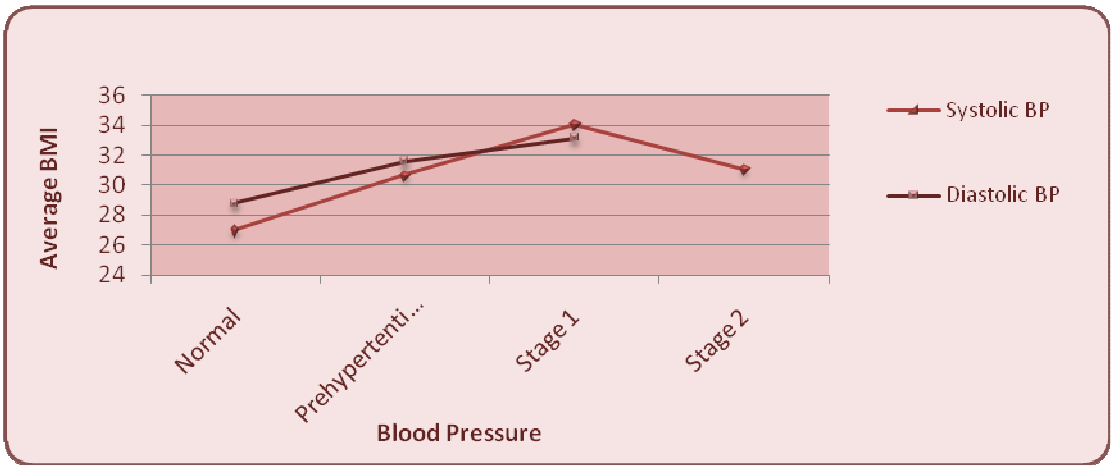

Figure 4.7 African Women BMI for Blood Pressure (n=35)

Figure 4.8 represents Indian women diastolic blood pressure and BMI increases from stage 1 high blood pressure. Although it is clear that there is a relationship between BMI and both DBP and more so in SBP, these relationships are not significant (BMI and systolic blood pressure, p =0.299; BMI and diastolic blood pressure, p = 0.111).

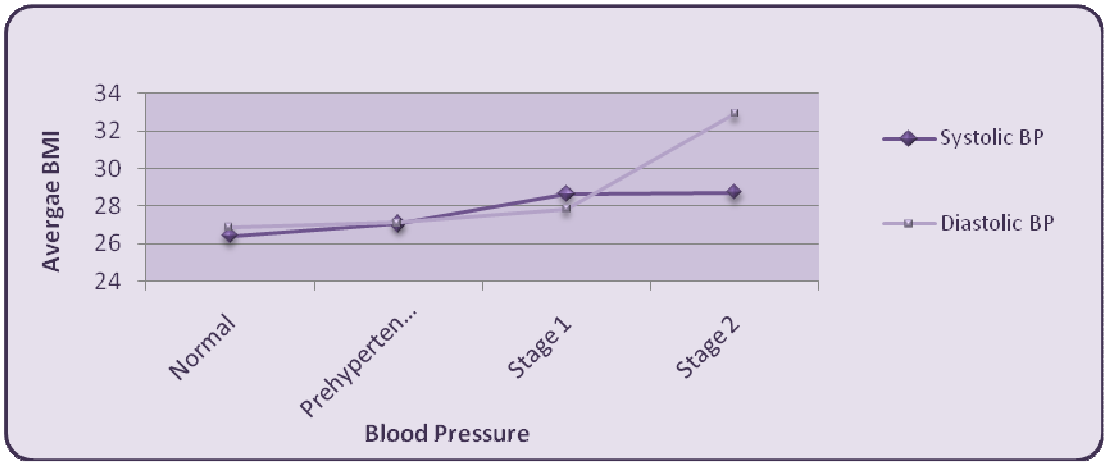

Figure 4.8 Indian Women BMI for Blood Pressure (n=155)

In Figure 4.9, the Indian men diastolic and systolic blood pressure increase with BMI from Prehypertension. The relationship between BMI and systolic blood pressure (p =0.006) as well as diastolic blood pressure (p = 0.047) was statistically significant in the Indian men.

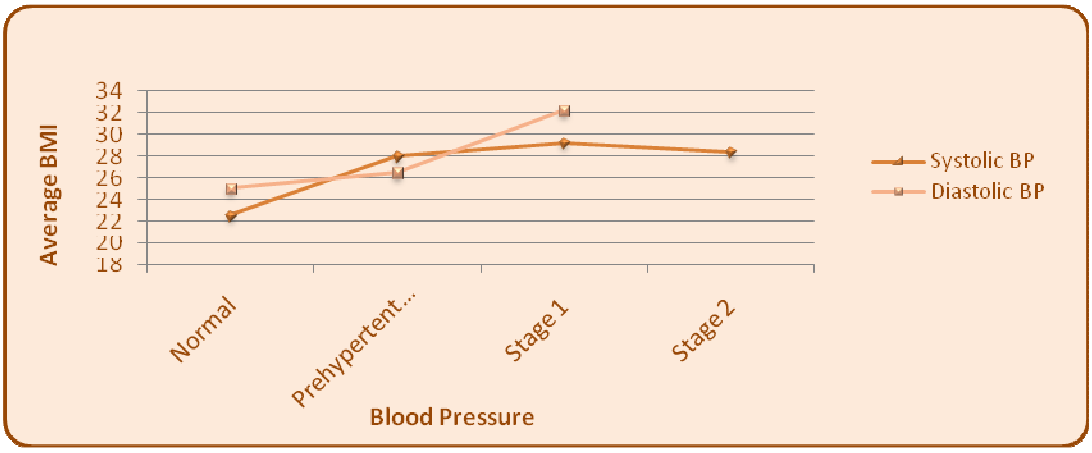

Figure 4.9 Indian Men BMI for Blood Pressure (n=51)

Figure 4.10 illustrates an increase in systolic blood pressure and then a drop, whereas the diastolic increases at stage 1 high blood pressure of the black men, however this was not found to be significant for systolic blood pressure (p =0.57) or diastolic blood pressure (p = 0. 595).

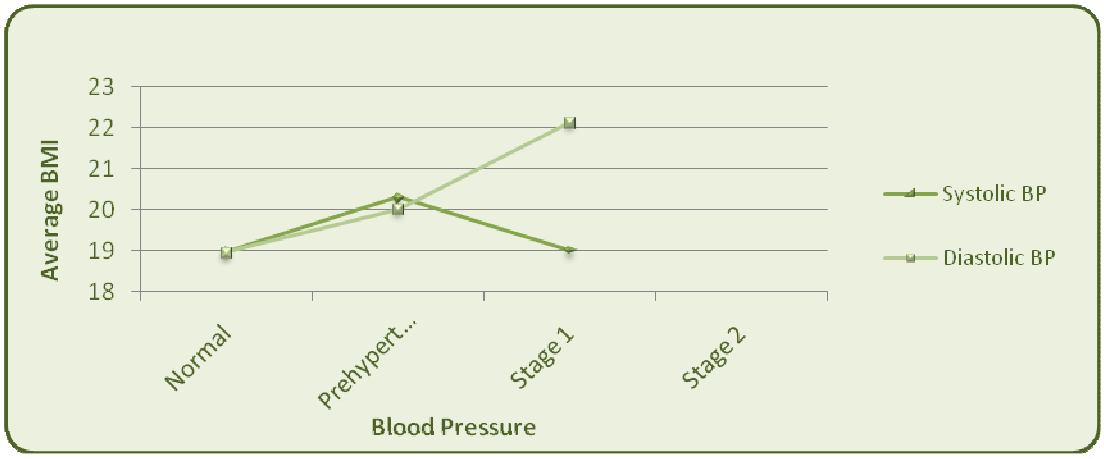

Figure 4.10 African Men BMI for Blood Pressure (n=8)

4.3.2 BMI for Energy

There is a significant (r =0.27), but weak positive relationship between the energy intake and BMI for Indian women indicated by Figure 4.11.

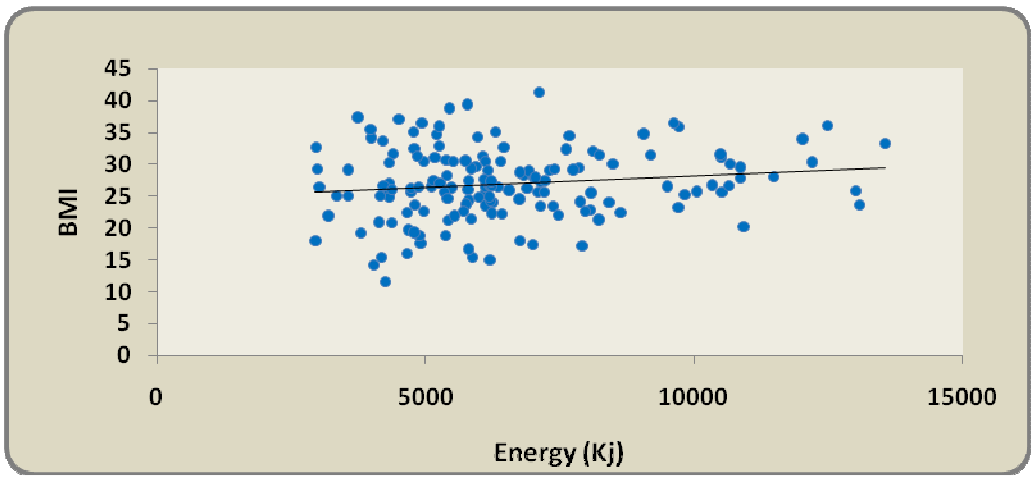

Figure 4.11 Indian women BMI for Energy (n=155)

There is no significant correlation (r =0.670) between the energy intake and BMI for African women as depicted by Figure 4.12.

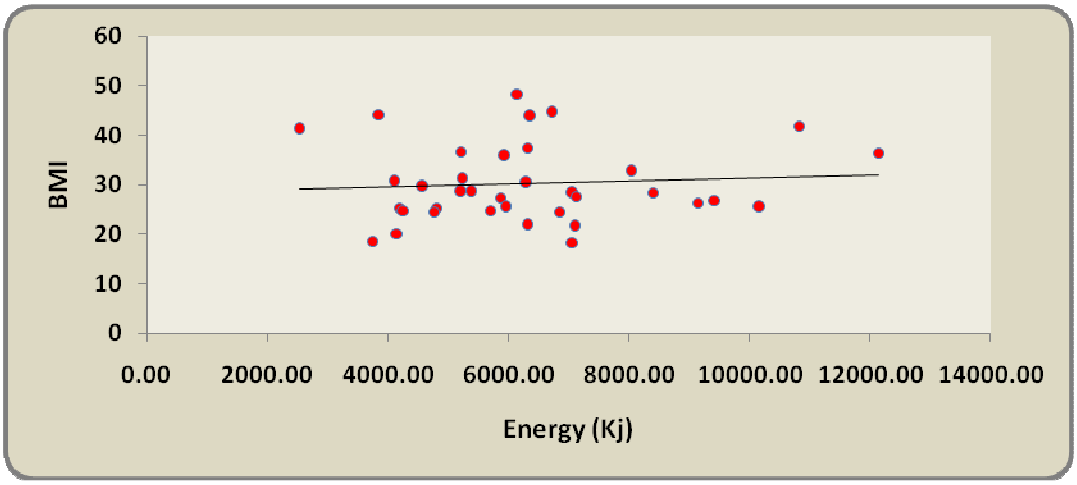

Figure 4.12 African women BMI for Energy (n=36)

Figure 4.13 illustrates a significant (r =0.27) weak negative relationship between the energy intake and BMI for Indian men.

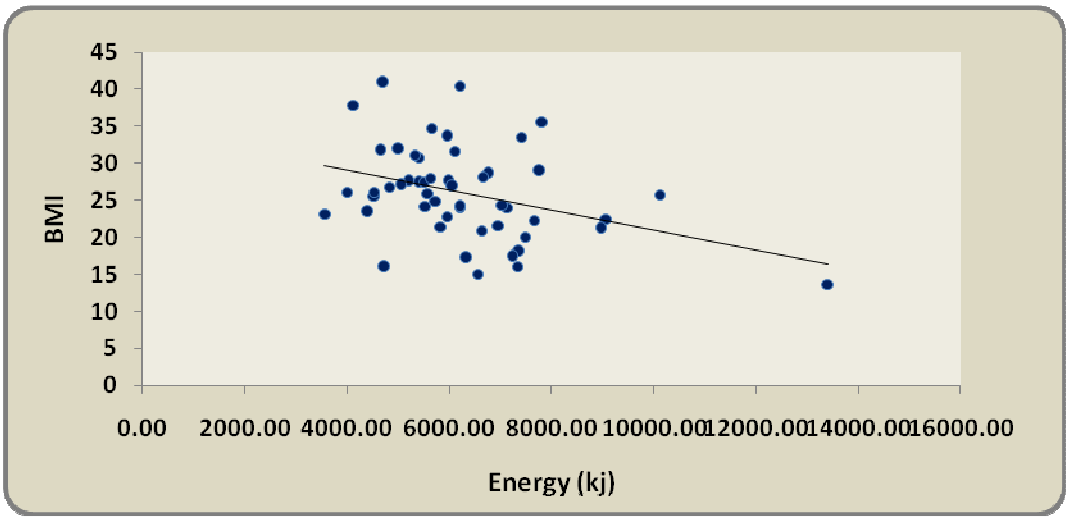

Figure 4.13 Indian Men BMI for Energy (n=51)

Although a similar trend is observed as for the Indian men, there is no significant correlation (r = 0.008) between the energy intake and BMI for African men as depicted by Figure 4.14. This may be due to the small sample size.

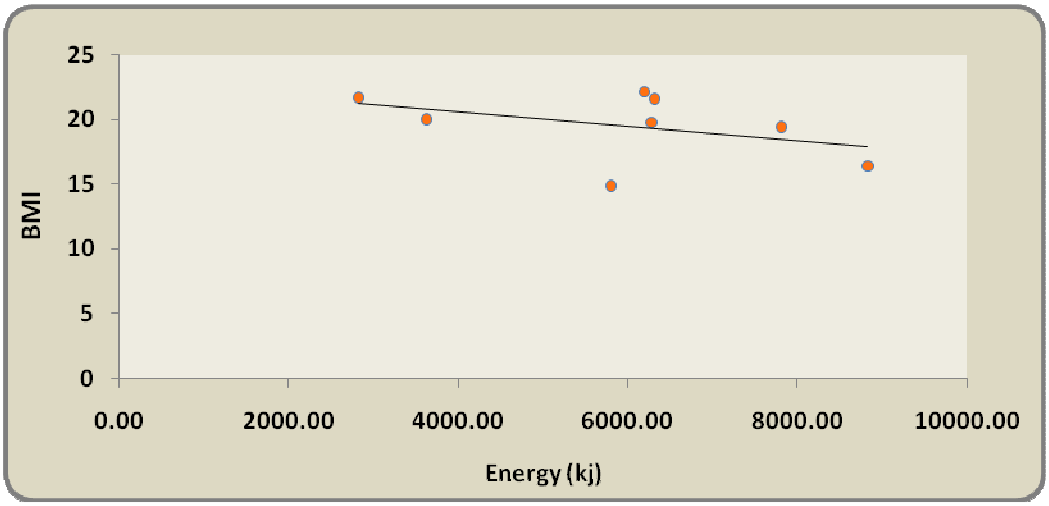

Figure 4.14 African Men BMI for Energy (n=8)

4.4 DISCUSSION

The wealth of data collected in this research illustrates the most comprehensive nutritional status and dietary intake patterns of the elderly attending a day care centre in Verulam. In this study, the results showed that the majority of the respondents (42.3%, n=108) lived in rented accommodation and spent less than R500.00 on food per month (55.6%, n=139).

Lombard and Kruger (2009) indicated in their research that the majority of South Africa's older population is income poor and live in large, multigenerational, female-dominated and female- headed households. Household food insecurity played an important role in the nutrient intake of this sample since 81.2 percent were food insecure. This was consistent with the findings of a study conducted by Labadarios, Davids, Mchiza, and Weir-Smith (2009) who indicated that the majority of elderly individuals were less educated and remained disadvantaged with respect to their living conditions and overall were black or of mixed ancestry, resided in informal settlements, and were food-insecure (Labadarios *et al*., 2009). Charlton *et al*. (2008) mentions that multi-generational households are more common amongst the elderly and this was also true in this study since 26.8 percent of the elderly live in a households with 6-10 people and, therefore, there is a risk of food insecurity in this community. These findings are also consistent with a study conducted in Botswana that

reported a positive association between the level of education in association with poor nutrient intake (Clausen *et al.,* 2005).

The results of this study further illustrate that 76 percent are pensioners and were depended on state old age grants. There is, therefore, a clear correlation in a study conducted by Ramashala (2001) and Charlton *et al.* (2008), who further indicated that the old age grant has been very critical to the survival of many households, particularly rural households, where members of the household may be unemployed; however the social security system is inadequate in addressing food security in addition to ensuring that every citizen is able to meet minimum dietary requirements to avoid malnutrition.

The results presented evidently indicate that the majority of Indian men (74.5%, n=38) and women (77.4%, n=120) fell in the overweight, obesity class I and obesity class II which are clearly risk markers for the prevalence of hypertension, chronic disease, CVD and insulin resistance (Ghosh, 2004 and Tyagi and Kapoor, 2010). However, a large percentage of the African women (75.0%, n=27) had excess body weight with a BMI ≥25 kg/m2. When these figures were compared with a study conducted by Joubert and Bradshaw (2006), there is a clear association of the comparatively high BMI by 60.0 percent of the women aged 65+ who are at risk of an assortment of related chronic conditions including IHD, hypertensive disease, ischaemic stroke, type 2 diabetes, osteoarthritis and several types of cancers. A further discovery from the results expressed that a large number of the elderly (46%, n=115) were not physically active which therefore, had a direct impact on the obesity levels.

A study conducted by Tyagi and Kapoor (2010), reported similarity of a positive association of BMI with blood pressure indicates an increased prevalence of hypertension with an increase in waist adiposity among the elderly females which is also prevalent when compared to the current study. In this study, the effects of a high WC were more apparent in the women than in the men; moreover an indication that the health risks are greater in Indian men and women as well as African women with high WC values compared with normal WC values, respectively.

It is evident that the majority of Indian and African men as well as Indian women have an increased systolic (>140 mmHg) and diastolic blood pressure (>90 mmHg). The Department of Health, Medical Research Council and Macro International (2002) findings illustrated very high levels of hypertension prevalence in the population 65+ years old, with 52.0 percent of men and 60.0 percent of women having had a blood pressure reading of ≥140/90 mmHg which causes an increased risk of IHD, stroke, hypertensive heart disease and other cardiovascular and renal diseases. In addition the use of salt during cooking was reported by the majority of the elderly in this study (69.2%, n=173), and a large number (51.2%, n=128) enjoyed salty foods along with 23.6 percent that added salt to their food after cooking. These results substantiate the high prevalence of hypertension among this study. Moreover, a study conducted by Van Rooyen, Kruger, Huisman, Wissing, Margetts, Venter, and Vorster (2000), indicate similarity of an increased prevalence of hypertension. However, the relationship that exists between an increased BMI and hypertension is a predictor of obesity leading to severe chronic illness amongst the elderly. Yalcin, Sahin and Yalcin (2005) have reported that WC in men and BMI in women are the most important predictors for the elevation in SBP and DBP.

The history of health associated disease in addition to the use of medication within this community is consistent with a study conducted in Sub-Saharan Africa (Kimokoti and Hamer. 2008). The use of tobacco (35.2%, n=88) and substance abuse (47.2%, n=118) is evident amongst this community and is similar to the data reported from a study of Sub-Saharan Africa elderly households (Kimokoti and Hamer. 2008). Self reported diseases of lifestyle were experienced by a large portion of the elderly respondents indicating suffering of the eyes, ears, nose, teeth (72.8%, n=182), headaches (62.0%, n=155), suffering of the skeleton and or joints (70.4%, n=176), and a further (32.4%, n=81) suffered from chest and the respiratory system. A large number of elderly persons were taking chronic medication and suffered from a number of disorders including painful joints, ear, nose in addition to throat infections and chronic headaches.

Smoking and alcohol consumption reported to be relatively low in this study and these results correspond with similar studies conducted amongst elderly persons in South Africa (Oldewage-Theron *et al.,* 2008b). The results of this study established various age associated problems among the elderly with the highest being vision problems experienced followed by joints pain and high blood pressure, however, the majority of elderly (84.6%, n=212) were on

chronic medication due to the related illness. Primary health care is free for all South Africans, and as far as secondary healthcare is concerned the elderly in receipt of a pension are eligible for free secondary healthcare services at public hospitals (Burns *et al*., 2005). It is evident in the results that a large number of the elderly (54%, n=135) are reliant on public clinics.

In this study the overall diet quality of the elderly was measured according to the food patterns and food variety the food variety score (FVS), dietary diversity score (DDS) as indicators of dietary adequacy in relation to nutritional status of the elderly attending a day care centre. The (FVS) indicated a regular consumption of cereal items by the elderly that also appeared in the first 5 food items of the top 20 food items, similarly a pattern for dairy was apparent. A study conducted by Oldewage-Theron and Kruger (2008) illustrates the similar dietary sequence of the FVS, DDS and the top 20 most common foods consumed by the elderly in Sharpeville.

The elderly have a good variety fruit and vegetable intake the mean FVS (± SD) for all the foods consumed from all the food groups over seven days was 33.32 (±15.20) indicating a medium food diversity (see Table 4.19). However the small quantities consumed as can be seen in the Top 20 most frequently consumed food items, is insufficient to meet the daily dietary requirements. Although the other vegetable group ranked the highest mean FVS (±SD) of 10.86±5.82, most of the micronutrient intakes were not optimal. The FGDS further illustrated a high FGDS (6-9 food groups) thus indicating a good food variety. This is not reflected in the FVS and both a good FVS and FGDS are thus needed for dietary adequacy. This community is thus exposed to a good food group variety, although not a good food portion, thus not optimal dietary diversity. A positive relationship exists between the BMI and 7-9 food groups for both the men and women.

The top 20 food consumption list in this study illustrated that the majority of food items consumed were carbohydrate-based with a low frequency of small portions of vegetables and fruit. Orange was the first fruit which ranked fifteenth on the first top 20 food items fourteenth on the second top 20 food items, not meeting the goal consumption intake of >400g per day recommended by the WHO (2002a). This should assist in the prevention of non-

communicable disease, as well as for the prevention and alleviation of several micronutrient deficiencies of which the elderly in this study's average intake of fruit and vegetables on both 24 Hour Recalls was a very poor intake as the first 24-Hour Recall illustrated 101.85g (± 40.83) and the second 24-Hour Recall 90.44g (± 38.90). The small amounts of fruit and vegetable intake amongst this community, is further evident by the nutrient analysis whereby both men and women significantly do not meet the recommended micronutrient DRI's as indicated by the IoM (2000) as well as the low dietary fibre intakes (mean 11g per day) since 99.5 percent of the women and 100 percent of the men did not meet the DRI for dietary fibre.

The percentage of energy distribution of the macronutrients from the two 24-Hour Recalls for both men and women of this community were within the World Health Organisation goals (WHO, 2003a). A study conducted amongst the elderly in Umlazi KZN by Mkhize (2011) illustrated similar trends in the Top 20 food items. However, the mean energy intakes were low compared to DRI and 82.72 percent of the women and 98.30 percent of the men did not meet 100 percent of the DRI for energy. Interestingly, although the mean energy intakes are reported to be low in this community, the majority of Indian men and women as well as black women were either overweight or obese. This confirms the findings by Townsend (2006) that hunger and obesity can exist within the same household, especially in low-income households, such as in this Verulam community. Wardle (2002) also found that higher obesity rates are associated with low incomes and low education levels, especially among women.

A study amongst Sharpeville elderly confirmed these findings amongst black South African women (Oldewage-Theron *et al.*, 2008). The low nutrient adequacy ratio for zinc, calcium, iron, zinc, vitamin A, B6, C and folate remained below 100 percent for the women; however, zinc, calcium vitamin A, C and riboflavin were below 100 percent for the men. In this study, the nutrient analysis databases of women respondents have shown to be more nutrient deficient than men which is comparable to that found in an elderly study in Botswana (Maruapula and Novakofski, 2010). A study conducted by Oldewage-Theron and Kruger (2008) illustrated similar micronutrient patterns amongst the elderly in Sharpeville.

Both systolic and diastolic blood pressure were positively correlated with an increase in BMI in both men and women. These findings were consistent with other studies conducted

amongst 25-65 year old men and women (Tesfaye, Nawi, Van Minh, Byass, Berhane, Bonita and Wall, 2007) as well as in +45 years and older men and women (Kaufman, Michael, Mufunda, Forrester, Wilks, Luke, Long, and Cooper, 1997).

4.5 CONCLUSION

In this chapter the results of the study were presented in line with the objectives in order to identify various nutrition related problems faced by the elderly and to develop appropriate strategies for an integrated nutrition education programme for this community. Although the majority of the respondents resided in brick houses, a large percentage of the elderly total household income per month was in the range of R1001-R1500 and, therefore, poverty, leading to food insecurity, is evident within this community.

The FGDS was good, however, the FVS was not good as reflected in the inadequate macro- and micronutrient intakes due to the consumption of a mainly carbohydrate based diet (Top 20 Foods). The poor health status among the elderly was mainly reflected by the increased BMI and hypertension. It can, therefore, be concluded, that this elderly community has a medium food variety with relatively small quantity consumptions coupled with lifestyle choices and sedentary behaviour which, therefore, contributed comparatively to the large percentage of elderly enduring a micronutrient deficiency not meeting the daily recommended intakes to live a more fulfilled life namely: dietary fibre, calcium, magnesium, phosphorus, zinc, iodine, thiamine, selenium, vitamin E and vitamin K.

CHAPTER 5 – CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

In the previous chapter the results of the proceeded data were presented and discussed with reference to Chapter 2 in relation to the objectives of this study. A discussion of the findings followed in order to identify the objectives needed for the formation of an adequate nutritional education programme promoting adequate nutrient intake and healthy eating habits. The research process reviewed the recommendations for further research since the wealth of information of the elderly expressed a global epidemic of malnutrition in both over and undernutrition. An adequate diet is an essential component of successful aging. However, dietary changes are promoting overweight and obesity; overnutrition has accelerated within this age group due to the nutrition transition (Vorster *et al*., 1999). However, during the later years, individuals are likely to experience physical, psychological, and social changes that impede their ability to obtain or prepare optimal meals. Moreover the elderly are known to be at an increased risk for impaired nutritional status with increasing age (Cowana, Roberts, Fitzpatrickb, Whilec and Baldwind, 2004).

The key determinants leading to malnutrition within the elderly population include poverty, declining family support systems, food insecurity, drought and famine, war, poor health services, and the indirect impact of HIV and AIDS (Clausen *et al*., 2005). HIV and AIDS, in particular, has caused an incredibly negative impact on the elderly, since the elderly have become burdened with the role of caregiver to sick children, as well as orphaned grandchildren, some of whom may be HIV-positive (Ferreira, 2004). Kimokoti and Hamer (2008) mentioned that the elderly are not a priority in the health and nutrition programmes of countries in Sub-Saharan Africa, which primarily targets children, pregnant and lactating women, in addition to people living with HIV and AIDS. Burns *et al. (*2005) state that although the South African social pension system is among the most far reaching and generous in the developing world, it does not contribute significantly to the independent living of most elderly people in South Africa.

The aim of the study was to conduct an analysis of the associations of nutrient intake and the dietary patterns exposure with the risk of malnutrition, both over as well as undernutrition, in addition to its effect on the quality of the total diet and consequences on the elderly's overall nutritional status and health outcomes. The translated findings of this study will aid in formulating practical recommendations for a sustainable consistent intervention strategy to improve the nutritional status of elderly in this community.

5.2 LIMITATIONS OF THE STUDY

The limitations of this study were the following

- The pilot study was relatively difficult in the beginning since the elderly at the Verulam day care were reluctant to participate in the study. Once the elderly understood the objectives of the study they were interested in participating.
- In addition, sometimes the researcher had to visit some of the elderly residing near the day care centre several times on a social basis to establish a trusting relationship and gain the cooperation of the elderly person before collecting the necessary data. This was time consuming; however, building a trust relationship is one of the principles of community participatory research in community research projects.
- The QFFQ questionnaire would have been the ideal tool to measure the habitual dietary intake over a period of one month. However, due to the low attention span of the respondents it was a difficult tool to use. Therefore, the administration of two 24-Hour Recall questionnaires relied on the compliance and participation of the respondents in terms of time and memory. This process was time consuming for the respondents, thus increasing non-response and influencing the reliability of the responses. However, previous research has found that a FFQ is less time consuming and in addition has a reduced respondent burden and cost than other dietary assessment tools (Willet, 1990; Block, 1982). Furthermore, a study by Oldewage-Theron and Kruger (2008:130) proved that dietary diversity indicators (FGDS, FVS) as measured by FFQ are good indicators of dietary adequacy.
- The men respondents were fewer than the women and, therefore, it was relatively challenging when comparing the data. However, research has shown that women

tend to get older than men and thus are always in the majority globally (Charlton *et al.,* 2008) and in SA (Oldewage-Theron, Samuel and Venter 2008).

- Time was a significant factor since the elderly dispersed the venue by 1pm due to transportation, therefore, not all measurements could be taken on the same days, owing to the low attention span of the elderly. Therefore, the data collection for the 24-Hour Recall questionnaire was disrupted when it was time for the elderly to go home and, therefore, left with not completing the interview process. The researcher and fieldworkers had to re-conduct the interview process on the next day and this added more pressure in terms of the respondents' willingness to spend more time being interviewed which caused an accumulation on the data collection process.

5.3 MAIN FINDINGS

5.3.1 Literature

The wealth of literature illustrates that the elderly are increasing globally and the main health problems experienced by this group are: overnutrition-related chronic diseases such as obesity, diabetes mellitus, hypertension, CVD and certain forms of cancer. The epidemiological transition is marked by a shift from predominantly endemic deficiency diseases (themselves caused by inadequate diet) and infectious diseases (the risk of which is often increased by poor nutrition), to predominantly epidemic chronic diseases. Presence of both under and overnutrition is most common amongst low income elderly, primarily overnutrition which is a key predictors of poor nutritional status. Moreover, the elevated prevalence of noncommunicable diseases is associated with overweight and obesity, which includes a variety of factors that may be responsible for higher prevalence of obesity even in developing countries such as are urbanisation and life style factors, lower energy expenditure labour, mechanization, and automation which also incorporates watching television and other sedentary activities.

In addition, the literature further reports that hunger and obesity can exist within the same household and is especially true for low-income households. However, there is evidence that higher obesity rates tend to be associated with low incomes and low education levels,

particularly among women. The impact of higher food prices and low household income implicates the elderly food choices, dietary habits and diet quality, therefore resulting in a consumption of energy-dense foods, particularly staple foods to stretch the food budget. Staple foods are more affordable and thus allow for an increased consumption. Therefore, household food insecurity and poor dietary intake results in micronutrient deficiencies.

5.3.2 Socio-Demographic

Significant socio-demographic variables that were identified in the present study were gender, ethnicity and socio-economic status. The women (76.4%, n=191) form a larger percentage of the sample population when compared to the men (23.6%, n=59). The majority of the respondents (76.0%, n=190) relied on state grants to supplement their income. A large segment of the respondents (55.6%, n=139) is food insecure since less than R500 is used to purchase food per month and a small portion of the sample (28.4%, n=71) never have enough money to purchase food. However, the highest education attained by the respondents was primary school (52.4%, n=131) which, therefore, can be a contributing factor to poor nutrition knowledge which has implications on the nutrient intake of this community. This sample did have access to proper sanitation and water. This is thus a poor community experiencing food insecurity due to a lack of resources and education.

5.3.3 Anthropometric Indicators

The results of this study illustrated that overweight and obesity were the most outstanding anthropometric features in both Indian and black women as well as the Indian men. This was confirmed by the high WC. Reported sedentary behaviour, in addition to the mainly carbohydrate-based diet and poor food variety, may have contributed to the increased BMI, however, Townsend (2006) and Wardle (2002) found that hunger is associated with overweight and obesity in low-income communities.

5.3.4 Health status

The main health problem measured was hypertension in the majority of men and women in this community. This was exacerbated by the preference of salty foods in the majority of the

sample (51.2%, n=128). Other reported illness by the majority of African men and women were skin disease and skeleton and joint problems. The majority of black women further reported heart, chest and digestive problems compared to mainly headaches in the Indian women. The majority of the Indian men reported ear, nose or throat diseases. Furthermore, regular alcohol usage was reported by 47.2 percent (n=118) of the respondents of which 30.4 percent, (n=76) preferred strong liquor and 35.2 percent (n=88) smoked, which are both risk factors for the development of chronic diseases of lifestyle (CDL). Overnutrition and a risk of CDL are thus the main health problems experienced by the sample in this community.

5.3.5 Dietary intakes and Nutrient Adequacy

The findings of this study confirmed that the total range of individual food items consumed by an individual during the seven-day data collection period was 4-66 foods. The majority of respondents (91.5%, n=228) consumed thirteen to sixty two individual food items in seven days. Of these, the highest consumption was 19 to 24 food items by 23 percent (n=57) of the respondents. The mean FVS (±SD) for all the foods consumed from all the food groups in a period of seven days was 33.32 (±15.21), indicating medium variety. In this sample, the majority of the respondents (52.6%, n=131) consumed from all nine nutritious food groups during the seven-day data collection period, indicating good dietary diversity. However, the low nutrient adequacy ratio for zinc, calcium, iron, zinc, vitamin A, B6, C and folate in the women and zinc, calcium vitamin A, C and riboflavin in the men indicated poor dietary intakes, thus both a good FVS and FGDS are needed to ensure nutrient adequacy.

The findings have indicated that this community's diet is largely carbohydrate-based according to the energy distribution of macronutrients in women (59.11%, n=191) and men (61.25%, n=59) respectively, containing primarily starchy staple foods, however, there is an insufficient intake of animal products, dairy foods and fruit and vegetables, possibly resulting in the observed deficiencies. A good variety of fruit and vegetables were evident in this community, however, low frequency and small portions of vegetables and fruit were reported. Orange was the first fruit which ranked 15th on the top 20 food items, not meeting the goal consumption intake of >400g per day recommended by the WHO (2002a).

5.4 CONCLUSION

This study has found poverty, resulting in household food insecurity and poor dietary intakes. Although the elderly reported a medium food variety, the dietary intakes for most nutrients did not meet the DRIs in this community. This study has exemplified the increasing prevalence of lifestyle disease due to the diet patterns and health status. The progression of malnutrition, especially overnutrition experienced by the majority of the respondents in this study, illustrates environmental interference due to the dietary intake patterns. The health status of the respondents was also compromised, especially with regard to the prevalence of hypertension and CDL, as well as the fact that the majority (84.8%, n=212) of the sample used chronic medication.

5.5 RECOMMENDATIONS

The elderly contribute immensely to the growth of society provided that they are appropriately cared for. However, many elderly are faced with poverty, neglect, inadequate health care, lack of health insurance and even abuse which is on the increase. The high prevalence of inadequate nutrient intake amongst the respondents demonstrates the need for effective and wide reaching nutrition strategies aimed at improving nutrient intake.

- **Recommendation 1: Policy Makers**

- **Government Initiatives**

Social grants for the elderly should be reviewed by government since the funds are insufficient to meet the daily requirements of the elderly. However, more attention should also be paid to the proper administration of the social grants received by the elderly. More importantly, the government should endorse the Food Stamp Programme currently run by Shoprite, Checkers and Checkers Hyper to eradicate food insecurity endured by many elderly. The community based nutrition programme developed by the Department of Health such as the soup kitchen and food parcels has encouraged food based programmes for community's to improve nutrient adequacy. However, consistent monitoring should be done by senior authorities in charge of community based nutrition programmes to ensure these programmes are received by the elderly and well maintained by individuals in charge.

Appropriate government interventions should thus be aimed at improving the health status of the elderly which will lead to a healthier community.

- **Integrated Nutrition Programme (INP)**

The INP initiated by the Department of Health is specifically aimed at mothers and children, HIV and AIDS as well as TB sufferers. Consequently, there are nutritional programmes available to assist the elderly which are not effective, and community-based nutritional strategies should be well co-ordinated when implemented by local government or NGO's. Moreover, it is essential that the INP co-ordinaters acknowledge the elderly when developing nutrition strategies to eliminate malnutrition, both over as well as undernutrition, and will result in physical and cognitive functional ability of this age group. In addition, nutrition education, food fortification and supplementation strategies are needed to improve nutrient adequacy for the elderly.

- **Non-Government Organisations**

Non-governmental organisations have a key role in bringing to the forefront nutritional problems experienced by the elderly within society at large and through its various services it has sown the seeds for an opportunity whereby the voice and the concerns of the elderly can be met. However, the inclusion of food aid should be implemented regularly to ensure the elderly receive adequate sustenance. A nutritious meal could be delivered to the elderly during the day at a communal meeting place to ensure they are not burdened with food preparation if very frail or are faced with inadequate funds to purchase ingredients to prepare food. Community centre kitchens or lunch clubs would also benefit the elderly by acquiring the necessary meals in a social environment and moreover to prevent meals from being passed to grandchildren.

- **Recommendation 2: Nutrition Education Intervention**

- **Nutrition Education**

A study conducted by Bernstein, Tucker, Ryan, O'Neill, Clements, Nelson, Evans and Singh (2002) indicated the importance of nutrition education programmes for the elderly. The importance of dietary diversity in the diet to alleviate nutritional problems and related diseases should be included. Moreover, nutrition education is essential to educate the elderly

to modify their food procurement, preparation and meal patterns to address the prevalence of various micronutrient deficiencies. However, a sustainable nutrition education programme would benefit this community by helping them to make informed nutritious food choices, and, therefore improve their dietary patterns, food habits, food preparation and meal planning skills within a limited household budget.

The kitchen staff at the Verulam Day and Frail Care Centre should also attend a nutrition education programme to enhance food knowledge in addition to developing suitable cooking methods and host a variety of meals that are nutritionally balanced to meet the nutrient requirements of the elderly.

- **Increasing Physical Activity of the Elderly**

Hallaj, Geneidy, Mitwally and Ibrahim (2010) have indicated the importance of the elderly pursuing a physically active lifestyle which significantly delays age-related risk factors associated with cardiovascular, respiratory control, lowering blood pressure, type 2 diabetes and helps to maintain weight and musculoskeletal functions and delays many of the physical and psychological problems that commonly occur with aging. The encouragement of physical activity at the day care centre is beneficial for keeping fit. Stimulating social interaction for the elderly is a vital aspect for a positive quality of life. A large portion (46%, n=115) of the elderly in this study have indicated no physical activity, therefore the need to incorporate physical activity into the elderly lifestyle should be seen as a priority. An exercise programme has been developed for the elderly at the day care centre which is carried out daily in the morning, however, very few elderly take full advantage of the programme since the programme is being practiced very early before the majority of the elderly reach the day care centre. The day care centre could consider rescheduling the time of the morning exercise routine to a more suitable time to accommodate all the elderly as the WHO (2010d) recommends physical activity in the elderly which includes leisure time physical activity, transportation (e.g. walking or cycling), occupational (if the individual is still engaged in work), household chores, playing games with grandchildren, sports or planned exercise, in the context of daily, family and community activities.

- **Recommendation 3: Agricultural Interventions**

Kimokoti and Hamer (2008) recommended that household diversification is necessary and should aim at the achievement of a balanced range of basic essential food production and availability in food-insecure households such as in this community. Furthermore, Ireland (2011) highlights the benefits of fresh vegetables which provide more nutrients than canned or frozen vegetables. The World Health Organisation (2004b) further indicates that vegetable gardens are an exceptionally good hobby for the elderly to practice, since tending the garden will promote physical activity, without exhaustion, and with mental stimulation and the ability to enjoy the outdoors without too much exposure. Growing plants stimulates production of calming chemicals in the body which is also associated with keeping blood pressure down (Ireland, 2011 and WHO, 2004b) as well as enhances the activity of the respondents. The satisfaction associated with growing your own food provides conversation material and a chance to socialize when the elderly share a meal. The encouragement of the elderly practicing planting of vegetables in a small area or in a container at the day care centre or at their place of residence will help enhance activity levels and provide the body with essential nutrients (WHO, 2004b). In addition, raising chickens for meat and eggs, and goats for milk to ensure sustainability within this community can also be investigated as a possible intervention.

- **Recommendation 4: Adoption of a Healthy Diet**

  Epidemiologic evidence suggests that there is a relationship between high fruit and vegetable consumption and the prevention of many chronic diseases, which is seen with increased prevalence in the older population (Mccame, 2000). The elderly in this community have a medium food variety and the FGDS was good; however, the fruit and vegetable portion size, dairy products as well as whole grain should be increased to meet the DRI's required for optimal health in the elderly.

5.6 RECOMMENDATIONS FOR FUTURE RESEARCH

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

- This study further highlights the need for a nutrition intervention to prevent the progression of risk markers and will, therefore, enable this community to adjust current

food choices when purchasing food and healthier food preparation methods to address the increased prevalence of lifestyle disease and micronutrient deficiencies.

- Investigate micronutrient malnutrition in the elderly, especially with regard to the gender differences in nutrient intakes and deficiencies.
- Identify the relationship between obesity and diet, since the majority of the elderly experience lifestyle disease due to overnutrition that compromises longevity. These strategies need to be investigated for feasibility and efficacy to improve the diet of the elderly in this community.
- The development of an affordable multimix to supplement the elderly daily dietary requirements should be further study for this community since the majority of the elderly in this study were micronutrient deficient.
- Establish a relationship between the cooking techniques and an increased BMI to develop an awareness programme promoting healthy cooking methods.
- Identify the usefulness of dietary diversity and food variety increasing fruit and vegetable portion size, since the elderly did not meet the World Health Organisation goals for fruit and vegetable intake of >400g in a nutrition education programme to improve the overall diet content.
- The associations between socio-economic status, food intake patterns and overweight status of the elderly with suitable interventions to improve overall dietary intake patterns.
- Community support for improved nutrition for the elderly and community-based interventions.

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Annexure A: Letter of permission from the Verulam Day and Frail Care Centre

VERULAM DAY & FRAIL CARE CENTRE

NPO NO. 002-516 NPO

109 Todd Street
Verulam
4340

Telephone: (032) 533 7538 / 5330201
Fax: (032) 533 3611
Email: vlmdaytrail@telkomsa.net

P.O. Box 1512
Verulam
4340

For Attention : Dr C. Napier

The Supervisor
Durban University of Technology

21 August 2008

Miss Thiloshni Govender

Student Ref. – 20202346

We hereby confirm that permission has been granted to Miss Govender to complete her research as a pre requisite for her Masters Degree in Food and Nutrition :Consumer Science. The research will be conducted in 2009 with 250 elderly participants once funding has been confirmed.

We wish Miss Govender well in her research endeavours.

Thanking you

Yours faithfully

[redacted]

Ms F. Khan

Senior Social Worker / Section Head

INCORPORATING:

1. V.J. KARAHALL
2. PAKCO FRAIL CARE CENTRE
3. A. RAMSUNDER GERIATRIC CLINIC

4. SATELITE CLUBS

TRENANCE PARK	NDWEDEWE
REDCLIFF	REDCLIFF QUARRY
OTTAWA	COTTONLANDS/
AMOATANA	HAZELMERE
IMBALI	KUTHALA

Annexure B: Letter of Consent

Department of Food and Nutrition

Tel: (031) 3732323

LETTER OF CONSENT TO PARTICIPATE IN NUTRITION RESEARCH

I, the undersigned…… (Full names in print) have read the details of the project, or have listened to the oral explanation thereof, and declare that I understand it. I have had the opportunity to discuss relevant aspects with the researcher and declare that I voluntarily participate in the project. I hereby give consent to participate in the project.

Name: ……..

Signature ……

Witnesses

Name …….. Name……

Signature …… Signature……..

Signed at …… on……....

Contact Number: ……

Reference No.: ……

D U R B A N
UNIVERSITY *of*
TECHNOLOGY

FACULTY: APPLIED SCIENCES

DEPARTMENT OF FOOD AND NUTRITION
CONSUMER SCIENCES

NATIONAL DIPLOMA:

FOOD AND NUTRITION: CONSUMER SCIENCES

Fieldworker Guide

2008

CONTENTS **PAGE**

1. INTRODUCTION

Welcome to Fieldwork, this is a stimulating opportunity to work with the Department of Food and Nutrition researchers and their communities around Durban. Research fieldwork in communities cannot be conducted without the assistance of fieldworkers.

Fieldworkers are the key to the success of community studies. They act as interviewers, collect physical measurements or observe features in the participants. Often in community studies fieldworkers can also enter people's homes and interview them there. Data collection in the community is often hard work; if people are not available repeat visits need to be made. Fieldworkers should be well trained in the survey methods being used in a specific study, to ensure reliable data. As part of Work Integrated Learning all 3rd year Food and Nutrition Consumer Sciences students must take part in data gathering of one or more research project in the department.

What is a Field Worker?

The field worker is an extremely important person in this project. In fact, this research would not be possible without the field workers. The field workers are the individuals who must interview the subjects (the people chosen to take part in the research) and get correct and accurate information from them. The subjects must feel at ease with the field worker so that they will not feel threatened or intimidated and will willingly answer the questions to the best of his or her ability.

2. ENQUIRIES

The following staff members are concerned with Field Work:

Senior Lecturer/Researcher : DR C. Napier

S9 Level 3, Room 312

Tel. No. : 031 373 2326

E-mail : carinn@dut.ac.za

Research Assistant : Mrs. T. Govender

S9 Level 3, Room 314

Tel. No. : 031 373 2961

E-mail : researchFN@dut.ac.za

3. FIELDWORK REQUIREMENTS

- All 3rd year students will be expected to attend a fieldworker training course separately or as part of Nutrition 3.
- Each student must complete at least 10hours of fieldwork in one or more of the current research projects in the department of Food and Nutrition Consumer Sciences, a time sheet will be signed by the researcher in charge of the project to control the hours worked.
- Fieldworkers will **NOT** be remunerated for the 10 hours of fieldwork completed; any fieldwork completed by a fieldworker over and above the10 hours will be paid at a rate per hour.
- The researcher in charge of the project will complete an assessment sheet for mark allocation for this part of the Work Integrated Learning (WIL) Module.
- Fieldwork marks adds up to **10%** of the final mark for **WIL**.
- Students can be expected to do any of the following tasks as part of their 10 hours:
    - Fieldwork in a community
    - Data capturing
    - Participating in a community upliftment project
    - Assisting with other research activities, e.g. Departmental Research Day

Details regarding the logistics will be discussed at the training session and each researcher will inform participating students of dates, times and venues.

1. ASSESMENT CRITERIA

DEPARTMENT OF FOOD AND NUTRITION CONSUMER SCIENCES

SUBJECT: Work-integrated Learning

LECTURER/RESEARCHER ASSESSMENT: Academic Service Learning component

Student name:_____

Student number:_____

ASSESSMENT CRITERIA	**Very good** **10 - 9**	**Good** **8 - 6**	**OK** **5**	**Poor** **4 - 3**	**Unacceptable** **2 - 0**	**Your mark**
Arrived timeously						
Professional appearance						
Approached task in an organised manner						
Worked effectively as a team member						
Patience and respect shown towards subjects						
Anthropometrical measurements were correctly applied (if applicable)						
Accurate and detailed recording of information						
All details included in completion of forms						
Followed the task through to the end						

Number of hours completed: _____

General comments:

_____

_____

_____

Researcher Signature: _____ Date: _____

Print name: _____

4. FIELDWORKER CODE OF CONDUCT

4.1 BEHAVIOUR

In order to be a successful interviewer, a field worker must have (or develop) the following characteristics:

1. **Friendliness**: the field worker must be able to make each subject feel relaxed and not threatened in any way. The subject must feel that the field worker sees him or her as a person, not just another number that must be dealt with.

2. **Respect**: the subject must be treated with respect at all times. For example, he must be greeted politely, thanked for his time and co-operation; he must not be forced to answer a question that he is not willing to answer. The field worker must never show if she disagrees with something the subject has said.

3. **Patience**: each subject has to be asked the same questions in the same way. This means that the field worker must ask the same questions over and over, which can be very tiring and irritating. However, the field worker may never show that she is impatient or irritated even when the subjects are slow to answer or when they do not understand the questions. She must be able to control her own feelings and hide them when necessary.

4. **Reliability**: the field worker must be reliable, she/he must pay attention to detail, record all answers accurately, not skip over questions or make up answers.

5. **Enthusiastic and Motivated**: the field worker must be enthusiastic about the research. She should be doing it because she really wants to and not just because it's just a job.

6. **Flexible**: a good field worker is able to adapt to circumstances. She is aware that things do not always work out as planned and sometimes she will have to work under difficult and uncomfortable conditions.

8. **Neat Appearance**: the field worker must always look neat and well groomed, but never overdressed. The following guidelines for dress should be followed:

   - wear neat, simple and comfortable clothes

   - do not wear badges or emblems of organisations, churches, etc. as these may influence the way subjects answer.

   - dress so that the subject will concentrate on the interview and not on the way you are dressed.

4.2 CONDUCTING THE INTERVIEW

If the subjects in a project are children, the parents and/or caregivers will need to be involved in the interview process to verify information that is needed for the questionnaires. If the subjects are adolescents they can usually remember what they ate and can answer their own questions. If the questions need to be translated the interviewers must be careful not to change the focus of the question.

1. How do I begin?

- Greet the subject politely and introduce yourself.
- Ask what language the subject would prefer to speak.
- Explain what the interview is about. Let the subject ask questions about the research. Reassure the subject that the answers are confidential and that neither the subject nor his or her address will be identified.
- Put the subject at ease. Be flexible and sensitive to the subject. Some subjects may be tense or apprehensive. In such cases, talking about something general, e.g. the weather may put the subject at ease.

2. How do I conduct the interview?

- During the interview direct the questions to the subject, but if it is a child and he or she cannot answer, ask the parent/caregiver for the information needed.

- Ask the questions exactly as they are written on the questionnaire. Try even to keep your tone of voice the same for each subject so as not to lead the subject or to give him an idea of how you want him to answer. You may have to explain a question or use different wording if the subject cannot understand it.

- Ask the questions in the order that they appear on the questionnaire. If the subject refuses to answer the question, record the lack of response and go on to the next question.

- Follow the instructions on the questionnaire. Sometimes it may seem that a subject has already answered a question when he answered a previous one, but the

interviewer must still answer the question. For example, the questions about polony and atchaar. Start the question: “We have already mentioned this, but…”.

- Do not lead the respondents. Do not try to influence the way the subject answers. Keep your facial expression friendly, but neutral. Never show surprise or shock or approval to the subject’s answers. Try to avoid unconscious reactions such as nodding the head, frowning, raising the eyebrows. Never give your own opinions.

- Keep the tone of the interview conversational. Be friendly and courteous. Do not make the subject feel as if he or she is taking an examination or is on trial be familiar with the questionnaire so that you can ask questions conversationally rather than reading them stiffly. The questionnaire is designed to keep the amount of writing to a minimum. However, if a subject gives a long response to an ‘other’ question, say, ‘excuse me while I write that down’. Don’t make the subject feel as though you have forgotten he is there.

- Keep control of the interview. Do not let the subject go off into irrelevant conversation. If he or she does, bring him or her gently back to the interview.

- Allow the subject time to think; do not hurry him to answer. However, if he is silent for too long, repeat the question, or ‘prompt’ him. For example, say ‘you have told me how you cook cabbage; now please tell me how you cook pumpkin.

- Follow the instructions on the questionnaire for recording the responses. Record all responses, including negative responses or refusals to answer.

- **Make sure that you have written in the subject’s number.**

3. How do I end the interview?

  - Tell the subject that you have finished the interview.
  - Reassure him that everything he has told you is confidential.
  - Thank him for his time and cooperation. Direct him to the next stage. Greet him.

5. INTERVIEW EXAMPLE

24-HOUR FOOD RECALL QUESTIONNAIRE

The 24-hour recall is a questionnaire on what the subject has eaten the day before over a 24 hour period. Often the 24-hour recall is used to establish whether the QFFQ is valid or not. It is important to think of the 24-hour recall questionnaire as being a totally separate questionnaire and not a cross-reference to the QFFQ. Therefore, the answers to the questionnaire need to be very detailed. You will need to ask what is eaten and drunk, what type of food or drink is consumed, the brand name, the preparation method and the quantity consumed. Remember to include spreads, sugar and milk to tea / coffee, snacks, sweets, juices, sauces, salts and other condiments.

Example: The subject is asked what she has in the morning on waking up.

I: What do you have in the morning when you wake up?

S: I drink tea and then have porridge.

I: How do you take your tea?

S: With 2 sugars and a little milk.

I: How big is the spoon and is it level or heaped? (*Showing the teaspoon*).

S: It is like that spoon and I also have it heaped.

I: What type of porridge did you eat and how much did you have? (*Showing a bowl or cup*).

S: I had soft mealie meal porridge and I had about 2 of those cups to the fill in a bowl.

I: Do you put anything else in the porridge?

S: Yes, 2 spoons of sugar, like my tea, and a little margarine about 1 spoon.

I: At about what time was this meal?

S: At 6 am.

I: Where did you have this meal?

S: At home.

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					
6 am	**Home**	**Tea, rooibos**	**1 cup/mug**		

		With milk, full cream	**little milk – 2 tablespoons**		
		And sugar, white	**2 heaped tsp**		
		Soft mealie meal porridge	**2 cups**		
		With sugar, white	**2 heaped tsp**		
		And margarine, hard brick	**1 tsp**		

7. PORTION SIZES

FOOD	Smaller than smallest	Between small and medium	Between medium and large	Between large and very large	Larger than large/very large
Stiff porridge	125 g	275 g	425 g	600 g	800 g
Soft porridge	125 g	275 g	425 g		575 g
Samp and beans	100 g	200 g	375 g	600 g	800 g
Rice	70 g	105 g	190 g		310 g
French fries	30 g	90 g	185 g		340 g
Fried beef	15 g	45 g	80 g		120 g
Beef with bone	45 g	75 g	120 g		180 g
Meat stew	55 g	165 g	275 g		385 g
Sausage/ Wors	20 g	50 g	90 g		135 g
Offal	20 g	60 g	100 g		140 g
Pilchards	15 g	45 g	90 g		150 g
Mashed pilchards	15 g	45 g	90 g		240 g
Fried fish	50 g	70 g	105 g		155 g
Cabbage, potato and onion	15 g	45 g	75 g		105 g
Spinach, potato	15 g	45 g	75 g		105 g
Tomato and onion	10 g	30 g	60 g		100 g

FOOD	Smaller than smallest	Between small and medium	Between medium and large	Between large and very large	Larger than large/very large
gravy					
Pumpkin	15 g	35 g	60 g		80 g
Carrots, potato	45 g	65 g	80 g		95 g
Green mealie	50 g	110 g	180 g		260 g
Beetroot salad	10 g	30 g	65 g		85 g
Fat cake	20 g	50 g	70 g		90 g
Bread	15 g	45 g	80 g		120 g
Margarine	2,5 g	7,5 g	12,5 g		17,5 g
Dumpling	20 g	70 g	125 g		175 g
Apple	70 g	130 g	195 g		265 g
Banana	40 g	60 g	95 g		130 g
Canned peaches	30 + 10 g	70 + 15 g	110 + 25 g		150 +35 g
Custard	5 g	20 g	35 g		65 g
Atjar	10 g	45 g	80 g		120 g
Polony	5 g	15 g	30 g		45 g
Peanuts	5 g	20 g	60 g		105 g
Cheese curls	6 g	18 g	38 g		62 g

8. Other Questionnaires

The researcher may also use any of the following questionnaires:

- Food Frequency Questionnaire
- Socio-demographic questionnaire
- Nutrition knowledge questionnaires
- Health questionnaires
- Smaller questionnaires drawn up by each individual researcher e.g. lunch box content of school children.

Annexure D: Socio-Demographic Questionnaire

Food and Nutrition Consumer Sciences

SOCIO-DEMOGRAPHIC QUESTIONNAIRE: INDIAN COMMUNITY

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 from any reports or publications.

1. GENERAL INFORMATION

Subject number:…….

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	

3. ACCOMMODATION AND FAMILY COMPOSITION

3.1 Do you live in a?

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

3.2 Do other people live in your house?

Yes	No

3.3 How many people live in your house?

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

3.4. Please Complete the table below on all members of the household

Name of household member	Age (yrs)	Gender M / F	Family relationship	Does this person eat and sleep in this house at least 4 days a week?

3.5 Are all members' permanent residents in this house?

Yes	No

3.6 If yes, how long have you been staying permanent in this house?

< 1 year	1-5 years	>5 years

3.7 In what type of house are you staying in?

Brick	Clay	Grass	Wood	Zinc/shack

3.8 How many rooms does your house have?

< 2 rooms	3-4 rooms	> 4 rooms

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

Yes	No

3.10 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…….	

3.11 Do you have the following facilities at home?

3.11.1 Water

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

3.11.2 Toilet Facilities

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

3.11.3

Waste Removal	Yes	No

3.11.4

Tarred road in front of house	Yes	No

3.11.5

Gravel road in front of house	Yes	No

3.12 To what extent do you have problems with the state of your house (e.g. too small, repairs, dampness, etc.)?

……

3.13. Do you have problems with the following?

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

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 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?

<	R501-R1000	R1001-R1500	R1501-	R2001-R2500	> R2500

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

4.10. 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

4.11. 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

4.12. How often do you buy food?

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

4.13. Where do you buy food?

Tuck shop	Street vendor	Wholesalers	Supermarket	Other, specify……

4.14. What type of transport do you use to get around?

Taxi	
Bus	
Train	
Own vehicle	

Other Specify	

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

R 0 – R 50	R 51 – R 100	R 101 – R 150	R 151 – R 200	R 201 – R 250	R 251 – R 300	> R 500	I do not know

5. EDUCATION AND LANGUAGE

5.1. What is your highest education level?

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

5.2 What language is spoken mostly in the house?

English	Hindi	Tamil	Telugu	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 immunization schedule?

None	1	2	3	4	5	6	7	8	All

5.5 Number of children attending school

None	1	2	3	4	5	6	7	8	All

5.6 How do the children get to school?

Walk	Bus	Taxi	Lift	Other, specify…….

6. ASSETS

Tick one block for every question:	Self	Father	Mother	Sibling	Grandma	Grandpa	Aunt	Uncle	Cousin	Friend	Other

6.1 Who is mainly responsible for food preparation in the house?											
6.2 Who decides on what type of food is bought for the household?											
6.3 Who is mainly responsible for feeding/serving the child?											
6.4 Who is the head of this household?											
6.5 Who decides how much is spent on food?											

6.6 How many meals do you eat per day?

0	1	2	3	> 3

6.7 Where do you eat most of your meals?

Home	Friends	Work	School	Other, specify…….

6.8 Where do your children eat most of their meals?

Home	Friends	School	Other, specify…….

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

	Yes	No	Quantity
Electrical stove			
Gas stove			
Primus or paraffin stove			
Microwave			
Hot plate			
Radio			
Television			
	Yes	No	Quantity
Refrigerator			
Freezer			
Bed with mattress			
Mattress only			
Lounge suite			
Dining room suite			
Electrical iron			
Electrical, kettle			

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

Wood fire	Paraffin	Electricity	Gas	Coal	Other, specify……

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

Cast iron	Aluminum	Stainless steel	Clay	Other, specify……

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

Annexure E: Anthropometric Measurements

DURBAN UNIVERSITY of TECHNOLOGY

FOOD AND NUTRITION CONSUMER SCIENCES

Anthropometric Measurements

Section A:

1. Number/Name of the subject……

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 F: Health Questionnaire

DURBAN UNIVERSITY of TECHNOLOGY

Food and Nutrition Consumer Science

ELDERLY HEALTH, MEDICAL AND BEHAVIOURAL QUESTIONNAIRE

Section A:

HEALTH QUESTIONNAIRE:

1.

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?			

2.

	YES	NO
Have you lost weight during the past month?		
Have you had a recent change in appetite?		
Do you have problems with the following:		
* chewing?		
* swallowing?		

* nausea?		
* diarrhoea?		
* vomiting?		
* constipation?		
Do you follow a special diet?		
If yes, specify…….		
Are you allergic to any foods?		
If yes, specify		

3.

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)	

4.

How often do you get tired?	**Always**	**Sometimes**	**Never**

5.

	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 …… …… ……		

6.

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

7. If yes in question 6, answer question 7.

What do you smoke and how many per day?	**YES**	**NO**	**NUMBER per DAY**
Cigarettes, home made			
Cigarettes, bought			
Cigarettes, bought, light			
Cigars			
Pipe			
Other, specify			

8.

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

9.

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

10.

Do you use alcohol on a regular basis ?	**Tick the correct block**
1. Yes	
2. No	
3. Not applicable	

11.

If you use alcohol, How often?	**Tick the correct block**
1. Every day	
2. Once a week	
3. Occasionally	

12.

What type of alcoholic drinks do you drink?	**Tick the correct block**
1. Commercial beer / cider	
2. Home brewed beer	
3. Strong liquor ex. Whiskey, brandy, Vodka etc.	
4. Wine	

13.

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

…… …… ……		

Section B:

MEDICATION AND HEALTH FACILITY QUESTIONNAIRE:

1.

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?**

2.

Do you take any supplements?	**YES**	**NO**

3. If yes in previous question.

Specify the type	Vitamins, specify…… …… ……	Minerals, specify…… …… …….	Multivitamin	Other, specify…… …… ……

4.

Which health facility is commonly used by you?	**Tick the correct block**
1. Private Doctor	
2. Clinic	
3. Hospital	
4. Traditional Healer	

5. Other (please state)	

5.

How do you travel to the health facility?	**Tick the correct block**
1. On foot	
2. Taxi	
3. Bus	
4. Own transport	
5. Other (please state)	

I declare that the above-mentioned information is true and correct and that I have not withheld any information.
Signature……Date……..

Thank you very much for your co-operation.

Annexure G: 24-Hour Recall Questionnaire

Department of Food and Nutrition

Subject Name: _____ Subject Surname:_____

Subject Date of Birth: _____ Age: _____ Gender: Male ☐ Female☐

Subject Address:

_____

Interviewer:_____Date:_____

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

I want to find out 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 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 the day's activities					

Time (Approximately)	Place (Home, school, etc.)	Description of food and preparation method.	Amount	Amount in g (Office use only)	Code (Office use only)
During the morning at work or home					
Middle of the day (Lunch time)					
During the afternoon					

Time (Approximately)	Place (Home, school, etc.)	Description of food and preparation method.	Amount	Amount in g (Office use only)	Code (Office use only)
At night (Dinner time)					
After dinner, before going to bed					

Annexure H: Food Frequency Questionnaire

FOOD AND NUTRITION CONSUMER SCIENCES

FFQ LIST OF FOODS AND FOOD GROUPS DIVERSITY

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, Lamb)		
Meat (Pork)		
Meat (Goat)		
Dried Meat (Biltong)		
All Mince		
All Tribe/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		

	Y	N
All Cheese		
Custard		
Ice Cream		
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		
Scones/Biscuits		
Mageu		
Breakfast Cereals (Corn Flakes, Oats, Weet Bix, Matabela)		
All Tubers/Roots (Amadumbe, Sweet Potato)	**Y**	**N**
Potatoes		
GROUP 5: Legumes and Nuts	**Y**	**N**
All Beans Dried		
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		
Spinach		
Butternut		

	Y	N
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		
Kiwi fruit		
Watermelon		
Guava		
Paw- Paw		
Juices	**Y**	**N**
Juice (100% pure juice e.g. Ceres/Liquifruit)		
GROUP 8: Other Vegetables Diversity	**Y**	**N**
Onions		
Cabbage		
Beetroot		
Tomatoes	**Y**	**N**
Green beans (fresh)	**Y**	**N**

	Y	N
Peas (fresh)		
Cauliflower		
Chili (red/green)		
Lettuce		
Green\ Yellow\ Red Pepper		
Frozen Vegetables (Mixed)		
Ginger & Garlic (Fresh)		
GROUP 9: Oils and Fats Diversity	**Y**	**N**
Butter		
Sunflower oil		
Margarine		
Lard		
Salad dressing/oil		
Potato Crisps		
Coffee Creamer (Cremora, Ellis Brown)		

Annexure I: Language Editing Certificate

This is to certify that the language editing of this Masters Degree written by Ms T. Govender was done by Prof L A Greyvenstein.

Prof L A Greyvenstein is a member of the South African Translators' Institute, membership number: 1001691. She completed her primary, secondary and tertiary education, including a doctoral thesis, in English. She has done the English language editing of many proposals, dissertations, theses and scientific articles.

Lesley Ann Greyvenstein (Prof)
(South African Translators' Institute: membership no. 1001691)
P O Box 20767
Noordbrug
Potchefstroom
2522
Tel: 018 293 0975 082 9744 505