NUTRITIONAL PRACTICES AND HEALTH STATUS OF HEALTH CARE WORKERS IN MAKHADO MUNICIPALITY OF LIMPOPO PROVINCE, SOUTH AFRICA

BY

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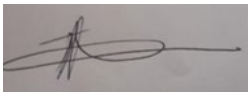
Declaration

I, **Itani Faith Masala,** hereby declare that the research Master of Science in Public Nutrition at the University of Venda, hereby submitted by me, has not been submitted previously for a degree at this or any other university, that it is my own work, design and in execution, and that all reference material contained therein has been duly acknowledged.



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14 June 2022

Date

Dedication

This dissertation is dedicated to my LORD, my strength and personal Saviour, Jesus Christ; my late grandparents, Mr Solomon Maanda Masala Mugovheli Gununu Mahni, Mr Andries Mbulaheni Mashau Mulembamuthihi; and Mrs Martha Tshinakaho Ntshavheni Rasikhanya-Masala. May their souls continue to rest in peace.

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Abstract

Background: Health care workers spend 80% of their time daily at work and workplaces are sedentary settings for many workers. Energy-dense food and beverages are commonly consumed, resulting in increased overweight and obesity, which are health-risk factors, especially for non-communicable diseases. The study aimed to describe the nutritional practices and health status of health care workers in the Makhado municipality.

Methodology: Cross-sectional survey design using a quantitative research method was applied. Study participants were health care workers who were registered with professional boards and working in the health facilities at the Makhado municipality. A total of 336 health care workers were randomly selected from 25 health care facilities across the municipality. Data were analysed by description and inferential statistics using version 2020 of the statistical package for social sciences.

Results: The current study indicates that 62% of total participants was obese, 26% was overweight, 18.2% had body fat percentage in the overweight range and a total of 67.6% of participants had a total body fat percentage in the obese range. More than two-thirds (at 72%) of total participants had waist circumference above normal. Biochemically, there were disorders of blood glucose, total cholesterol, low-density lipoprotein and high-density lipoprotein among participants. The majority of female participants and 45% of male participants prepared their meals and they usually ate home-prepared breakfast and lunch while at work. About 60% of participants in both groups ate three meals a day, and 34% of male and 27% of female participants ate food from takeaway restaurants once a week. Above half (at 54.1%) of female participants and 39% of male participants had very good lifestyle habits. The majority of participants in both groups had fair and poor nutritional knowledge (with male = 80.7%, female = 83.6%).

Conclusion: The majority of participants had acceptable nutritional practices, except 30.1% of participants who skipped meals. Health status is of high concern because very few of the total participants had normal weight. The majority of participants had abdominal obesity and there were participants with disorders in biochemical and clinical parameters.

Keywords: Nutritional practices, health status, health care workers, health care facilities, local municipality

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Abbreviations/Acronyms

BMI	Body Mass Index
CVD	Cardiovascular Disease
DBP	Diastolic Blood Pressure
DRIs	Dietary Reference Intakes
NRVs	Nutrient Reference Values
FFQ	Food Frequency Questionnaire
HCWs	Health Care Workers
HDL	High-Density Lipoproteins
HPCSA	Health Professional Council for South Africa
NCDs	Non-Communicable Diseases
PHC	Primary Health Care
SA	South Africa
SACSSP	South African Council for Social Service Professions
SANC	South African Nursing Council
SBP	Systolic Blood Pressure
SPSS	Statistical Package of Social Science
WHO	World Health Organization

CHAPTER 1
INTRODUCTION

1.1. Background and motivation of the study

In determining one's health, anthropometry has a long tradition of assessment of adults as it is an inexpensive, non-invasive method that provides detailed information on different components of body structure, especially muscular and fat components (Bhattacharya *et al*., 2019). Among the widely used anthropometric measurements in adults, the body mass index (BMI) is the most significant and reliable (Bharat *et al*., 2007). In health, anthropometry is generally used to determine the nutritional status of individuals and populations by implicating the availability of adequate food (Kruger *et al*.,2005). In the current study health status is assessed by anthropometric, biochemical, clinical and dietary intake. Similar to what Singh-Manoux *et al. (*2005:106) explained component of health status to be the anthropometric indicates the measurement of weight, height, waist circumference (WC) and total body fat percentage.

Biochemical tests, also known as biomarkers, often detect nutrient deficits long before anthropometric measures are altered and clinical signs and symptoms appear (Kruger *et al*.,2005). They provide more objective and quantitative data on nutritional status (Lee & Niemand, 2013:317). Some of these tests like triglycerides and high density lipoprotein (HDL) are useful indicators of recent nutrient intake and can be used in conjunction with dietary methods to assess food and nutrient consumption (Lee & Niemand, 2013:317) as in the current study.

Clinical assessment of nutritional status involves a detailed history, a thorough physical examination, and the interpretation of the signs and symptoms which can be an efficient and effective way (Lee & Niemand, 2013:353). In this study blood pressure will be assessed as clinical parameter and one of risk factors of the metabolic syndrome.

Dietary patterns includes dietary history, information about the participants's eating practices and a wide range of information about usual eating patterns (timing and location of meals and snacks), food preferences and aversions (Lee & Niemand, 2013:353). Gupta (2017) indicated that being health care workers (HCWs) may have impact on dietary and lifestyle habits, consequently affecting their intake and nutritional status due to the majority of them being responsible for their own meal provision as they are financially independent. Consequences of poor eating are malnutrition in all its forms, as well as non-communicable diseases (NCDs) (WHO, 2018).

An unhealthy diet and lack of physical activity are leading global risks to poor health (Hooper, *et al*., 2015). Other causes of poor health for millions globally are rooted in political, social and economic injustices, where poverty is both a cause and a consequence of poor health (Roberts, 2018). Poor health status causes people to have double the chance to develop heart diseases; five times as likely to develop diabetes; and three times likely to have a heart attack or stroke (Singh, 2018).

Increasing sedentary lifestyles, is one of the outcomes of economic development known to be associated with changes in health and increased prevalence of chronic diseases (Noor, 2014). The accelerated pace of industrialisation and urbanisation in recent decades has inevitably brought changes in lifestyles and dietary habits amongst the working population (Bradshaw *et al.,* 2014). In SA, it is estimated that 56% of the population now resides in urban areas, with urbanisation of the Black population increasing rapidly (Dalal *et al.,* 2011). This rapid urbanisation globally is accompanied by large shifts in the nutritional patterns of many countries, including SA (Puoane *et al.,* 2010, WHO, 2011). According to Florindo *et al.* (2015), consequences of lifestyle changes include diet, lack of physical activity, smoking, adiposity and alcohol use.

Nutritional knowledge is of great concern, various interventions and modifications aiming at the promotion of healthy eating behaviours have limited impact due to insufficient understanding of dietary habits (Naeeni *et al*., 2014). Health care workers with greater nutritional knowledge are more likely to consume healthier diets (Geaney *et al.,* 2015).

Health care workers are responsible for assessing the health status of the general population and do not get time to assess themselves or to do medical consultations. Judd *et al*. (2015) indicated that health status is when there are meaningful associations between anthropometric status, biochemical and clinical parameters, dietary patterns and lifestyle habits. Therefore, the current study aims to bridge that gap, hence it is of great importance to assess the nutritional practices and health status of HCWs in the Makhado local municipality.

1.2. Problem Statement

Health care workers are seen as leaders in health issues and people listen to them. The researcher observed the eating habits of HCWs, which made her want to study their dietary patterns in relation to health and also to determine their nutritional knowledge. There was also an increase in the development of shopping complexes around hospitals with fast-food outlets increasing. Nutritional practices determine health status, while bad nutritional practices mainly physical inactivity and unhealthy dietary pattern cause obesity and increase the risk of

cardiovascular risk which worsen the health status (Ker, 2016). Poor diets continue to be the number one driver of the global burden of diseases (Haddad *et al.,* 2015). Low fruit and vegetable consumption and high saturated fat intake are associated with high anthropometric status, risk of metabolic syndrome and coronary heart disease (Judd *et al*., 2015). Dietary pattern is paramount to the determination of haematological profiles, like high-density lipoprotein (HDL) and triglycerides (Hayford *et al.,* 2016). Several dietary practices such as high intake of saturated fatty acids, high total fat intake and inadequate consumption of dietary fibre are linked to unhealthy body weight (Spires *et al*., 2016).

The consumption of fast foods and other meals prepared outside homes has risen and for this reason, the current generation of young adults aged 18 to 35 years are born into an obesogenic food environment (Allman-Farinelli *et al*., 2015). Leading to overweight and obesity being a serious public health problem worldwide affecting both developed and developing countries including SA (Phetla & Skaal, 2017). Sedentary behaviour is emerging as an important risk factor for poor health and mortality, independently associated with overweight and obesity (Parry & Straker, 2013). Consequences of bad nutritional practices and health status are lifestyle-related diseases that cause impairment in quality of life, impaired productivity and impaired service delivery among local government employees, resulting in premature death. The current study will serve as a health awareness to HCWs in the Makhado local municipality.

1.3. Research Question

What are the nutritional practices and health status of HCWs in the Makhado local municipality?

1.4. Aim of the Study

The study aims to describe nutritional practices and health status of HCWs in the Makhado local municipality.

1. 5. Objectives of the Study

Upon completion of the study, the researcher aims to achieve the following objectives:

- To assess the anthropometric status of HCWs (height, weight, waist circumference and total body fat percentage);
- To assess biochemical parameters on HCWs measured by blood glucose, triglycerides, total cholesterol, low-density lipoprotein (LDL) and HDL;
- To assess clinical parameters on HCWs measured by systolic and diastolic blood pressure;

- To determine dietary patterns of HCWs;
- To assess nutrient intake of HCWs;
- To determine lifestyle habits of the HCWs;
- To assess nutritional knowledge of HCWs; and
- To determine the relationship between nutritional status and health status of HCWs.

1.6 Significance of the study

Study results provide recent information, which is evidence-based on the nutritional practices and health status of HCWs in the Makhado local municipality, Limpopo province. The information obtained in this study may help policy makers when developing policies for promoting adult health and nutrition. The study may provide a baseline for the development of healthy environment that promote healthy eating and lifestyle habits in the workplace and also for the public. The study was an eye-opener to participants on health risk caused by anthropometric, biochemical, clinical and dietary parameters. The results obtained may contribute to the existing body of knowledge in public nutrition and public health and may be used in planning and developing Integrated nutrition and health promotion programmes. The study may be the basis for future research among health professional researchers.

1.7. Definition of operational terms

Body fat percentage on the overweight range – For men, a percentage of body fat between 21-25% and for women, a percentage of body fat between 31-33% (Gallagher *et al*., 2000).

Body fat percentage on the obese range – For men, is a percentage of body fat greater than 25% and for women, a percentage of body fat over 33% (Gallagher *et al*., 2000).

Dietary patterns – healthy dietary pattern means choosing a variety of nutritious foods in the right amounts and making these choices part of the everyday routine (dietary guidelines for Americans, 2015). In this study, dietary/eating patterns refer to how, when and what HCWs eat, including portion sizes.

A health care worker – is an individual who is qualified by education, training, licensure/regulation and facility privileging who performs a professional service within his/her scope of practice and independently reports that professional service (Derricks, 2013). In this study, HCW refers to an individual who is an allied staff (occupational therapist, optometrist, pharmacist, physiotherapist, radiographer, social workers, speech and audiologist), clinical staff (psychology, medical officer, oral health staff) and nurse, working in health facilities of

the Makhado local municipality and is registered as an independent practitioner with various professional boards such as the health professional council for South Africa (HPCSA), South African nursing council (SANC) and South African council for social service professions (SACSSP).

Health status – is a multidimensional concept, requiring multiple indicators and multiple methodologies for adequate measurement, it can be constructed and be useful in epidemiologic analyses of risk factors as well as for monitoring trends (Madans & Wester, 2015). In this study, health status is the state of the body in relation to the absence of diseases, illnesses and not being at risk of developing lifestyle diseases like overweight or obese and metabolic syndrome.

Lifestyle habits – Lifestyle is the interests, opinions, behaviours, and behavioural orientations of an individual, group, or culture (Kahle & Close, 2011). In this study, lifestyle habits are the actions that put a person at health risk, for example, smoking, physical inactivity and skipping meals daily.

International metabolic syndrome – This is a cluster of the most dangerous heart attack risk factors: diabetes and raised fasting plasma glucose, abdominal obesity, high cholesterol and high blood pressure (Ker, 2016). In this study, metabolic syndrome refers to the measurements of total body fat percentage, blood pressure, blood glucose, triglycerides, total cholesterol, low-density lipoprotein (LDL) and high-density lipoprotein (HDL).

Nutritional knowledge - is an understanding of nutrition, including the intellectual ability to remember and recall food and nutrition-related terminology (Macías & Glasauer, 2014). In this study, nutritional knowledge refers to an understanding of the South African food-based dietary guidelines and food fortification programs of South Africa.

Nutritional practices – is the nutritional theories and evidence that contribute to practices of what and how people eat (Kerklaan & Fivez, 2015). In this study, nutritional practices are activities of individuals that could affect their nutritional status such as eating patterns and lifestyle habits.

1.8 The research structure

The structure of the dissertation is as follows:

Chapter 1: Introduction

This chapter looks at the background of the study, statement of the problem, research questions, aim of the study, study objectives, and significance of the study.

Chapter 2: Literature review

This chapter reviews literature related to the study on nutritional practices and health status of health care workers in the Makhado local municipality. Literature related to the question of this study is spelt out. In exploring the literature sources, the content is organised around headings and sub-headings based on the study objectives.

Chapter 3: Methodology

This chapter presents the research design and methodology; population; sampling procedures; sample size; data collection instruments; data collection procedures; data analysis; ethical considerations; and pilot testing that are used in this study. Inclusion and exclusion criteria of the study population are also highlighted.

Chapter 4: Results

This chapter presents the findings of the data generated from the study. The data are presented, guided by the research question and objectives of the study. For each research objective, data findings are presented jointly from questionnaires and interviews, with interview data playing the role of supplementing quantitative findings.

Chapter 5: Discussion of results

This chapter covers limitations of the current study with discussion of presented results. This chapter aims to discuss the main findings and compare these findings with existing studies.

Chapter 6: Conclusion and recommendations

This chapter summarises findings of the research study, elaborates on conclusion and gives recommendation remarks for improving the developed model.

A list of references used in the study is indicated in alphabetical order at the end of the dissertation.

Annexures are attached at the end.

CHAPTER 2
LITERATURE REVIEW

2.1 Overview

Nutrition forms the foundation for health, physical performance and provides the fuel for biological work and the chemicals for extracting and using food's potential energy (Hornstrom *et al*., 2011). Total accurate and valid assessment of body composition is essential for the diagnostic evaluation of health status, identifying relevant outcome measures such as anthropometry, biochemical, clinical and determining the effect of the present and future nutritional interventions in relation to health (Smith & Madden, 2016).

Anthropometric, biochemical, clinical and dietary measurements are important factors for determining the health status of individuals, used to diagnose chronic illness (Zaman *et al*., 2010). Socio-demographic characteristics and dietary habits on the health status and the extent to which anthropometric and biochemical has on health status has the combined effect of anthropometric measurements, biochemical and clinical measurements on health status in developing countries like South Africa (Sampa *et al*., 2020). Consequently, it is important to examine these factors simultaneously to assess their combined impact on health.

As part of anthropometry, obesity, waist circumference and body fat percentage assessment are part of health status, and the most common nutritional disorders occurring are consequences of long-term excess energy consumption relative to an individual's energy use, thus leading to an accumulation of excess fat (Laz *et al.,* 2015). The morbidity associated with obesity is divided into metabolic, mechanical and psychosocial complications (Klug *et al*., 2018). The current study also focuses on parameters that cause metabolic disorders of metabolic syndrome, strongly predicting an increased cardiovascular diseases and diabetes risk (Smith *et al*., 2015).

Biochemical tests was used to examine the validity of various methods of measuring dietary intake or to determine if respondents are underreporting or overreporting what they eat (Lee & Niemand, 2013:318). Biochemical parameters, especially disorders in blood lipids, are caused by ingestion of excess dietary fat leading to coronary arterial and heart diseases such as atherosclerosis (Sikka *et al*., 2021). Blood glucose is the other biochemical parameter used in the diagnosis of glucose disorders, glucose intolerance and diabetes mellitus (Allie *et al.,* 2017). This is a condition whereby the body is incapable of proper utilization of glucose and glucose is not properly managed and can lead to critical illness (Todd *et al.,* 2017). Glucose

monitoring and decision support are vital in avoiding potential adverse health effects caused by the main sugar found in the blood, which carries glucose to all cells of the body for energy supply (Allie *et al.,* 2017). Severely elevated glucose levels can result in a medical emergency like diabetic ketoacidosis (DKA) or hyperglycemic hyperosmolar nonketotic syndrome (Stöppler & Balentine, 2021).

Clinical parameters such as elevated BP is the number one risk factor for mortality and most common cardiovascular condition in the world (WHO, 2011). Furthermore, elevated blood pressure is associated with increased healthcare costs (Sikka *et al*., 2021). In hypertension and disease conditions that affect blood pressure, changes in blood pressure usually are described in terms of the systolic and diastolic pressures (WHO, 2016). The purpose of the control of blood pressure is to keep blood flow constantly to vital organs such as the heart, brain and kidneys to prevent death, as death ensues within seconds, minutes, or days from interruptions of blood flow to these organs (Steyn *et al*., 2016).

Nutritional practices determined by dietary patterns is the other main exposure of health because it represents what people eat including HCWs (Judd *et al*., 2015). Good nutritional practices are an essential component of efforts to prevent or control diseases of the lifestyle/ NCDs. The HCWs are in a position to provide health behaviour counselling to the public, yet most reports insufficient training to deliver effective counselling for promoting healthy eating and lifestyle (Smith *et al*., 2015). Due to rapid urbanization and lifestyle changes, people are more likely to eat typical fast foods outside their homestead, such as pizzas, hamburgers, deep-fried foods and sugar-containing drinks, all of which are unhealthy (Sampa *et al*., 2020). However, these foods are gaining popularity and many fast-food shops are operating, especially in urban areas (Sampa *et al*., 2020).

Improved health workers' nutritional knowledge may facilitate positive changes in their attitudes toward nutrition care and in their behaviour, including lifestyle habits (Sunguya, 2013). Literature on nutritional practices and health status of HCWs is explained below, subdivided into anthropometric, biochemical and clinical parameters, dietary patterns, lifestyle habits and nutritional knowledge.

2.2 Health status

Health status is the range of manifestations of disease including symptoms, functional limitation and quality of life, in which quality of life is the discrepancy between actual and desired function (Rumsfeld, 2012). The focus of discussion in this section is anthropometric, biochemical as well as clinical parameters.

2.2.1 Anthropometric status

Anthropometry is the study of the measurement of human body in terms of dimensions of bone, muscle and adipose/fat tissue (Shisana *et al*., 2014). Though anthropometry measures the dimensions and composition of the human body (Akano *et al.,* 2016), its indicators and measures are predictive of the risk of chronic diseases and health status (WHO, 2011). Anthropometric indicators are weight, height, body mass index (BMI) and waist circumference, highly related to the health status of individuals and also predict the overall performance of health and survival (Sampa *et al*., 2020). In addition, anthropometric measurements are used as a baseline for physical fitness and to measure the progress of fitness (Sampa *et al*., 2020).

Body mass index is a simple index of weight for height that is commonly used to classify adults with underweight, normal weight, overweight and obesity (Table 2.1) (WHO, 2011). The BMI is defined as "a person's weight in kilograms divided by the square of his height in meters [weight (kg)/height (m^2)]" (Agyemang *et al.,* 2015). The BMI is the traditional indicator that measures body size and composition, and it is used to diagnose the status of the body (Shisana *et al.,* 2013), but it is a poor tool for determining the health of an individual (Kelly, 2019). High BMI predicts future morbidity and death (Sampa *et al*., 2020). Therefore, BMI is an appropriate measure for screening obesity and its health risks (Agyemang *et al.,* 2015). Risks of having high BMI include, namely, cardiovascular (heart and blood circulation) disease, gallbladder disease, high blood pressure (hypertension), Type 2 diabetes, osteoarthritis, certain types of cancer, such as colon and breast cancer, depression and other mental health disorders (Nuttal, 2015). The BMI of less than 18.5kg/m^2 indicates underweight, while BMI of above 25.0 to 29.9kg/m^2indicate overweight while BMI of 30kg/m and above indicates obesity (Table 2.1).

Table 2.1: BMI classification of adults

BMI classifications kg/m^2	Interpretation
<18.5	Underweight
18.5–24.9	Normal
25.0–29.9	Overweight
30.0 and above	Obesity

Source: WHO (2011)

Malnutrition is defined as having a diet that provides too little (undernutrition) or too much nutrients (over-nutrition) (Dobner & Kaser, 2018). Malnutrition occurs when the body doesn't get enough nutrients, causes include a poor diet, digestive conditions or another disease (Abarca-Gómez *et al.,* 2017). Malnutrition (underweight, overweight and obesity) is a widespread problem, affecting the global population at some life stage (WHO, 2011). This public health epidemic targets everyone, but the most vulnerable groups are poverty-stricken

people, young children, adolescents, older people, those who are with illness and have a compromised immune system, as well as lactating and pregnant women (Dukhi, 2020). Underweight, overweight or obese is associated with adverse health consequences throughout the life course (Dobner & Kaser, 2018).

Globally, being underweight contributes 16% to the disability-adjusted life year, with a stronger health impact in developing countries (Selvamani & Singh, 2018). Health risks associated with being underweight include undernourishment, vitamin deficiencies, increased risk of excess mortality, poor cognition, poor self-rated health and poor health-related quality of life. Underweight is a front burner issue in some developing poor countries where it is a recognized perennial problem that has led to negative health consequences and sometimes death (Mendez et al., 2015). The NCD risk factor collaboration (NCD-RisC) network for health scientists indicated that the burden of underweight is increasingly concentrated in South Asia, Central, East and West Africa (Abarca-Gomez, 2017). In 2014, approximately 462 million adults worldwide were underweight (Abarca-Gómez *et al.,* 2017). In Asian countries, such as India and China, excess mortality owing to underweight is higher, with 35 percent older adults aged 50 and above being underweight (Selvamani & Singh, 2018). A similar observation was made in the study conducted by Biswas *et al.* (2017) where 30.4% of participants in Bangladesh were underweight. On the contrary, Puoane *et al*. (2012) reported that 12.2% of adult men and 5.6% of adult women in South Africa were underweight with a BMI of less than 18.5 kg/m^2. However, Goon *et al*. (2013) reported that only 2% of nurses in the Limpopo rovince was underweight.

ALAteeq and ALArawi (2014) indicated significant overweight and obesity among HCWs. High and middle-income countries as compared to low-income countries have a higher proportion of people who are overweight or obese (WHO, 2016). WHO (2016) estimated that in 2014, more than one third of adults 18 years and above were overweight, while one in ten were obese. More than two-thirds of American adults are overweight or obese with more than one-third being obese (Escott-Stump, 2015:625). Another prevalence in the United Stated shows that 8% of physicians was obese and 54% of the nurses was overweight (Neovius *et al.,* 2009). According to the review done by Gregg and Shaw (2017), it was reported that 39% and 58% of the adult population in Europe and the United Kingdom are overweight and obese, respectively. A similar trend was observed in Africa where 57% and 36% of the female HCWs aged 45 years and above, and male HCWs aged 45 years and above were obese, respectively (WHO, 2016). In Nigeria, grade one obesity, BMI of 30.0–34.9 kg/m^2 was indicated among HCWs and the difference was not significant between male and female respondents, while 39% of adults 18 years and above was found to be overweight with BMI of 25 to 29,9 kg/m^2

(Akano *et al.,* 2016). In SA the rate of people with obesity is increasing rapidly, with almost 70% on females and 40% on males either overweight or obese (NDoH, 2016). A similar trend was observed in the study done in Mpumalanga province among HCWs by Phetla and Skaal (2017) where 29% males and 56% of females were obese. The prevalence of overweight or obese among the South African population has been rising annually over the past few decades due to consumption of unhealthy diet (NDoH, 2015). The 2012 South African national health and nutrition examination survey (SANHANES) reported that prevalence of overweight and obesity is at 64% of the population with 39% being overweight and 25% obese (Shisana *et al.,* 2014). The prevalence of overweight and obesity has increased to 68% (at 27% overweight and 41% obese) from the year 2012 to 2015 (South African demographic and health survey (SADHS, 2016). These findings show that overweight and obesity is high among females when compared to their male counterpart.

Obesity pre-disposes the public to metabolic syndrome and it is a major public health problem in both developing and developed countries (Rawal *et al*., 2018). On the assessment of body fat percentage, 3% of body fat in males is essential, while females have higher requirements of body fat (at 12%); this storage fat accumulates under the skin and around the internal organs to protect them from trauma (Mahan & Raymond, 2017:559-60). Challenges of low body fat % is that, those people are prone to serious heart problems, low heart rates, cardiac arrhythmias and sudden cardiac death (Goon *et al*., 2013). Resistance to diseases and energy levels are lower in people with low body fat % and they are also at risk of health issues (Selvamani & Singh, 2018). Participants with too high body fat % are at higher risk of diabetes and other health problems (Dobner & Kaser, 2018).

Waist circumference is an alternative measure that reflects abdominal adiposity and is superior to BMI in predicting the risks of Metabolic Syndrome (WHO, 2011). The tape measure is needed to start measurements, from the hip bone, bringing the tape measure around the body, level with the belly button. Ensuring that participants don't hold breath, while measuring and the tape is not too tight (Lee & Nieman, 2010:179). Waist circumference is measured by non-elastic tape, it assesses abdominal adiposity also called gynoid obesity, which is more common in women to enable and meet the demands of conception, pregnancy and breastfeeding (Mahan & Raymond, 2017:558). WHO (2011) indicated that increased visceral adipose tissue due to overweight and obesity is associated with a range of metabolic abnormalities such as insulin resistance. Having WC above the derived cut-point was associated with a twofold probability of having at least two components of metabolic syndrome (Ekoru *et al.* 2018). The waist circumference is a clue to determine higher risk for type 2 diabetes, high blood pressure, high cholesterol, and heart disease (Dobner & Kaser, 2018).

Table 2.2 illustrates waist circumference classifications as per gender and risk of metabolic complications.

Table 2.2: Waist circumference classification

Classifications		Risk of metabolic complications
Male	**Female**	**Interpretation**
94 cm and less	80 cm and less	Normal
>94 cm	>80 cm	Increased
>102 cm	>88 cm	Substantially increased

Source: WHO (2011)

Abdominal obesity is evaluated by waist circumference (WC) and a significant increase has been reported in developed countries. An Australian 12-year cohort study reported an increase from 4.32 cm of WC in 1999 to 6.25 cm increase of WC in 2011 for both males and females (Han *et al*., 2017). The prevalence of WC over 102 cm among men aged 40 to 79 years has increased by 13.1% in North-East European cities from the year 2003 to 2010 (Tanamas *et al.,* 2016). In the US, the overall age-adjusted mean of WC increased by 3 cm from the year 1999 to 2012 (Ford *et al*., 2014). Developing countries such as China have also experienced a serious obesity crisis, with the prevalence of abdominal obesity increasing dramatically from 17.3% to 39.4% between 1997 and 2009 (Qian *et al.,* 2019). A positive rural-urban gradient (rural to semi-urban to urban) in Benin, West Africa reflected abdominal obesity (at 28.2%, 41.5%, 52.5%; $P < .001$) among the adult population (Ntandou *et al.,* 2009). Ekoru *et al.* (2018) in their study in sub-Saharan Africa reported the proposed optimal WC cut-off points among South African black population to be 81.2 cm and 81.0 cm for men and women, respectively, with comparable accuracy in men and women. The study done in the Limpopo province by Goon *et al*. (2014) reported that 68% of nurses had abdominal obesity. These findings show that abdominal obesity is on the rise when compared to the previous years.

Body fat percentage is the total mass of fat divided by total body mass, multiplied by a hundred (Gallagher *et al.,* 2000). The body fat percentage is a measure of fitness level because is the only body measurement that calculates a person's relative body composition directly, without regard to weight or height (Kelly, 2019). The lower the body fat percentage, the higher percentage of lean muscle mass in the body frame (Rawal *et al*., 2018). Some "overweight" people are healthy, while others with "normal weight" are unhealthy (Han *et al*., 2017). However, body fat percentage tells what weight is comprised of, specifically, the percent of total body weight that is fat (Rawal *et al*., 2018). Body fat percentage is measured by a scale with bio electric impedance method, where participants stood upright barefooted on the bio-electric impedance equipment. Bioelectrical impedance method of analysis enables a rapid,

low cost and safe assessment of body fat percentage, it is very simple and quick to perform (Elia, 2013). Disadvantages of bioelectrical impedance are poor precision and the fact that validity and reliability can be affected by many factors, including sex, age, height, disease state, and race (Lee & Niemand, 2013:343). Its limitation is that the equipment can be expesive (Elia, 2013).

It is important to use the table below alongside BMI even if the weight is classified as normal. Table 2.3 below illustrates total body fat percentage classification as per gender and age.

Table 2.3 Body fat percentage classification

Interpretation of body fat percentage	**Age (years)**					
	18 – 39		**40 – 59**		**60 – 99**	
	Male	Female	Male	Female	Male	Female
Under fat (%)	0 – 8	0 – 21	0 – 11	0 – 23	0 – 13	0 – 24
Healthy (%)	8 – 20	21 – 33	11 – 22	23 – 34	13 – 25	24 – 36
Over fat (%)	20 – 25	33 – 39	22 – 28	34 – 40	25 – 30	36 – 40
Obese (%)	≥ 25	≥ 39	≥ 28	≥ 40	≥ 20	≥ 40

Source: Gallagher et al., (2000)

The range of body fat (that is, essential fat plus storage fat) is associated with optimal health, 8% to 24% in males and 21% to 35% in females (Mahan & Raymond 2017:561). Body fat percentage gives more accurate results as compared to BMI. For example, if persons have higher muscle mass, they will have high BMIs and be classified as overweight and obese, wherein, according to body fat percentage, they are healthy with minimal body fat (Krabbe, 2017). Similar to high BMI, the above-average body fat percentage increases the risk of heart diseases and other chronic conditions. Health care workers should be role models who increase community awareness of obesity prevention and encourage patients to change their behaviour towards a healthy lifestyle, despite working in an environment related to disease prevention and health promotion.

The HCWs in several studies have shown a trend towards obesity over time and to have higher levels of obesity than the general population (Kunyahamu *et al*., 2021). Obesity status affect biochemical status, as biochemical and anthropometry status determine health status.

2.2.2 Biochemical status

Biochemical parameters represent better, precise, and objective tools for the assessment of the health status in comparison to anthropometric, clinical, and dietary methods. In general, they constitute laboratory tests to estimate the concentration of circulating nutrients in body fluids (Gupta, 2020). Biochemical parameters are suggestive of acute or subclinical conditions

when other methods of nutritional assessment fail to interpret the condition (Gupta, 2020). Biochemical measurements such as blood glucose and lipid panel are used to assess the health status of an individual, and poor health status is a biomarker of various chronic diseases (Lee *et al.,* 2019). Biochemical measurements are used to identify metabolic syndrome and to estimate health status in its severity. In the current study, biochemical parameters that are described are, namely: blood glucose, total cholesterol, triglycerides, LDL and HDL.

2.2.2.1 Blood glucose

Blood sugar refers to glucose which is the most widely distributed sugar in nature, usually a component of disaccharides or polysaccharides (Mahan & Escott-Stump, 2012:43). Normal blood glucose level is 3.3 mmol/l to 6.4 mmol/l, while high blood glucose level is 6.5 mmol/l and above (Lee & Nieman, 2010:339). A random glucose test is a quick test used to perform glucose test, the person does not need to fast beforehand and the test requires a small blood sample using a needle, often from the finger (Barrel & Rhee, 2022). In random blood glucose test, normal result depends on when the person last ate. Most of the time, the blood glucose level will be 6.9 mmol/l or lower. To help confirm the diagnosis, a different type of test, such as a fasting glucose test or an oral glucose tolerance test (OGTT) can be used (Lee & Niemand, 2013:322).

High blood glucose consistently serve as a contributing factor in participants developing diabetes mellitus (Mahan & Escott-Stump, 2012:775), which is the primary cause of renal failure, blindness, amputations as well as birth defects (Granada, *et al.,* 2014). It is important to also note that the brain is highly dependent on the regular predictable supply of glucose (Barrell & Rhee, 2022). The prevalence of diabetes mellitus is soaring globally, fuelled by obesity (Dooley & Chaisson, 2011) because higher BMI relates to the increased rate of type 2 diabetes development (WHO, 2016). WHO (2011) indicated that globally, diabetes increases with overall abdominal fat gain and obesity development. The prevalence of diabetes in adults worldwide was estimated to be 4.0% in 1995 and is expected to rise to 5.4% by the year 2025 (WHO, 2016). In addition, WHO (2016) indicated that the prevalence of diabetes is higher in developed countries as compared to developing countries. However, a major numerical increase is observed in both developed and developing countries (WHO, 2016). WHO (2016) estimated 42% increase, from 51 to 72 million, in the developed countries and a 170% increase, from 84 to 228 million, in the developing countries. WHO (2021) recently estimated that more than 75% of people living with diabetes will be residing in developing countries by the year 2025 as compared with 62% in 1995.

Furthermore, WHO (2021) estimated that in 2025, countries with the largest number of people with diabetes are India, China and USA. Menke *et al*., (2015) earlier estimated diabetes prevalence among USA adults to have increased from 5.3% in the year 1976-1980 up to 11.5% in the year 2011-2014. International diabetes federation (2019) indicated that the prevalence of diabetes varies in different countries across the globe. It is reported that the prevalence of diabetes ranges from 5.6% in the UK to 22% in Kuwait and India (International diabetes federation, 2019). On the other hand, Gregg (2004) earlier indicated that the prevalence of diabetes varies substantially by sociodemographic variables and weight status. The prevalence of diabetes in Kenya was higher among women (at 16.35%) compared to that among men (at 13.95%) and significantly increases with advancing age, to the overall diabetes prevalence of 15.4% (Christensen *et al*., 2009). Werfalli (2018) reported that the prevalence of diabetes increased with age in South Africa ranging from 7.1% amongst 50 to 59 years old, to 12.4% amongst 70 years and older. In addition, the self-reported prevalence of diabetes was 9.2% in South Africa (Werfalli, 2018).

2.2.2.2. Triglycerides

Triglycerides (TG) are lipids consisting of three fatty acid chains esterified to glycerol phosphate molecule, and more than 95% of lipids in the food supply are in the triglyceride storage form (Mahan & Escott-Stump, 2012:42, 55). The level of serum triglyceride in the body is indicated in Table 2.4 below, which shows that 1.69 mmol/L and less is a normal triglyceride and ≥ 5.64 mmol/L is very high.

Table 2.4: Triglyceride classification

Serum TG	Classification (mmol/l)
Normal	1.69 and less
Borderline-high	1.7 – 2.25
High	2.26 – 5.63
Very high	≥ 5.64

Source: Lee & Nieman (2010:339)

Serum TG is a risk factor for coronary heart diseases (Lee & Niemand, 2010:339). Triglycerides are independent predictors of cardiac artery diseases (CAD) and tend to be eliminated by HDL cholesterol (Patsch *et al*., 2019). Triglycerides can also raise heart disease risk. Adipocytes and adipose tissue store the greatest amount of body lipids, including triglycerides and free cholesterol, resulting in abnormal levels of circulating lipids (Bays *et al.,* 2013).

2.2.2.3 High-density lipoprotein

High-density lipoproteins are particles that contain more protein when compared to some lipoproteins and are an anti-inflammatory, antioxidant protein that helps to remove cholesterol from the arterial wall to the liver (Mahan & Escott-Stump, 2012:389). High-density lipoprotein is measured in mmol/l and its classification per gender is indicated in Table 2.5.

Table 2.5: HDL-C classification

Interpretation	HDL classification (mmol/l)		Risk of metabolic syndrome and CHD
	Men	Women	
Desirable	More than 1.0	More than 1.2	Lower risk
Non-desirable	Less than 1.0	Less than 1.2	Higher risk
More desirable	1.2 – 1.9	1.2 – 1.9	Moderate to low risk

Sources: Reiner et al. (2016); Mtyintyane et al. (2007)

High-density lipoprotein has athero-protective properties and its deficiency is marked as a coronary risk factor that inhibits the inflammation associated with atherosclerotic plaque development (Rudd *et al*., 2012). Abnormalities in HDL cholesterol are widely prevalent in the United States of America as well as Europe and are one of the defining features of metabolic syndrome (Danaei *et al*., 2014). The HDL-C of >1.0 mmol/l in men and >1.2 1.0 mmol/l in women, as well as TG of <1.7 mmol/L indicate a lower risk of metabolic syndrome (Klug *et al.*, 2018).

2.2.2.4. Total cholesterol

Total cholesterol "is a fat-like substance which is positively associated with ischaemic stroke and is found in the bloodstream, bodily organs and nerve fibres" (WHO, 2015). Total cholesterol is measured in mmol/l where less than 4.5mmol/L is desirable and more than 4.5 mmol/l is non-desirable (Table 2.6).

Table 2.6: Total cholesterol classification

Total cholesterol interpretation	Classification TC (mmol/l)
Desirable	Less than 4.5
Borderline	4.5
Non-desirable	More than 4.5

Sources: Reiner Z et al. 2016; Mtyintyane et al. (2007)

Elevated levels of cholesterol increase the risk for coronary heart disease (CHD). Cholesterol is measured to help assess the patient's risk status and to follow the progress of the patient's treatment to lower serum cholesterol concentrations (Vidigal *et al*., 2015).

2.2.2.5 Low-density lipoprotein

Low-density lipoprotein is the primary cholesterol carrier in the blood and is formed by the breakdown of very LDL (Mahan & Escott-Stump, 2012:838). LDL is artherogenic because they activate platelets and the coagulation cascade and lead to clot formation (Mahan & Escott-Stump, 2012:838-9). The LDL is measured by mmol/L as indicated in Table 2.7 below.

Table 2.7: LDL cholesterol classification

Interpretation	Classification LDL (mmol/l)
Normal range	Less than 1.8
Border line	1.8
Higher range	Above 1.8

Sources: Reiner Z et al., (2016); Mtyintyane et al., (2007)

The LDL-C increases per 1% in addition of energy coming from saturated fats in the form of saturated fatty acids, they are dietary fats with the higher impact on LDL cholesterol (0.02 - 0.04 mmol/L) (Mahan & Escott-Stump, 2012:838). Saturated fat increases both LDL-C and HDL-C levels, the TC/HDL-C ratio will not be greatly affected despite an adverse change in LDL-C (Klug *et al*., 2018).

2.2.3 Clinical status

Clinical outcomes are measurable changes in health, function or quality of life that result from care (Seedat *et al*., 2014). Clinical outcome is an important method for assessing the level of health in a person, assessed from measurements of Blood Pressure (BP) (Lee *et al*., 2019). The clinical parameter measuring clinical status in the current study is systolic and diastolic blood pressure and is used to measure the health status of HCWs.

High blood pressure or hypertension is elevated blood pressure, characterized by an elevated BP measured on three separate occasions, a minimum of two days apart (Klug *et al.,* 2012). Hypertension is a major risk factor and antecedent of cardiovascular and organ damage (myocardial infarction, chronic kidney disease, ischaemic and haemorrhagic stroke, heart failure and premature death) (Anderson *et al.,* 2016; WHO, 2013). Complications of untreated hypertension include stroke, renal failure, vision impairment, heart failure, erectile dysfunction and heart attack (WHO, 2014). Table 2.8 shows how BP is measured and classified, where normal BP is <120(mmHg) systolic and <80(mmHg) diastolic; high BP is systolic of 140(mmHg) and above with diastolic of 90(mmHg) and above (Table 2.8).

Table 2.8 Classification of BP

Stages	Systolic BP(mmHg)	Diastolic BP (mmHg)
Normal	< 120	< 80
Optimal	120 – 129	80 – 84
High normal	130 – 139	85 – 89
High	140 and above	90 and

Source: Seedat et al. (2014)

Hypertension remains a global public health challenge and an estimated 26% of adults worldwide have hypertension (Geaney *et al.,* 2015). Hypertension is the main cause of premature death worldwide, estimated 1.13 billion people worldwide have hypertension, two-thirds of them living in low and middle-income countries (WHO, 2021). Arterial hypertension is the main risk factor of cardiovascular diseases causing about 7.5 million deaths per year (Malta & Bernal, 2011). In the period 2012 to 2013, 34% of Australians aged 18 years and above was hypertensive, of which their BP was greater than 140/90 mmHg, and 68% of them had uncontrolled or untreated hypertension (Weber *et al*., 2016). The prevalence of hypertension differs from country to country. Similar statistics between male and female where observed in an Indian study, were rural India had lower prevalence of hypertension: 3.4% among men and 6.8% among women (Ali & Al-Asadi, 2009). Higher statistics were reported in Poland, where hypertension was at 68.9% among men and 72.5% among women (Ali & Al-Asadi, 2009). Different statistics was found in a study which was conducted among female teachers in Barash, Iraq where the prevalence of hypertension was at 21.3% (Ali *et al*., 2009). A study conducted among university staff in Zambia showed the prevalence of hypertension to be 40% (Mulenga & Siziya, 2013). Similarities where observed in Romania, the prevalence of hypertension among medical staff was 30% of which 51.1% were aware that they have hypertension and physicians had the highest prevalence of hypertension (Giurgiu *et al.,* 2013). Furthermore, in Malaysia, the prevalence of hypertension within university academic staff was indicated to be 34.4% and 33.9% were on the stage of prehypertension (Rampal *et al.,* 2011).

In SA, 12.5% of men and 17.9% of women are hypertensive and the prevalence is higher among White men (35.8%) and Indian women (29.1%) (Puoane *et al.,* 2010). Skaal and Pengpid (2011) confirm the observation by indicating that one-third of South African HCWs suffer from NCDs and stress. Hypertension is primarily responsible for 13% of deaths associated with cardiovascular diseases (CVD), 62% of strokes and 49% of Ischaemic heart disease (Geaney *et al.,* 2015). Different statistics where observed in a household study conducted in 2011 in SA which indicated the prevalence of hypertension per province was 22.3% in Northern Cape; 18.7% in North West; 18.5% in Free State; 16.6% in the Western Cape; 15.9% in the Eastern Cape; 12.8% in Gauteng; 12.3% in Mpumalanga; 11.3% in

Kwazulu Natal and the lowest 9% in the Limpopo province (Statistics South Africa, 2011). Higher statistics was observed in adults from rural communities in Limpopo province, were community-based cross-sectional study indicated the prevalence of hypertension to be 41% (Ntuli *et al*., 2015).

Lee and Niemand (2010:282) show that there is a relationship between sodium intake and the risk of hypertension. Less sodium intake reduces the risk of hypertension and improves its management (Geaney *et al*., 2015). The world health organization (WHO, 2021) advises an individual's salt intake should not exceed 5g of salt (2g of sodium) per day. The current daily salt consumption in most European countries is estimated to be between 8 to 12 grams per day, with few member states above and below this intake level. The department of health is a step closer to achieving a reduction of salt intake among South Africans as they implemented a regulation of salt reduction in which five grams is recommended per day (van Rooy & Coopoo, 2017).

2.2.4 Metabolic syndrome

Metabolic syndrome is a public health burden due to its increased prevalence partially explained by the aging population and lifestyle factors such as diet (Fabiani *et al.,* 2019). WHO (2010) defines metabolic syndrome as “a subject with increased cardiovascular morbidity and mortality”. Metabolic syndrome is a cluster of the most dangerous risk factors associated with a heart attack (Unwin *et al.,* 2010). Metabolic syndrome is a state and a cluster of interrelated factors including abdominal obesity, insulin resistance, dysglycemia, hypertension, dyslipidemia triglycerides (TG) and HDL cholesterol (Pérez-Martínez *et al.,* 2017). Metabolic syndrome is diagnosed using three or more of the following criteria: waist circumference (WC), HDL-C, triglycerides, BP and fasting glucose (Fabiani *et al*., 2019).

The etiological categories of metabolic syndrome include obesity, disorders of adipose tissue, and insulin resistance (Grundy, 2012). Hyper-triglyceridaemia is a major component of metabolic syndrome (NDoH, 2013). Song *et al.* (2016) indicated that low HDL and high TG increase the risk of diabetes. Adeoye *et al.* (2015) indicated that participants who had metabolic syndrome were older and had higher BMI, mean systolic BP, and fasting plasma glucose which was above normal. Furthermore, aging is associated with the development of insulin resistance, hormonal alterations, and an increase in visceral adipose tissue.

Metabolic syndrome is linked to the higher rates of cardiovascular diseases and death rates (Adeoye *et al*., 2015). Findings suggest that approximately 20-25% of the world population are suffering from metabolic syndrome, mainly because it is a disorder of energy use and

storage (WHO, 2016). Individuals with metabolic syndrome are at higher risk to develop CVD, stroke and disease related to fat deposition in artery walls (Klag *et al*., 2018). Possible complications include heart attack, kidney failure, leg amputation, vision loss and nerve damage (Steyn *et al*., 2016).

Worldwide, the prevalence of metabolic syndrome varies from 13.6% to 46%, depending on the diagnostic criteria used and the population (WHO, 2016). This is very common, around one in four adults in the UK are thought to have metabolic syndrome (Grundy, 2016). According to the national health and nutrition examination survey (NHANES, 2014), the prevalence of metabolic syndrome among the USA adults aged 18 years or older, rose by more than 35% from 1988-1994 to 2007-2012, increasing from 25.3% to 34.2%. In addition, nearly 40% of people over age 60 years meet the criteria of having metabolic syndrome (NHANES, 2014). A systematic review by Vidigal *et al.* (2015) revealed that the metabolic syndrome of the adult population in Brazil ranged between 4.9% and 65.3% which is similar to Nigeria's prevalence that ranges between 12.1% and 54.3% (Adeoye *et al.,* 2015). The prevalence of metabolic syndrome among health employees in the Littoral region of Cameroon was reported to be 19% (Tachang *et al.,* 2012). Those findings differ with observation by Shafei *et al*., (2011) who indicated that 33% of nurses working in academic hospitals was suffering from metabolic syndrome. Similar statistics to Shafei *et al*.'s (2011) findings is that a total of 34.9% of participants in Sanchez-Villegas and Sanchez-Tainta had metabolic syndrome, and most of those were men than women (Rubinsztajn *et al*., 2017). Higher statistics were observed by Watz *et al*. (2010) and Manglano *et al*. (2014) who found that 50% and 42.9% of both male and female participants in the Western Cape metropole, South Africa, had metabolic syndrome, respectively.

2.3. Nutritional practices

Nutritional practices are the act of living and eating which impact nutritional status and health status, determined by dietary patterns and lifestyle habits in the current study. Nutritional practices are activities of individuals that affect nutritional status (WHO, 2016). Traditional nutrition concerns in Sub-Saharan Africa (SSA) have centred on hunger and underweight, however, economic development and urbanization have shifted traditional food patterns (Holmes *et al*., 2017). Food guide and guidelines that encourage healthy eating patterns and that serves as the basis to help people in making healthy food choices, choosing adequate portion sizes that provide adequate energy and essential nutrients for the body to function well and to prevent short and long-term illnesses (Parker *et al*., 2012).

2.3.1 Dietary patterns

Dietary patterns represent a typical habitual diet and dietary habits that are characterized by specific foods or food groups (Weichselbaum, 2013), including daily consumption and the proportion of daily vegetables being higher among male employees who ate at the canteen (Raulio, 2011). The dietary reference intake (DRI) is a system of nutrition recommendations introduced in 1997 to broaden the existing guidelines known as recommended dietary allowances (RDAs). Recommended dietary allowances are also used as the levels of intake of essential nutrients that are judged by the food and nutrition board to be adequate to meet the known nutrient needs of practically all healthy persons, while the NRV is an abbreviation of 'nutrient reference value', set for 13 vitamins and 14 minerals for food labelling and guidance levels on the daily amount of vitamin or mineral that the average healthy person needs to prevent deficiency (National research council, 1989).

The above recommendations i.e., (DRIs/DRAs and NRVs) promote best practices for adult eating, which are eating more fibre, fruits and vegetables, eating breakfast, reducing daily caloric intake, engaging in moderate physical activity and getting adequate sleep (Kerklaan & Fivez, 2015). The food-based dietary guidelines (FBDGs) became part of the food and agriculture organization (FAO) and WHO strategy to promote appropriate diets through recommendations of optimal dietary patterns (Voster, 2008). Nutritional guidelines provide advice that enables people to lead longer, healthier and more independent lives (Fabiani *et al*., 2019).

Dietary patterns are derived statistically as a way to identify the overall dietary habits of the populations (Erika *et al*., 2016). Schulze *et al.* (2018) defined dietary patterns as quantities, proportions, variety or combinations of different foods and beverages in diets, and the frequency with which they are habitually consumed. Each country has their dietary patterns around the world, of which some are beneficial to health, while others increase the risk of diseases of the lifestyle (Chew *et al.,* 2016).

Dietary patterns are also used to study the relationships between diet and diseases by examining the effects of the overall diet of the population instead of focusing on individual foods or nutrients (Martins *et al.,* 2011). Proper dietary patterns maintain the health of the body and mind, prevent diseases, helps in the development of the body, and take important roles in maintaining mental and emotional stability (Mpofu, 2015). Distinct patterns give an accurate representation of what people eat and their complete diets in relation to NCD (Green *et al.,* 2016).

Evaluating trends in global dietary patterns indicate the highest score for healthy foods in low-income countries, as well as few mediterranean ones (La Vecchia & Serra-Majem, 2015). Whereas the low scores for healthy foods indices are in central European countries, which reflects favourable scores for a few unhealthy, concentrated in low-income African and Asian countries (Holmes, 2018).

Australia has a total of eight dietary patterns which are guidelines for the country. All of those promote regular consumption of whole grains/cereals and both fruits and vegetables (Chew *et al*., 2016). From the eight Australian dietary patterns, seven include regular consumption of legumes (including soy); four include frequent consumption of nuts and five include regular consumption of fish, low consumption of red meat and meat products; while three dietary patterns promote regular consumption of poultry, five encourages regular/moderate consumption of low-fat dairy and drinking more water or other fluids to stay hydrated (Chew *et al.,* 2016).

Asia adherence to the guideline focuses on promoting a "western" pattern (Fabiani *et al.,* 2019). Swedish guidelines focus on promoting a healthy pattern that includes consumption of vegetables, fruits, fish and seafood, vegetable oils and negatively on refined bread and fast foods (Erika, 2016). Traditional patterns of Sweden do not promote whole foods: they are loaded with potatoes, meat and processed meat, full-fat milk products, sweet bakery products, sweet condiments and margarine (Erika, 2016). Green *et al.* (2016) indicated that there are two dietary patterns in India of which one promote healthy eating of fruits, vegetables, pulses and cereals, while the unhealthy dietary patterns are composed of high fatty and sugary foods as well as meat.

In South Africa, FBDGs are used to encourage the general population to consume locally produced food and to promote a healthy optimal diet (Vorster *et al.,* 2013). Healthy eating is the result of the overall diet pattern of food consumption (Green, 2015). Healthy and unhealthy eating patterns are characterised by a wide variety of plant-based foods and by excess consumption of sugary, fatty and processed foods, as well as traditional alcohol, respectively (Judd *et al.,* 2017). South Africans are encouraged to consume vegetables, fruits, whole grains, legumes, nuts, low-fat dairy products and seafood, and limit the intake of sodium, saturated fat, refined grains and sugar-sweetened foods and beverages, as well as low intake of red and processed meats (Rodgers, 2015).

Unhealthy eating is responsible for 16% of the total burden of disease worldwide and is associated with excessive intake of energy-dense foods, saturated fat, and added refined

sugar or salt (Pezdric *et al.,* 2015). Low consumption of fruit and vegetables is within the top 10 risk factors that lead to certain diseases which result in mortality (WHO, 2014). Appropriate dietary patterns that are characterised by the consumption of adequate fruit, vegetables and high fibre foods protects against obesity, hypertension, cardiovascular disease, and diabetes (van Rooy & Coopoo, 2017). The consumption of vegetables, fruits, wholegrains, fish and low-fat dairy products is associated with a decreased risk of non-communicable diseases (Mertens *et al*., 2017).

Health care workers are categorized as adult population. Sondik (2010) indicated that 75% of adult Americans do not eat enough fruits, more than half of people (at 56%) do not eat enough vegetables, and 64% of the population consumes too much saturated fat. In Australia, only 5.5% of adult population meet guidelines which are; two servings of fruit and five servings of vegetables, with 18-34 years old people less likely to meet the recommendations by 3.4% (Sondik, 2010). According to Mahan and Raymond (2015), 31% of adults in the United Kingdom meet the daily recommendation of five fruits and vegetable intake, while 2.2% of men and 3.5% of women in the United States eat enough fruit and vegetables (i.e., four servings). The dietary pattern of most South Africans consists of less fruits and vegetables with high fat and high sugar-containing foods (National department of health (NDoH), 2015).

Recognition of the role of diet in health and diseases has led to numerous efforts to promote health while preventing diseases (Lee & Nieman, 2010:14). Eating patterns and habits of South Africans are determined by traditions and customs, trends, availability of foods and to some extent the preference (Vorster *et al.,* 2013). The rapid growth of the fast-food industry during the last decade has added a dimension to change in food consumption patterns (Noor, 2014). Dalais *et al*. (2014) reported patterns of overeating (at 41%), poor eating habits (at 39%), eating the wrong foods and/or not eating breakfast (at 48%) on South African HCWs. A typical South African diet is urbanized and atherogenic with regard to the distribution of fat and carbohydrate intake, while the consumption of dairy products, fruit and vegetables remains low (Steyn *et al*., 2016).

Worldwide socio-economic status is associated with unhealthy dietary patterns (Mayen *et al.*, 2016). According to Kuczmarski *et al*. (2018), people with no and low educational levels and limited income are more likely to consume a western diet. Poor dietary intake is one of the most important risk factors for preventable diseases and premature mortality (Pezdirc *et al*., 2015). Yahia *et al.* (2016) indicated that intake of saturated fat, trans-fat, and cholesterol is associated with an increased risk of Coronary Heart Disease.

Dietary change is advocated for the prevention and treatment of NCDs, and HCWs play an important role in promoting diet change to prevent NCDs (Vorster et al., 2013). Appropriate dietary changes, such as replacing 1% of dietary saturated fats with 0.5% monounsaturated fats and 0.5% polyunsaturated fats, result in significant lowering of cholesterol levels by 0.06 mmol/l, BP and heart disease-related deaths (WHO, 2013).

The study conducted in the Western Cape province of SA shows that nurses often eat fast food because they do not have time to prepare meals due to long working hours and tiredness (Phiri *et al.,* 2014). Van Rooy and Coopoo (2017) reported that 28% and 29% of the population eat meals away from home on a weekly and monthly basis, respectively. The later habits result in increased consumption of salt that contributes to a high prevalence of hypertension in the country. The NDoH recommends that salt intake of the South African population should be less than five grams per day (Swanepoel *et al.,* 2016), as one of the interventions to reduce the prevalence of hypertension (Mthuli, 2016).

Employees who ate at a worksite canteen consumed more vegetables and fish dishes at lunch than those who ate packed lunches from home (Raulio, 2011). Food-service units that offer predominantly unhealthy foods had a negative effect on the health of HCWs (Phiri *et al.,* 2014). Food intake is important not only in terms of the energy content of ingested food but also in terms of the quality of the diet (Calella *et al.,* 2017). During working days, women eat lunch from canteens/restaurants (Raulio et al., 2011), and these habits widely affect their health status.

2.3.2 Lifestyle habits

Healthy lifestyle habits are a way of living that lowers the risk of being seriously ill or dying early (NDoH, 2015). The recommended healthy lifestyle habits of the population include physical activity, healthy diet, non-smoking and moderate alcohol use (Malm, 2017). The two most important behavioural or lifestyle aspects of metabolic syndrome risk is diet and physical activity (Dalais *et al.,* 2014). An unhealthy diet, physical inactivity, tobacco use and excessive alcohol consumption are the behavioural risk factors that contribute to the development of metabolic syndrome (Maimela *et al*., 2016).

Lifestyle habits are measured using the Lifestyle Index table (Table 2.9) as referred to in Potchefstroom university manual and Sangala, (2006). The Lifestyle Index table has seven points that participants had to respond to with a yes or no. If the responses show seven yes is an indication that the participant has a very good lifestyle and one yes indicates a very bad lifestyle habit. Those points include maintaining normal body weight, eating breakfast,

engaging in moderate physical activity two to three times a week, getting adequate sleep seven to eight hours a day, eating three times a day, not smoking and not drinking excessive alcohol.

Table 2.9 Lifestyle index table

Scoring	Interpretation	Points of lifestyle habits
7	Very good	Following a healthy lifestyle, keep it up
5 – 6	Good	Not bad at all, but keep a close eye on self
4	Fair	Evaluate lifestyle seriously. It is important to consider some positive changes
2 – 3	Bad	Lifestyle is detrimental to health. It is important to commit self to self to serious changes
1	Very bad	Destructive lifestyle may pose serious health problems in life. Self and company will benefit by serious commitment to a healthy lifestyle.

Source: Sangala (2006)

Good lifestyle habits are lifestyles of a particular person or group of people: the living conditions, behaviour and habits that are typical of them or are chosen by them. Lifestyle has been defined in three different forms, which include the way of life by people, families and societies; set of behaviours presented by people, families and societies in different situations such as physical, social, psychological and economic; as well as a branch of habits that includes social fundamentals (Farhud, 2017). Lifestyle can be detrimental to health and healthy lifestyle is the mainstay of preventive medicine of which its relationship to health status has been proven to be certain for years (ALAteeq & ALArawi, 2014). Van den Berg (2013) identified lifestyle as the modifiable risk factor for metabolic syndrome and many NCDs, including obesity, atherosclerosis, coronary heart disease, hypertension, diabetes and cancer.

A healthy lifestyle helps to keep and improve people's health and well-being (Malm, 2017). Many governments and non-governmental organizations work at promoting healthy lifestyles because of the benefits, with critical health numbers, including weight, blood sugar, BP and blood cholesterol. Healthy living is a lifelong effect and being healthy includes healthy eating, physical activities, weight management, and stress management (Kilani *et al*., 2013). Good health allows people to do many things that include mental and physical activities.

A healthy lifestyle also incorporates a balanced diet, not cutting out important food groups of the diet or limiting self on the amount of calories per day. A well-rounded diet involves employing mostly all of the food groups in every meal. Meats, dairy, fruits and vegetables are all important components of a meal that will ensure the body is full while still staying healthy (Schulze *et al*., 2018).

Nutrition-related lifestyle choices are the framework for health and wellness (Mahan and Escott-Stump, 2012:227). Unhealthy foods in the health care environment have a negative influence on the lifestyle behaviours of HCWs (Phiri *et al*., 2014). Foods such as red and processed meat; sugar-sweetened foods and drinks; and fried foods were generally associated with an increased risk of unhealthy lifestyle (Mertens *et al.,* 2017), and skipping breakfast is the other unhealthy lifestyle habit in public health (Judd *et al.,* 2017).

Globally, the prevalence of physical inactivity is increasing, with approximately 3.2 million people being inactive resulting in a 20% to 30% mortality rate caused by NCDs and an increased rate of overweight among people aged 18 years and above (WHO, 2016). When comparing male and female HCWs; males have better lifestyle parameters because only 20% are physically inactive as compared to female counterparts (at 27%) (WHO, 2016). An inactive lifestyle is the risk for health problems, and it is stated that everyone should participate in a moderate amount of physical activity which is 15 minutes of running, 30 minutes of brisk walking, 45 minutes of playing volleyball on most days of the week (Mahan & Escott-Stump, 2012: 273). Regular physical activities reduce the risk of metabolic syndrome besides weight control (Malta & Bernal, 2011).

Alcohol is a psychoactive substance with dependence-producing properties that has been widely used in many cultures for centuries (WHO, 2014). Alcohol consumption has numerous biological and social determinants with important health-related consequences such as obesity and liver diseases (Rosenquist *et al.,* 2010). Excessive use of alcohol causes diseases, social and economic burdens in societies and is the leading risk factor for death in males aged 15 to 59 years (WHO, 2014). Alcohol remains a major cause of liver disease worldwide (O'Shea *et al*., 2016). The global death of 5.9% is attributable to alcohol consumption and approximately 3.8% die each year from the harmful use of alcohol (WHO, 2014). More than half of these deaths occur from metabolic syndrome risk factors and liver cirrhosis (WHO, 2010).
There is no significant difference between HCWs and non-medically trained participants in patterns for drinking alcohol (Fryhofer, 2016). Approximately two-thirds of adults drink some alcohol; with the majority drinking small or moderate amounts, and do so without evidence of clinical disease (O'Shea *et al.,* 2016). Women are more vulnerable to alcohol-related harm considering their level of alcohol use and drinking pattern, which are lesser than those of men (WHO, 2014).

Smoking is the most common cause of chronic obstructive pulmonary diseases which are preventable illnesses, and risks for acute bronchitis are much higher in smokers than non-

smokers (Escott-Stump, 2015:312). Globally, almost six million people die from tobacco use each year, both from direct tobacco use and second-hand smoke, those deaths are expected to increase to 7.5 million by 2020 (WHO, 2015). Smoking causes 71% of lung cancer, 42% of chronic respiratory disease and nearly 10% of Cardiovascular Disease (WHO, 2015). Approximately 440.000 Americans die each year accordingly and in the United Kingdom (UK), approximately 80% of all deaths emanate from lung cancer, bronchitis, emphysema and heart disease due to smoking (Action on smoking and health (ASH), 2016).

All forms of tobacco use, including different types of smoking and chewing tobacco and inhalation should be discouraged to prevent metabolic syndrome and CVDs (Gehani *et al*., 2012). The prevalence of smoking in HCWs was 8.4%, impacting on obesity and premature mortality due to failure to control smoking which causes inappropriate control for associated conditions such as hypertension, dyslipidaemia and hyperglycaemia (ALAteeq & ALArawi, 2014).

2.4. Nutritional knowledge

Good nutrition knowledge is an important aspect of maintaining a balanced and healthy diet (Calella *et al.,* 2017). The medical and nursing curriculum lacks adequate practical nutrition training to fit the clinical reality that health workers face in their practices and such deficit creates health workers with poor nutrition knowledge (Sunguya *et al.,* 2013). Fundamental knowledge about nutrition and lifestyle habits contribute tremendously to an individual's level of wellness, including the enhancement of health and vitality (van Rooy & Coopoo, 2017). Health and nutrition is important and critical components of basic needs in developing countries (WHO, 2016). Lack of nutritional knowledge and confidence are significant barriers that prevent HCWs from offering dietary support (van den Berg *et al.,* 2015). The latter further indicated that good knowledge of eating habits and a healthy lifestyle does not motivate health care professionals to practise what they preach. Health care workers give advice based on their knowledge and life practices (Van den Berg *et al.,* 2015).

All HCWs should be knowledgeable and competent in nutrition as it applies to health promotion, management and treatment of diseases (Munuo *et al.,* 2016). Furthermore, HCWs need to be equipped to deal with the increasing obesity and obesity-related morbidity occurring in developing countries (Van den Berg *et al.,* 2015). Yalcin *et al.* (2013) and Crogan (2011) indicated that nutrition knowledge is not increased by long-term clinical experience among nurses. Health care workers have physical and psychological influences on health outcomes, especially on treatment and management of chronic disease risk factors and consumption patterns (Jorn-Hon, 2006).

Nutrition knowledge among HCWs is influenced by cultural norms and beliefs (van Rooy & Coopoo, 2017). Financial status and education level do not affect nutritional knowledge (Shisana *et al*., 2013). According to Parker *et al*. (2010), the cause of insufficient nutrition knowledge amongst HCWs is low interest in nutrition.

Munuo *et al.* (2016) and Mowe *et al.* (2012) reported that insufficient knowledge is the most common cause of inadequate nutritional practice. The study conducted among HCWs at the Groote Schuur Hospital in Cape Town revealed that 3% of the respondents had adequate and 31% had inadequate nutrition knowledge, and they often experience difficulty in translating their limited knowledge into practice (Parker *et al.,* 2010).

Good nutrition knowledge has a positive effect on eating habits and food selection (Nti *et al.,* 2015). In the study conducted by Laz *et al*. (2015), higher scores of nutrition knowledge among health professionals were considerably associated with healthy eating behaviours, such as eating smaller quantities, substituting high-calorie foods to lower-calorie foods, exercising, eating more fruits, vegetables and consuming less sugar. Yahia *et al.* (2016) indicated that HCWs with greater nutritional knowledge consume less unhealthy fats and cholesterol.

2.5. Summary of literature review

Obesity has become a significant public-health threat with prevalence increasing worldwide. Obesity among HCWs is an important issue as it can affect both their health condition and their professional capability, attributing to occupational factors. Health care workers are not immune to overweight, obesity and lifestyle habits that promote weight gain. Biochemical data (viz., blood glucose and blood lipids; cholesterol, triglycerides) and clinical parameters, especially BP, play a major role in determining the health status of participants. Lipid abnormalities are the main factor that shows the relationship between diet and diseases, mainly cardio-vascular diseases.

Worldwide, poor diet quality is a key reason for mortality and disability, while the risk for overweight and NCDs, which have been identified as a global priority, also increases (Betancourt-Nuñez *et al.,* 2018). Dietary patterns enable the combination of foods that make up a person's habitual diet to be known. For now, little is known about the dietary patterns of Health care workers. A nutrition transition associated with the frequent intake of processed, sugary and high-fat foods is categorized as unhealthy dietary practices which lead to an increased risk of obesity and poor health outcomes (Rothmana *et al.,* 2019).

The WHO (2014) agreed on global targets to reduce the harmful use of substances such as alcohol and tobacco due to their effect on the health status of the population. Fast-food consumption and skipping breakfast as well as smoking results in fatigue and suboptimal concentration levels, and also increased the risk of developing obesity (Seedat & Pillay, 2018). The South African FBDGs promote healthy eating and good lifestyle habits that prevent diseases.

The South African national health and nutrition examination survey (SANHANES-1) of 2012 also found the there prevalence of overweight and obesity amongst South African adults. A sedentary lifestyle, poor diet, being overweight and obese increases the risk of metabolic syndrome. The risk factors of metabolic syndrome, dietary patterns, lifestyle and obesity are the leading cause of NCDs. To halt the rise of obesity, metabolic syndrome and NCDs, it is imperative to scale-up population-level prevention.

Good and outstanding nutritional knowledge is the modifiable determinant of dietary behaviours that influence and improve nutritional practices. However, having nutritional knowledge does not always guarantee healthy nutritional practices or ensure that individuals will engage in healthy behaviours. There are also studies that showed no association between knowledge and practices. Further research should be done to assess the relationship between nutrition knowledge and health status.

CHAPTER 3
METHODOLOGY

3.1 Overview

This chapter covers the methodology implemented to conduct the research study. Discussions include focus on the study design; population and study area; sampling; inclusion and exclusion criteria; subject recruitment; measurements and techniques; data collection; selection of field workers; pilot study and pre-testing; validity and reliability; statistical analysis; institutional approval; ethical consideration; and dissemination of results.

3.2 Study design

A cross-sectional design was used. Cross-sectional designs "involve the collection of data once, the phenomena under the study are captured during a single period of data collection" (Polit & Beck, 2012:184). Furthermore, "cross-sectional design is appropriate for describing the status of phenomena or for describing relationships among phenomena at a fixed point in time" (Polit & Beck, 2012:184). In the current study, data were collected at one point, while the researcher described nutritional practices and health status of HCWs in the Makhado local municipality. The quantitative research approach was used. According to Babbie (2010:135, 189), "quantitative methods emphasize objective measurements and the statistical, numerical analysis of data collected through questionnaires and surveys".

3.3 Population and study area

The study population was HCWs. The target population was HCWs in Makhado local municipality (Annexure 1). The Makhado local municipality is located in the northern part of the Limpopo province (coordinates 23° 00′ 00′′ S 29° 45′ 00′′ E) approximately 100km from the Zimbabwean border along the N1 Route (Makhado local municipality report, 2019). The total population of the Makhado local municipality was 416 728 in 2019 (Makhado local municipality report, 2019). The Makhado local municipality had the total of 38 health care facilities, which are three hospitals and 35 primary health care (PHC) facilities and 1933 HCWs including allied staff (Occupational therapist, optometrist, pharmacist, physiotherapist, radiographer, social workers, speech and audiologist), clinical staff (Psychology, medical officers), oral health staff and nurses in health facilities (Annexure 2).

3.4 Sampling

The Slovin's formula (Hitang, 2013) was used to calculate sample size and number of facilities which was included in the study to represent HCWs in the Makhado local municipality. To get

the sample size of health care facilities, n=sample size, N=population size and e = error tolerance. Standard level of confidence 95% and 0.05 margin of error was applied. Margin error "is the error attributed to chance made when selecting random samples to represent a given population under consideration. It is the expected chance difference, variation or deviation between a random sample and the population" (Hitang, 2013; Altares, 2005).

Facility sampling:

$n= N/ (1+ Ne^2)$

$n=40/ (1+ 40\times0.05^2)$

$n=40/ (1.2)$

$n=33.3$ facilities

n= 33 health care facilities

For the purpose of the study, 25 health care facilities were randomly selected as a sampling frame which are, namely: 18 clinics, two mobile clinics, two health centres and three hospitals, due to financial constraints. All three hospitals in the Makhado local municipality, which are Elim, Siloam and Louis Trichardt memorial hospital were conveniently sampled and included in the study because they have more HCWs from different categories. Selection of PHC facilities was done using simple random sampling, where names of all PHC facilities in the Makhado municipality were placed in a bowl, mixed and facilities were picked by an independent person from the bowl without looking. The same process was applied to clinics and mobile clinics. All PHC facilities in the Makhado local municipality had an equal chance to be included in the study. A sampling of HCWs was done from the total population of 1933.

$n= N/ (1+ Ne^2)$

$n=1933 / (1+ 1933\times0.05^2)$

$n=1933/ (5.8325)$

$n=331.4$ (HCWs)

n= 331 HCWs

The sample was 331 HCWs according to Solvin's formula. However, a total of 336 HCWs completed the questionnaire and met the requirements of the study. The numbers of participants varied per category of facilities, in clinics an average was 7, in CHC was 15 and in hospitals was 40 participants. The study included different disciplines of HCWs clustered together and they were selected by systematic random sampling method. Cluster sampling is based on identifiable similar characteristics that ensure their comparability, the process of selecting a sample in this manner is a multi-stage cluster sampling (Kumar, 2011:204-205).

In systemic random sampling, the sample frame is first divided into several segments called intervals, and then from the first interval, one element is selected (Kumar, 2011:208-209). Sampling varied from facility to facility, in facilities with all three disciplines fourteen participants were sampled (four nurses, three clinical practitioners and eight allied staff) and for facilities without other disciplines, the number of participants in dominating disciplines was increased, leading to 127 participants from the clinics, 40 from the CHC, 157 from hospitals and 12 participants from mobile clinics as those included in the study, for sampled categories refer to Table 3.1.

Table 3.1: Number of sampled HCWs included in the study per categories

Category	Clinics	CHC	Hospitals	Mobile clinics	Total sample
Allied (e.g., occupational therapist and optometrist))	12	2	62	-	76
Clinical (e.g., Medical Officers and psychologists	-	2	12	-	14
Nurses	115	36	83	12	246
Total	**127**	**40**	**157**	**12**	**336**

3.5 Inclusion and exclusion criteria

3.5.1 Inclusion criteria

Health care workers registered with the professional boards such as health professional council for South Africa (HPCSA), South African council for social service professions (SACSSP) and South African nursing council (SANC) working for at least 12 months in their occupation, were included in the study.

3.5.2 Exclusion criteria

The following HCWs were excluded from the study:

- Dieticians and nutritionists were excluded from the study because they are well equipped with nutrition knowledge and they may influence the results of the study negatively, especially on nutritional practices and nutritional knowledge;
- Pregnant women were excluded because their dietary patterns, biochemical parameters and anthropometric status are influenced by their condition. Their nutritional practices and health status are not the true reflections; and
- Illicit drug users (self-reported drug users) were excluded because both their nutritional practices and health status are dominated by drugs.

3.6 Subject recruitment

First visit

The researcher informed managers and CEOs of health facilities about the study to be conducted, using both provincial health and district health permission letters in communication (Annexures 3 and 4). In all health facilities, the researcher explained what is expected from employees and what should be done in the study and requested to set an appointment to meet with HCWs.

Second visit

The researcher addressed HCWs in their meeting and the aim of the study was explained. The procedures of the study were explained, recruitment letters (Information sheet) (Annexure 5) and the consent form (Annexure 6) were given to HCWs so that they can have enough time to read, understand and fill the consent forms. Managers were asked for a venue that could be used by the research team during data collection.

Third visit

The researcher gave more clarity and information on the aim of the study and what should participants expect and what is expected from them. The consent forms (Annexure 6) that were issued on the second visit were collected. Sampled HCWs, who were not on duty on the second visit were given the consent forms to fill before data collection process commenced. Data collection commenced at this stage.

3.7 Measurements and techniques

This section described the instrument development, techniques and measured variables.

3.7.1 Instrument development

The questionnaire was developed in english, guided by study objectives and relevant literature, which the researcher referred to, while developing the instrument of the current study. The purpose of referring to literature was to improve validity and quality of the tool by developing questions that are clearly stated and in detail. At the end of the process, the researcher submitted the self-administered questionnaire to supervisors to check if all objectives will be answered by the developed questions, questionnaire was also checked by the nutrition experts. The questionnaire was also pretested with HCWs. The researcher checked if the questions were clear and understandable. A questionnaire was also checked at the departmental level, faculty higher degree's committee, university higher degree's committee as well as research ethics committee of the university of Venda. During this

process, other academics checked if the questionnaire does answer the aim and objectives, and subsequently made relevant recommendations.

Questions included in the instrument were discussed with the supervisor, co-supervisor and the researcher to ensure that all objectives are covered, the questionnaire (Annexure 8) consisted of four sections, namely: socio-demographic, dietary patterns, lifestyle habits and nutritional knowledge. A record sheet was developed with three sections, which are, namely, anthropometric, biochemical and clinical.

Section A: Socio-demographic data

The questions in this section were adapted from statistics SA, 2015 - 2017. This section includes questions such as gender, age, ethnicity, marital status, highest education and designation.

Section B: Lifestyle habits

Questions on lifestyle habits were adopted from Sangala (2006). The questions included eating patterns, consumption of alcohol and maintaining a normal weight.

Section C: Dietary patterns

Questions were developed referring to the study by Judd *et al*., (2015) and Weichselbaum (2013). Examples of questions included are, namely, number of meals per day, who prepares meals and foods frequently consumed. Foods frequently consumed were assessed using a food frequency questionnaire (FFQ). Development of the FFQ – The process included interviewing of 15 HCWs using 24-hour recall, then food items where listed on the FFQ. The HCWs interviewed represented three disciplines, that are nursing, allied and clinical staff to determine the food that they commonly consume. Additional food items known to be consumed in the local communities were also included on the FFQ list.

Section D: Nutrition knowledge

South African food-based dietary guidelines (NDoH, 2012) and food fortification program (NDoH, 2012) were used in the development of nutritional knowledge questions. The researcher also referred to the study by Vorster (2013).

Record sheet

A record sheet was used to capture anthropometric, biochemical and clinical data (Annexure 7). The record sheet had the following three sections:

- Section i. Anthropometric data – weight, height, WC and body fat %.

- Section ii. Biochemical data – blood glucose, lipid panel (triglycerides, total cholesterol, low and high-density lipoprotein).
- Section iii. Clinical data – BP readings.

3.7.2. Techniques

Measurement of the variables follows below.

3.7.2.1. Lifestyle habits of health care workers

Lifestyle habits refer to factors that include diet, exercise, rest and alcohol use (Stanhope & Lancaster, 2008:83). In this study, lifestyle habits refer to dietary, physical activity, exercise, sleep, smoking, and alcohol use and weight management. Questions on the assessment of lifestyle habits are indicated in Table 3.2 (Sangala, 2006).

Table 3.2: Seven questions on lifestyle index

		Yes	No
1	Eating three meals a day		
2	Eating breakfast daily		
3	Engaging in moderate exercise 2 – 3 times a week		
4	Getting adequate sleep (7 – 8 hours per night)		
5	Not smoking		
6	Consuming no alcohol		
7	Maintaining a moderate/normal weight		

Source: Sangala (2006)

Lifestyle habits assessment questions were rated and analysed according to the total number of 'yes' using the lifestyle Index table (Table 3.3) (Sangala, 2006). A score of two to three "Yes" rating was reported as bad habits, and the one with five to six "Yes" rating was regarded as a good habit.

Table 3.3: Lifestyle index

Ratings	Classification	Description
7	Very good	Following a healthy lifestyle, keep it up
5 – 6	Good	Not bad at all, but keep a close eye on self
4	Fair	Evaluate lifestyle seriously. It is important to consider some positive changes
2 – 3	Bad	Lifestyle is detrimental to health. It is important to commit self to self to serious changes
1	Very bad	Destructive lifestyle may pose serious health problems in life. Self and company will benefit by serious commitment to a healthy lifestyle.

Source: Sangala (2006).

3.7.2.2. Anthropometric assessments of health care workers

Weight, height, WC and body fat % was assessed by the researcher and the dietician who was one of the research assistants. Repeated measurements of anthropometric were taken, after calculating the average, it was recorded and analysed. Repeated measurements of body fat % were taken/assessed. The anthropometric measurements were taken following the standard procedure as explained by Lee and Nieman (2010:164–179).

i. Weight and height measurements

(a) Weight

Weight was measured using scalerite, Micro T3 model calibrated scale, from Tanita company. The scale was placed on a flat, hard surface that allowed participants to stand securely without rocking or tipping. The scale was calibrated with a known mass, accuracy of the weighing scales was checked periodically and after the scale has been moved by zeroing the scale. Participants were weighed with light clothing and without shoes. Participants stood still in the middle of the scale's platform without touching anything and with the weight equally distributed on both feet. The weight was recorded numerically on the record sheet to the nearest 0.01 kg.

(b) Height

Height was measured with a stadiometer for mobile height measurement called Seca stadiometer 213. Participants stood without shoes, with heels together, arms to the sides, legs straight, shoulders relaxed and head in the Frankfort horizontal plane (looking straight ahead). Heels, buttocks, scapulae (shoulder blades) and back of the head was against the vertical surface of the stadiometer. Before the measurement was taken, participants were asked to inhale deeply and hold their breath and maintain an erect posture, while the headboard was lowered to the highest point of the head with enough pressure to compress the hair.

(c) Interpretation

The weight and height status refers to the current weight in kilogram (kg) and height in meter square (m^2), expressed as body mass index (BMI). The BMI is calculated as weight (kg)/height (m^2) (Lee & Nieman, 2010:170).

Overweight is a precursor to obesity, overweight and normal status is approximated based on BMI (Sugerman *et al*., 2008), were <18.5 kg/m^2 indicates underweight, 18.5–24.9 kg/m^2 indicate normal weight, 25.0–29.9 kg/m^2 indicate overweight, 30 and above indicate obese (Table 3.4).

Table 3.4: BMI classification

BMI classifications kg / m^2	Interpretation
<18.5	Underweight
18.5–24.9	Normal
25.0–29.9	Overweight
30 and above	Obese

Source: WHO (2011)

ii. Waist circumference

Waist circumference is an indicator of intra-abdominal adipose tissue, high levels of which confer an increased risk of cardiometabolic disease (Tanamas *et al*., 2016). Waist circumference guides in assessing health risk in person categorized as normal or overweight in terms of BMI and it provides an independent prediction of risk over and above that of BMI (Lee & Nieman, 2010:179).

(a) Waist circumference measurement

Waist circumference was measured with stretch-resistant tape. The participants stood erect, abdominal muscles relaxed, arms to the sides, and feet together. Participants were undressed to light under-clothing for easy access to the abdomen and waist. Clothes that compress the abdomen or distort the natural shape of the participant‘s abdomen and waist were removed. Measurements were taken along the mid-axillary line in a horizontal plane (parallel to the floor) around the abdomen, midpoint between the top of the iliac crest and the lower margin of the last palpable rib on the right side of the participants just after breathing out (Figure 3.1). The WC was taken three times to ensure that accurate measurement has been obtained. The WC assesses total abdominal fat content (sum of adipose tissue present in three compartments of the body’s abdominal region) which are subcutaneous (just under the skin), visceral (surrounding is a valuable the organs within the peritoneal cavity) and retroperitoneal (outside of and posterior to the peritoneal cavity).

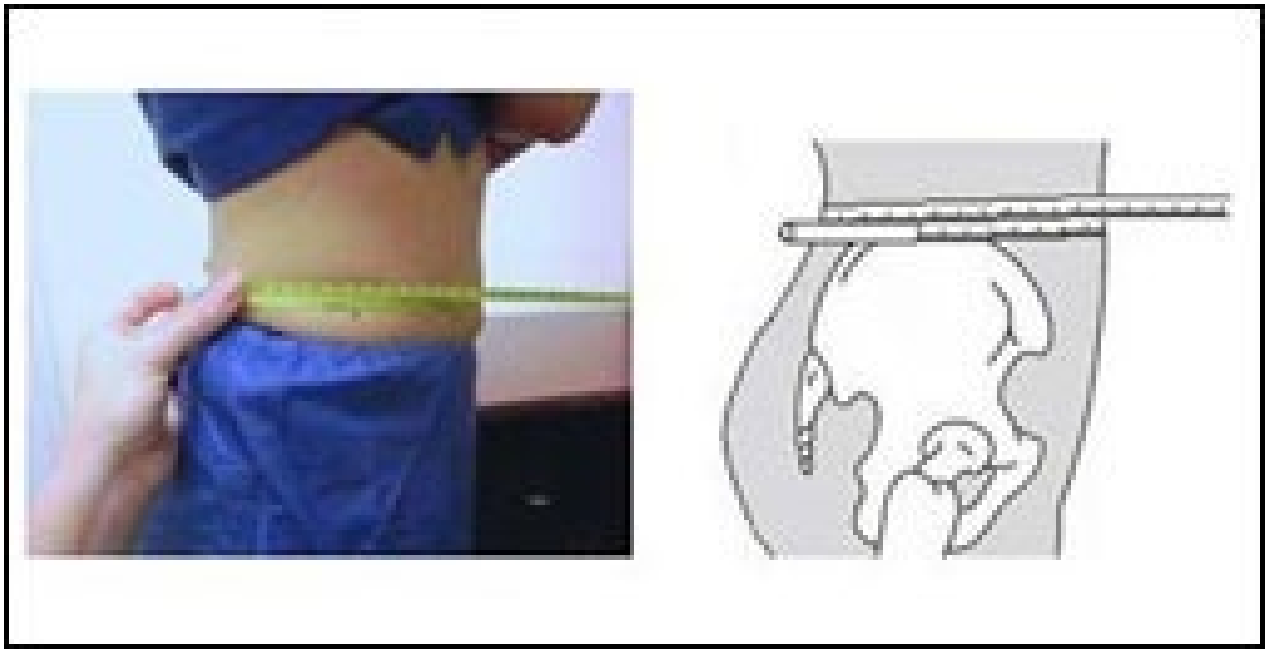

Figure 1: Measurement of waist circumference

(b) Interpretation

Cut-off points are indicated in table 3.5 below, showing that 94cm and less in males and 80 cm and less in females is normal WC; >94 cm in males and >80 cm in females is high WC; and, lastly, >102 cm in male and >88 cm in female indicates very high WC.

Table 3.5: Cut-off points and risk of metabolic complications

Male	Female	Interpretation	Risk of metabolic complications
94 cm and less	80 cm and less	Normal	Low risk
>94 cm	>80 cm	High	High risk
>102 cm	>88 cm	Very high	Very high risk

Source: WHO (2011)

iii. Body fat percentage

Body fat percentage refers to the body fat distribution in the upper body, android (male type) and lower body, gynoid (female type), expressed in percentage. This measurement is a clearer indicator of individuals' fitness, regardless of weight, the higher percentage of body fat, the more likely the person is to develop obesity-related diseases, including heart disease, high BP, stroke, and type 2 diabetes (Smith & Madden, 2016).

(a) Body fat percentage measurement

Body fat percentage was measured using model BC-533 Tanita inner scan body composition monitor, a technology that allows the imaging of the body without hazard to the participant. The scale was placed on a flat, hard surface that allows participants to stand securely without

rocking or tipping. Participants stood still in the middle of the scale's platform without touching anything and with the weight equally distributed on both feet. A participant's body fat was measured with light clothing, without shoes and socks (foot to foot impedence) to ensure that accurate measurement has been obtained.

(b) Interpretation of body fat percentage

Body fat percentage was classified according to the classification indicated by Gallagher *et al*., (2000) as shown in table 3.6, indicating under fat %, healthy fat %, overfat % and obese fat % according to age and gender. In interpretation age 40 to 59 years is the average age and it indicates that body fat % of 0–11 in males; 0–23 in females is under fat %, 11–22 in males; 23–34 in females is healthy fat %, 22–28 in males; 34–40% in females and ≥ 28 in males; ≥ 40 body fat % in females indicate body fat percentage in the obese range.

Table 3.6: Body fat percentage classification

Interpretation of body fat percentage	**Age (years)**					
	18 – 39		**40 – 59**		**60 – 99**	
	Male	Female	Male	Female	Male	Female
Under fat (%)	0 – 8	0 – 21	0 – 11	0 – 23	0 – 13	0 – 24
Healthy (%)	8 – 20	21 – 33	11 – 22	23 – 34	13 – 25	24 – 36
Over fat (%)	20 – 25	33 – 39	22 – 28	34 – 40	25 – 30	36 – 40
Obese (%)	≥ 25	≥ 39	≥ 28	≥ 40	≥ 20	≥ 40

Source: Gallagher et al. (2000)

3.7.2.3. Biochemical parameters

This section outlines additional parameters of measuring health status, which are non-fasting blood glucose, triglycerides, total cholesterol, LDL and HDL.

i. Biochemical measurements

Participants were asked to sit comfortably, with legs touching the floor by the professional nurse. The middle finger was wiped with a clean sterilized wet wipe, the finger was pricked once for both blood glucose and blood lipid panel measurements. After pricking the finger was wiped once with dry cotton wool, then a drop of blood was placed into the glucose monitor, then blood for lipid panel was also taken and placed into the Cardio-check monitor.

After two to three minutes' readings for blood glucose was read and recorded in the record sheet (Annexure 8). Biochemical parameters measured as part of lipoprotein panel (lipid panel) were triglycerides, total cholesterol, HDL and LDL which were measured at the same time (Werdo, 2016). Sample of blood was placed into the cardio check and after two to three

minutes readings of triglycerides, total cholesterol, HDL and LDL were read and recorded into the questionnaire.

(i) Non-fasting blood glucose

Blood glucose refers to the amount of glucose level in capillaries, and it should be as near normal as possible (Escott-Stamp, 2015: 546). Measurement of serum glucose is used to diagnose hypoglycaemia and is of interest in the diagnosis and management of diabetes mellitus (Lee & Nieman, 2010:339). Random blood sugar test is administered to determine the average blood sugar level of an individual and there is no need to fast before taking this test (Song *et al*., 2016).

(a) Interpretation of blood glucose

Normal blood glucose is classified as 3.3 to 6.4 mmol/l and high blood glucose as 6.5 mmol/l and above. Blood glucose was classified using table 3.7.

Table 3.7: Blood glucose classification

Interpretation	Classification
Normal	3.3 to 6.4 mmol/L
High	6.5 mmol/L and above

Source: Lee & Nieman (2010:339)

(ii) Lipid panel

Lipid panel is part of health status assessments, which include triglycerides defined as molecules of lipid family that circulate in the blood normally, if they accumulate in large quantities triglycerides can cause CVDs (Jellinger *et al.,* 2017). High levels of LDL cholesterol indicates cardiac risk (Gandy, 2014:778). High-density lipoprotein cholesterol functions as an anti-inflammatory, antioxidant protein that helps to remove cholesterol from the arterial wall of the liver (Mahan *et al.,* 2012:746). Total cholesterol, which its raised levels are the greatest risk factor for coronary heart diseases and the main risk factor for CVDs (Gandy, 2014:782).

(a) Triglyceride interpretation

Triglyceride of 1.69 mmol/l and less is normal, 2.26 – 5.63 mmol/l is high and ≥ 5.64 mmol/l indicate very high triglycerides, which is a risk factor for coronary heart disease (Lee & Nieman, 2010:339). For classification refer to table 3.8.

Table 3.8: Triglyceride classification according to the national cholesterol education program

Serum TG interpretation	Classification (mmol/l)
Normal	1.69 and less
Borderline-high	1.7 – 2.25
High	2.26 – 5.63
Very high	≥ 5.64

Source: Lee & Nieman (2010:339)

(b) High-density lipoprotein cholesterol interpretation

Desired levels of HDL are more than 1.0mmol/l for men and 1.2 mmol/l for women, carrying moderate risk for metabolic syndrome and CHD (Klug *et al*., 2013). Table 3.9 indicates the classification of HDL.

Table 3.9: HDL-C classification

HDL Interpretation	Classifications (mm/l)		Metabolic syndrome and CHD
	Men	Women	Risk
Desirable	More than 1.0	More than 1.2	Lower risk
Non-desirable	Less than 1.0	Less than 1.2	Higher risk

Sources: Ntyintyane et al., 2017; Reiner et al. (2016)

(c) Total cholesterol interpretation

Table 3.10 shows that less than 4.5mmol/l is desirable, while more than 4.5mmol/l indicated non-desirable.

Table 3.10: Total cholesterol classification

Interpretation	TC Classification (mm/L)
Desirable	Less than 4.5
Borderline	4.5
Non-desirable	More than 4.5

Sources: Ntyintyane et al., (2017); Reiner et al., (2016)

(d) (LDL) interpretation

Table 3.11 show the LDL cholesterol classification and interpretation. The normal range is less than 1.8mmol/l, 1.8mmol/l is borderline, while 1.8mmol/l and above is the high range of LDL.

Table 3.11: Low-density lipoprotein cholesterol classification

Interpretation	LDL classification(mmol/l)
Normal range	Less than 1.8
Border line	1.8
Higher range	1.8 and above

Sources: Ntyintyane et al., (2017); Reiner et al., (2016)

3.7.2.3.2 Clinical measurements

(a) Blood pressure procedure

Blood pressure was measured by a professional nurse using a digital automatic BP monitor (NBP-24 NG) and BP monitor (PG-800B5). A participant sat for five minutes before commencing measurements. A participant was requested to seat comfortably, with back supported, not talking, legs uncrossed and upper arm bared. The participant's arm was supported at heart level (Chew *et al*., 2016). Digital automatic BP cuff monitor was placed around the upper arm and the power button pressed on. The results of BP were shown by SBP (upper value) and DBP (bottom value) (Gandy, 2014:788). Blood Pressure measurements were taken three times, five minutes apart to ensure that accurate measurements have been obtained, as recommended by Lee and Niemand (2010:180).

(b) Interpretation of blood pressure

Blood pressure measurements of 135/85 mmHg or higher are regarded as not normal (Escott-Stamp, 2015: 384). In the current study high BP is measurements that equals to or exceeds 140/90 mmHg and if the participant have self-reported to be taking antihypertensive drugs. Normal BP is indicated by <120 mmHg systolic and < 80 mmHg. Elevated BP can lead to persistent hypertension, non-physiologic elevation of BP; defined as having an systolic blood pressure (SBP) of 140 mm Hg or greater; having a diastolic blood pressure (DBP) of 90 mmHg (McConnell *et al.,* 2016). Blood pressure was classified according to the classification indicated in table 3.12 below.

Table 3.12: Classification of blood pressure

Stage interpretation	Systolic BP(mmHg)	Diastolic BP (mmHg)
Normal	< 120	< 80
Optimal	120 – 129	80 – 84
High normal	130 – 139	85 – 89
High	140 and above	90 and above

Sources: WHO (2016); Seedat et al., (2014)

3.7.2.4. Nutritional knowledge

Nutritional knowledge refers to an individual's understanding of nutrition, including the intellectual ability to remember and recall food and nutrition-related terminology, specific pieces of information and facts (Macías & Glasauer, 2014). In this study, nutritional knowledge refers to the knowledge of the South African food-based dietary guidelines and food fortification regulation of SA. Assessment on nutritional knowledge included a combination of both closed and open-ended questions. Interpretation of the nutritional knowledge score was

done in percentages, where 0–29% indicate poor nutritional knowledge and 90–100% indicate excellent nutritional knowledge, which does not require improvement. Table 3.13 shows the nutritional knowledge scores.

Table 3.13: Nutritional knowledge score

Knowledge scores	Interpretation
0 - 29.9%	Poor
30 - 49.9%	Fair
50 - 69.9%	Good
70 - 89.9%	Very good
90 - 100%	Excellent

Source: Umalusi (2012)

3.8 Data collection

Data were collected using self-administered questionnaires that were distributed by the researcher and two field workers (registered dietitian and registered professional nurse). Participants completed the questionnaire in the presence of the researcher in a private room and clarity was given. The data were collected from four stations.

In the first station, participants completed a self-administered questionnaire, which included socio-demographic, lifestyle and nutritional knowledge. In the second station, the questionnaire was checked for partial completion. The anthropometric measurements were then taken by the researcher (who is a registered dietitian), which included weight, height and WC, as well as body fat percentage. In the third station, clinical (BP) and biochemical measurements (i.e., blood glucose, triglycerides, total cholesterol, LDL and HDL) were taken by the registered professional nurse. In the fourth station, FFQ was completed by the researcher and dietician during interview, because it needed probing and the use of pictures. Data were collected from August 2018 to March 2019.

3.9 Selection of field workers

Qualified professional nurse and dietitian registered as health care professionals were selected as field workers. The roles of field workers and selection criteria are outlined in Table 3.14 below.

Table 3.14: Selection of Field Workers

Profession	Qualification	Roles
Professional nurse	Bachelor of Nursing (BCur)	Take Blood Pressure measurement Take biochemical measurements
Dietician	Bachelor of Nutrition (B.Nutr)	Interview participants on FFQ Take anthropometric measurements
Researcher	Bachelor of Nutrition (B.Nutr)	Develop data collection instrument Train field workers Interview participants on FFQ Take anthropometric measurement Data cleaning – checking the completeness of questionnaires Complete 24hour recall

3.10 Pilot study and pre-testing

3.10.1 Pre-testing

Five HCWs working at the NDoH, a nurse, a dentist and three pharmacists participated in the pre-testing of the instrument. Participants completed the questionnaire in the presence of the researcher, gave inputs and comments after completing it. The common comment was that the instrument is too long. They also indicated questions that need to be rephrased. Pre-test in the current study served many purposes including identifying parts of the instrument package that are difficult for subjects to read or understand or that may have been misinterpreted by them; identifying any questions that participants find objectionable or offensive; determining whether the sequencing of the instrument is sensible; determining the needs for training data collection staff; and, lastly, to determine if the measures yield data with sufficient variability.

3.10.2 Pilot study

Pilot study aimed to reveal any further unanticipated problems with the questionnaire before committing time and effort to the field work (Hall & Hall, 1996:47). A pilot study was done after getting an ethical clearance and after the instrument had been scrutinized. The researcher chose the Bungeni health centre from the Collins Chabani local municipality as a piloting site. Fifteen HCWs participated as the piloting sample. Questionnaires were self-administered, anthropometric and clinical measurements were also measured and the last stage was FFQ interviews, which includes probing and was conducted by the researcher. Biochemical measurement such as blood was not taken because of the expense.

Piloting the study was an important function in planning the study because it included evaluation of the following:

- Adequacy of study methods and procedures;
- Likely success of a participant recruitment strategy;

- Appropriateness and quality of instruments;
- Strength of the relationship between key variables so that the number of needed study participants can be estimated;
- Identification of confounding variables that need to be controlled;
- Adequacy of training materials for research staff, potential problems, such as loss of participants during the study; and
- The extent to which the preliminary evidence justifies more rigorous research and project costs for budgeting purposes.

The process was to test the logistics of the study, its completeness and clarity, the validity of the measuring tools, and the acceptability of the topic to the study population (Hall & Hall, 1996:47). As a result, question 31 was re-phrased, from describing fortification, to what is food fortification, and questions 34 to 43 on nutritional knowledge were changed from open-ended questions into multiple-choice questions.

3.11. Validity and reliability

3.11.1 Validity

Validity of an instrument is a vital component of development because it assesses relevance and degree to which an instrument measures what is supposed to measure (Polit & Beck, 2012:336; Shafer *et al.*, 2012:978). Existing instruments were adapted following objectives and relevant literature, to the degree that the instrument of the current study has covered the content that it is supposed to measure. Laboratory blood sample are the most accurate as compared to the finger pricking. Two nutrition experts were consulted to check the content of the questionnaire to ensure that the objectives of the study are fully addressed and recommended edition of clinical parameters LDL and total cholesterol to the questionnaire and few questions were also modified. In the study, self-administered questionnaires were filled, in the presence of the researcher. The researcher also checked completeness on the questionnaire in the presence of participants to ensure that all sections are completed to promote accuracy, validity and consistency of information in the study.

3.11.2. Reliability

Reliability is the method used to measure variables and it concerns the soundness of the study‘s evidence – that is, whether the findings are unbiased and well-grounded (William, 2006:89). Readings were checked to ensure accuracy and consistency of measurements in the study. The less variation an instrument produced in repeated measurements, the higher its reliability (Polit & Beck, 2012:741). Inter-reliability has been used as a means to limit

variation in the instrument by pre-testing. Piloting the study was the method used to enforce reliability of the study. In addition, anthropometric measurements and clinical parameters were taken three times, written in the record sheet, average measurements calculated for use in analysis of the study. Weight scales were regularly calibrated before taking measurements.

3.12 Statistical analysis

Statistical analysis was done using the Statistical Package for Social Sciences Software (SPSS) version 23.0 (International business machine, 2015). Descriptive and inferential statistics were used to analyse demographic information and to organize/ summarise data into frequencies and percentages. The level of significance was placed at P≤0.05, value that was equal to/or less than 0.05 was considered as significant (association) and the one above 0.05 was regarded as not significant (no association). The captured questionnaire was first coded and then the data was entered into the excel program of the computer. The researcher requested help from a statistician to assist with data analysis. Pearson Chi-square test was used in comparison between variables and regression analysis in finding association among variables. The researcher worked together with the statistician to ensure that the required results are achieved.

3.13. Institutional approval

The study's research proposal was presented at the department of Nutrition and faculty of Health Sciences higher degree's committee for improvement and recommendation in preparation for the submission to the university higher degree and ethics committee for approval and ethical clearance. The study is approved by the research and ethics committee of UNIVEN. Ethical clearance was granted with project number: SHS/18/NUT/02/1603 (Annexure 7). The researcher requested permission to conduct the study in health facilities from Limpopo provincial office, department of Health (Annexure 3) and the Vhembe district health office (Annexure 4). The chief executive officers of the hospitals and managers of community health centre's and clinics included in the study were informed verbally about the study by making use of the university ethical clearance letter and the approval letters from the provincial health and district health offices.

3.14 Ethical consideration

The ethical clearance was obtained from the university research ethics committee before commensing data collection. The study was performed following the principles of the declaration of Helsinki (2008) and ethics in health research principles, processes and structures (2015). The researcher also sought permission from the Limpopo provincial department of health office.

Informed consent form

The researcher informed participants verbally about the study and explained the aim of the study as well as data collection procedure (Annexure 6). Thereafter, asked them to read and sign an informed consent form (Annexure 4) as a way of guaranteeing their willingness to freely participate in the study in the presence of a researcher.

Voluntary participation

Voluntary participation of participants was guaranteed. The researcher had a clear and fair voluntary participation agreement with participants, who had a leeway that allowed them to withdraw from the research study if they wanted to do so without being asked for a reasons and they will not be penalised by anyone. Participants were informed that if they were uncomfortable with any aspects of the research procedures, they were free to seek clarification from the researcher, or even to withdraw from participation.

Anonymity and confidentiality

Participants were guaranteed their privacy. On issues of anonymity and confidentiality, participants were informed that their right to remain anonymous would be fully respected and that pseudonyms would be used in the final research report (Bogdan & Biklen, 1992:49).

3.15. Dissemination of Results

A dissertation and disc of this study will be submitted to the university library. The report will be given to the department of health: Limpopo province, and the study will be presented during research day – Limpopo province. The findings will be presented in conferences, seminars and published in accredited journals in South Africa and internationally.

CHAPTER 4
RESULTS

4.1 Introduction

Results of the study are covered in this chapter. Data were analysed per gender and also as the total population. The purpose of this study was to describe nutritional practices and health status of health care workers in the Makhado local municipality. The results are presented under the following headings: socio-demographic information, self-reported family history of diseases, self-reported disease profile, anthropometry status, biochemical, clinical parameters, dietary patterns, lifestyle habits and nutritional knowledge.

4.2. Socio-demographic information

A total of 336 HCWs that participated in the study comprised of 18% males and 82% females. The ages of participants started from 23 years and ended with 63 years, with the following mean age for total participants of 42.4 ± 9.9 years and 37.84 ± 10.08 years for males and 43.45 ± 9.65 years for females. Very few participants (at 3%) in both groups were aged 60 years and above. Nearly half (at 45%) of male and 23% of female participants were aged 30 to 39 years. There was a significant difference in age for both male and female participants ($p = 0.0001$).

More than half of male (at 58%) and 44% of female participants were married, 35% of male and 46% of female participants were single. Very few participants in both groups (male = 5% vs female = 2%) had postgraduate degrees, 68% of both male and female participants had undergraduate qualifications and 27% of male vs 30% of female participants had certificate qualifications. More than a quarter of both participants (male = 56% vs female = 65%) worked in public health facilities for five years and more. Very few participants in both groups (male = 8% vs female = 4%) worked in public health facilities for one to two years.

More than one-quarter of male (at 27%) vs three quarters (i.e., 78%) of female participants were nurses, and 46% of male vs 15% of female participants were allied health care staff. Almost two thirds of participants in both groups (namely, male = 66% vs female = 69%) were Tshivenda speaking, while about 20% in both groups (with male = 23% vs female = 21%) were Xitsonga speaking.

Most male (at 64.5%) and 42% of female participants were working in the hospitals, followed by 26% of male and 40% of female participants who were working at the clinics. Few participants were working in community health centres, refer to Table 4.1.

Table 4.1: Socio-demographic information of participants

	Male		Female		Total sample	
	n = 62	%	n = 274	%	n = 336	%
Age (years)						
< 30	14	23	29	11	43	13
30 – 39	28	45	65	23	93	28
40 – 49	11	17	98	36	109	32
50 – 59	7	11	73	27	80	24
60+	2	3	9	3	11	3
Marital status						
Single	22	35	125	46	147	43
Married	36	58	123	44	159	47
Divorced	0	0	15	6	15	5
Widowed	4	7	11	4	15	5
Level of qualification						
Certificate	17	27	82	30	99	29
Diploma	9	15	104	38	113	34
Bachelor degree	33	53	83	30	116	35
Postgraduate degree	3	5	5	2	8	2
Work experience in the public health facility						
1 - 2 years	5	8	12	4	17	5
3 - 4 years	13	21	28	10	41	12
5 - 9 years	19	31	76	28	95	28
10 - 14 years	9	15	58	21	67	20
15+ years	16	25	100	37	116	35
Field of profession						
Nurses	17	27	215	78	232	69
Clinical	17	27	18	7	35	10
Allied	28	46	41	15	69	21
Ethnic group						
Venda	41	66	191	69	232	69
Tsonga	14	23	58	21	72	21
Pedi	3	5	20	7	23	7
Tswana	1	1	2	1	3	1
Other: Afrikaans, Shona, Xhosa	3	5	3	2	6	2
Workplace facility						
Mobile clinic	1	1.6	11	4	12	3.6
Clinic	16	25.8	111	40	127	37.8
Community health centre	5	8.1	36	13.1	41	12.2
Hospitals	40	64.5	116	42.3	156	46.4

4.3 Self-reported diseases

According to participants, some of their family members suffer from the following diseases: hypertension (male = 34% vs female = 51%), diabetes mellitus (male = 27% vs female = 32%) and CVDs (male = 5% vs female = 8%). The participants reported to suffer from the following chronic diseases: hypertension (male = 13% vs female = 22%) and diabetes mellitus (male = 2% vs female = 8%). Table 4.2 indicates the disease profile of both family members and participants.

Table 4.2: Self-reported family disease profile and participants disease profile

Family disease profile	Male		Female		Total sample	
	n = 62	%	n = 274	%	n = 336	%
Hypertension	21	34	171	51	150	54
Diabetes mellitus	17	27	106	32	89	33
CVD	3	5	26	8	23	8
Ulcer	8	13	30	9	22	8
Cancer	3	5	25	7	22	8
Allergy	4	7	43	13	39	14
Renal	1	2	9	3	8	3
Arthritis	8	13	57	17	49	18
Self-reported disease profile of participants						
Hypertension	8	13	60	22	68	20
Diabetes mellitus	1	2	22	8	23	7
CVD	-	-	3	1	3	1
Ulcer	4	7	27	10	31	9
Cancer	1	2	1	1	2	1
Allergy	2	3	26	10	28	8
Arthritis	1	2	20	7.	21	6

4.4 Health status

This section covers results of anthropometric measurements, biochemical and clinical parameters among HCWs.

4.4.1 Anthropometric status

The mean weight for male and female participants was 79.15 ± 15.09SD and 85.58 ± 17.32SD, respectively. The mean height for male and female participants was 1.71 ± 0.072SD and 1.61 ± 0.061SD, respectively, while the mean BMI is 27.16 ± 4.56SD in males vs 33.18 ± 6.54SD in females.

Table 4.3 below shows a BMI status of participants. Very few female participants (at 0.4%) were underweight, 30.6% of male vs 7.7% of female participants were of normal weight, 43.5% of male vs 22.3% of female participants were overweight, 25.8% of male vs 69.6% of female participants were obese.

Table 4.3: Distribution of body mass index by gender

Interpretation	BMI classifications ($Kg/m^{2)}$	Male		Female		Total sample	
		n = 62	%	n = 274	%	n = 336	%
Underweight	<18.5	0	0	1	0.4	1	0.3
Normal	18.5 - 24.9	19	30.6	21	7.7	40	11.9
Overweight	25 - 29.9	27	43.5	61	22.3	88	26.2
Obesity	30 and above	16	25.8	191	69.6	207	61.6

Table 4.4 below shows the body fat percentage of participants according to gender. Less than 20% of participants in both groups (male = 17.7% vs female = 18.2%) had body fat % in the overweight range, 56.5% of male vs 70.1% of female participants had body fat % in the obese range, while 22.6% of male vs 10.9% of female participants had body fat % in the healthy range.

Table 4.4: Body fat percentage

Body fat percentage category			Male		Female		Total sample	
Interpretation	Classification in %		n = 62	%	n = 274	%	n = 336	%
	Male	Female						
Under fat	0 – 11	0 – 23	1	1.6	1	.4	2	.6
Healthy fat	11 – 22	23 – 34	14	22.6	30	10.9	44	13.1
Over fat	22 – 28	34 – 40	11	17.7	50	18.2	61	18.2
Obese fat	28 and above	40 and above	35	56.5	192	70.1	227	67.6

Table 4.5 shows that 53.2% of male participants and 10.2% of female participants had a normal range of WC. Nearly one-quarter of male participants (24%) and 82.8% of female participants had very high WC.

Table 4.5: Waist circumference cut-off points and risk of metabolic complications

Waist circumference		Male		Female		Total sample	
Interpretation	Classifications	n=62	%	n=274	%	n=336	%
Normal	Men ≤ 94cm; women ≤ 80cm	33	53.2	28	10.2	61	18.2
High	Men > 94cm; women > 80cm	14	22.6	19	6.9	33	9.8
Very high	Men >102cm; women >88cm	15	24.2	227	82.8	242	72.0

4.4.2. Biochemical measurements

Blood samples were collected from 315 participants (53 males vs 262 females). Participants included in biochemical parameters tables are the ones in which blood lipids are measured. The mean blood glucose for male participants was 5.16 mmol/l ± 2.3 mmol/l and 6.68 mmol/l ± 3.2mmol/l for female participants. Table 4.6 shows that 61.3% of male vs 54.7% female participants had normal blood glucose. About a quarter of male (at 24.2%) vs 40.9% female participants had blood glucose that was above the normal range.

Table 4.6: Blood glucose level of participants

Blood glucose level (mmol/l)		Male		Female		Total sample	
Interpretation	Classification	n = 53	%	n = 262	%	n = 315	%
Normal	3.3 to 6.4	38	61.3	150	54.7	188	56.0
Higher	6.5 and above	15	24.2	112	40.9	127	37.8

The mean triglyceride for male participants was 1.21 mmol/l ± 0.74 mmol/l and 1.62 mmol/l ± 0.96 mmol/l for female participants. Table 4.7 shows that 11.3% male vs 19.3% female participants had borderline high triglycerides and 8.1% male vs 18.2% female participants had high triglycerides.

Table 4.7: Triglycerides classification

Triglycerides (mmol/l)		Male		Female		Total sample	
Interpretation	**Classification**	**n = 47**	**%**	**n= 255**	**%**	**n= 302**	**%**
Normal	1.69 and less	35	56.5	150	54.7	185	55.1
Borderline high	1.7 – 2.25	7	11.3	53	19.3	60	17.9
High	2.26 – 5.63	5	8.1	50	18.2	55	16.4
Very high	≥ 5.64	0	0	2	0.7	2	0.6

Mean HDL for male participants was 0.96 mmol/l ± 0.51 mmol/l and 1.14 mmol/l ± 0.41 mmol/l for female participants. Table 4.8 shows that 25.8% of both male and female participants had non-desirable HDL cholesterol, while 50% male and 39.1% female participants had desirable HDL-C.

Table 4.8: HDL-C classification

HDL-C mmol/l		Male		Female		Total sample	
Interpretation	**Classification**	**n = 47**	**%**	**n= 255**	**%**	**n= 302**	**%**
Desirable	More than 1.0 (male); more than 1.2 (female)	31	50.0	109	39.1	138	41.1
Non- desirable	Less than 1.0 (male); less than 1.2 (female)	16	25.8	148	25.8	164	48.8

The mean total cholesterol for male participants was 2.92 mmol/l ± 1.62 mmol/l and 3.91 mmol/l ± 1.31 mmol/l for female participants. Table 4.9 shows that 1.6% male vs 1.5% female participants had borderline total cholesterol, while 14.5% of male vs 32.5% of female participants had non-desirable cholesterol.

Table 4.9 Total cholesterol level of participants

Cholesterol mmol/l		Male		Female		Total sample	
Interpretation	**Classification**	**n = 47**	**%**	**n= 255**	**%**	**n= 302**	**%**
Desirable	Less than 4.5	37	59.7	161	58.8	198	58.9
Borderline	4.5	1	1.6	4	1.5	5	1.5
Non-desirable	More than 4.5	9	14.5	89	32.5	98	29.2

About one third (at 32.3%) of male vs 54.4% of female participants had higher range of LDL, 6.5% male and 3.6% female participants had a borderline LDL, while 37.1% of male and 35% of female participants had normal ranges of LDL (Table 4.10).

Table 4.10: Low-density lipoprotein

LDL mmol/l		Male		Female		Total sample	
Interpretation	**Classification**	**n = 47**	**%**	**n= 255**	**%**	**n= 302**	**%**
Normal	Less than 1.8	23	37.1	96	35.0	119	35.4
Borderline	1.8	4	6.5	10	3.6	14	4.2
Higher range	Above 1.8	20	32.3	149	54.4	169	50.3

4.4.3. Blood pressure measurements

The mean systolic blood pressure for male participants was 124.61 mmHg ± 11.23 mmHg and 120.57mmHg ± 14.87 mmHg for female participants. Less than 20% of participants in both groups (at male = 16.9% vs female = 17.5%) had high systolic blood pressure; 43.5% of male and 27% female participants had optimal systolic Blood Pressure; 27.4% of male vs 47.4% of female participants had normal systolic blood pressure (Table 4.11).

The mean diastolic blood pressure for male participants was 78.84 mmHg ± 9.77 mmHg and 78.24 mmHg ± 10.28 mmHg for female participants. Less than 15% of participants in both groups (at males = 12.9% vs females = 11.3%) had high normal diastolic blood pressure; 30.6% of male vs 15.7% of female participants' optimal diastolic blood pressure; while 43.5% of male and 58% of female participants had normal diastolic blood pressure.

Table 4.11 Blood pressure status

Systolic (mmHg)		Male		Female		Total sample	
Interpretation	**Classification**	**n = 62**	**%**	**n= 274**	**%**	**n= 336**	**%**
Normal	< 120	17	27.4	130	47.4	147	43.8
Optimal	120 – 129	27	43.5	74	27.0	101	30.1
High normal	130 – 139	10	16.9	48	17.5	58	17.3
High	140 and above	8	12.9	22	8	30	8.9
Diastolic (mmHg)							
Normal	< 80	27	43.5	159	58.0	186	55.4
Optimal	80 – 84	19	30.6	43	15.7	62	18.5
High normal	85 – 89	8	12.9	31	11.3	39	11.6
High	90 and above	8	12.9	41	14.9	49	14.6

4.4.4 Metabolic syndrome predictors

Table 4.12 shows proportion of participants who had parameters of metabolic syndrome and it only includes participants who were measured biochemical parameters. Metabolic syndrome is assessed by the presence of abnormalities in three or more of the following factors: blood pressure, blood glucose, serum triglycerides, total cholesterol, LDL cholesterol, HDL cholesterol and WC. According to the criteria by the US nation cholesterol education programme (NCEP-ATP III) (2005), the person is diagnosed with metabolic syndrome if the above-mentioned parameters are measured on three different occasions and are found to be abnormal according to cut off points. Participants with three factors and more indicate the risk

for metabolic syndrome. Results indicate that 19.4% male vs 27.4% female participants had three risk factors for metabolic syndrome, 11.3% of male vs 31.6% of female participants had four and more risk factors for metabolic syndrome. Nearly one-third of male (at 30.7%) vs 59% of female participants were at risk of metabolic syndrome.

Table 4.12: Proportion of participants with parameters of metabolic syndrome factors

Number of factors	Male		Female		Total sample	
	n = 45	%	n = 264	%	n = 309	%
One factor	13	21.1	30	10.9	43	13.0
Two factors	13	20.97	60	21.9	73	22.0
Three factors	12	19.4	75	27.4	87	26.1
Four factors and more	7	11.3	106	31.6	106	32.1

Source: NCEP-ATP III Criteria (2005)

4.5 Nutritional practices

This section covers the results of dietary patterns and aspects of lifestyle habits among HCWs.

4.5.1 Dietary patterns

Table 4.13 shows that 45% of male vs 91.6% of female participants prepare their own meals. More than half of male (at 54.8%) vs 2% of female participants indicated that their spouses were responsible for meal preparation, while 3% of male vs 12% of female participants indicated that their children were responsible for meal preparation. Very few participants in both groups indicated that their meal preparation was done by domestic helpers (at male = 2% vs female = 4%).

Table 4.13: Person responsible for meal preparations

	Male		Female		Total sample	
	n = 62	%	n = 274	%	n = 336	%
Self	28	45.2	251	91.6	279	83.0
Spouse/partners	34	54.8	5	1.8	39	11.6
Children	2	3.2	32	11.7	34	10.1
Siblings	0	0	4	1.5	4	1.2
Friends	1	1.6	0	0	1	.3
Domestic helpers	1	1.6	10	3.6	11	3.3
Mothers	2	3.2	6	2.2	8	2.4

Table 4.14 shows that about 60% of participants in both groups (at male = 58% vs female = 61%) eat three times a day, 36% of male and 28% of female participants eat two times a day, while 0.7% of female participants eats one meal a day. More than 40% of participants in both groups (male = 46% vs female = 42%) reported that they sometimes skip meals.

Table 4.14: Number of meals eaten per day and skipping meals

	Male		Female		Total sample	
	n = 62	%	n = 274	%	n = 336	%
Number of meals per day						
Once	0	0	2	0.7	2	0.6
Two times	22	35.5	77	28.1	99	29.5
Three times	36	58.1	168	61.3	204	60.7
Four times	1	1.6	17	6.2	18	5.4
More than 4 times	3	4.8	10	3.6	13	3.9
Skip meal						
Breakfast	23	37.1	70	25.5	93	27.7

Most participants in both groups (at males = 64.5% vs females = 71.1%) indicated that they do not skip meals. Of those who usually skipped meals, 32.1% of male and 36.4% of female participants indicated that they skip meals because they are always busy working, while about 21% of participants in both groups indicated that they lack appetite (Table 4.15).

Table 4.15: Reasons for skipping meals

Reasons given	Male		Female		Total sample	
	n = 28	%	n = 118	%	n = 146	%
No appetite	6	21.4	25	21.2	31	21.2
Don't feel hungry	8	28.6	47	39.8	55	37.7
No one could cook for me	3	10.7	0	0	3	2.1
Lack of money to purchase	1	3.6	0	0	1	0.3
Always busy working	9	32.1	43	36.4	52	35.6
Other reasons such as fasting	1	3.6	3	2.5	4	2.7

The majority of participants (male = 87% vs female = 91%) reported to eat breakfast whilst at work. Of those who eat breakfast, 70.9% of male vs 84% of female participants usually eat home-prepared breakfast, whilst 16.1% of male vs 7.3% of female participants eat take-away foods (Table 4.16).

Table 4.16: Types of breakfast meals usually consumed while at work

Breakfast foods	Male		Female		Total sample	
	n = 62	%	n = 274	%	n = 336	%
Home-prepared foods	44	70.9	230	84	274	81.5
Take-away from fast-food restaurants	10	16.1	20	7.3	30	8.9
Did not eat	8	12.9	24	8.8	32	9.5

When participants were asked about the type of food they usually eat during lunch, 3.2% of male and 5.5% of female participants indicated that they do not eat during lunch. Of those who usually eat lunch, 72.6% of male vs 79.9% of female participants usually eat home-

prepared meals for lunch, while 24.2% of male vs 14.6% of female participants usually eat take-away foods for lunch (Table 4.17).

Table 4.17: Types of lunch meals usually consumed while at work

Lunch meal	Male		Female		Total sample	
	n = 62	%	n = 274	%	n = 336	%
Home-prepared foods	45	72.6	219	79.9	264	78.5
Take-away from fast-food restaurants	15	24.2	40	14.6	55	16.4
Did not eat	2	3.2	15	5.5	18	5.4

When participants were asked how many times do they consume foods from quick service restaurant in a week, 37.5% indicated that it does not eat fast foods. Of those who consume fast food, 33.9% of male vs 27.7% of female participants eat fast foods once a week, while 11.3% male vs 3.3% of female participants eat daily.

Table 4.18: Frequency of fast-food consumption per week

Frequency of fast-food consumption	Male		Female		Total sample	
	n = 62	%	n = 274	%	n = 336	%
Do not eat	14	22.6	112	40.9	126	37.5
Once	21	33.9	76	27.7	97	28.9
Two times	7	11.3	40	14.6	47	14.0
Three times	9	14.5	23	8.4	32	9.5
Four times	4	6.5	14	5.1	18	5.4
Daily	7	11.3	9	3.3	16	4.8

Table 4.19 shows restaurants that HCWs usually buy and eat fast food from. The grouping of restaurants is done according to cooking methods used, for example, fried chicken. More than one-quarter of participants in both groups (at male= 25.8% vs female = 27%) usually eat food from fried chicken quick restaurants such as Kentucky fried chicken (KFC); 29% of male vs 31.8% of female participants usually eat food from grilled chicken quick restaurant such as *Gallitos*/chicken dust, while 25.8% male vs 7.7% female participants usually eat food from street vendors.

Table 4.19: Restaurants usually visited

Types of restaurants	Male		Female		Total sample	
	n = 62	%	n = 274	%	n = 336	%
KFC/Chicken Licken/Hungry Lion	16	25.8	74	27.0	90	26.8
Chicken dust/ Nandos/ Barceló's/ Gallitos/ Mochachos	18	29.0	87	31.8	105	31.3
Romans/ Debonairness/ Steers	11	17.7	42	15.3	53	15.8
Cooked food by street vendors	16	25.8	21	7.7	37	11.0
Cooked food from supermarkets	15	24.2	50	18.2	65	19.3

4.5.1.1. Nutrient intake

Table 4.20 shows participants' median nutrient intake, dietary reference intakes (DRIs) and nutrient reference values (NRVs) as classified in Gandy (2014:280), using a 95% confidence interval to significant difference. The median energy and protein intake are above the DRIs for both male and female participants. The median intake of total fat is below the DRIs for both male and female participants. Median cholesterol intake and carbohydrates intake is way above the DRIs in both male and female participants. Median total dietary fibre intake for male participants is below the DRIs, while total dietary fibre intake for female participants exceeds the DRIs. Micronutrients of public concern: the median intake of calcium, iron, sodium, vitamins A and C is below the NRVs. The median intake of folate is above the NRVs in both male and female participants, median zinc intake for male participants exceeds the NRVs, whilst median zinc intake in female participants is below the NRVs. Intake of nutrient above the 95% CI mean, also above the DRIs were energy, protein and fat.

Table 4.20: Nutrient intake

Nutrients	**Males**				**Females**			
Macro-nutrients	DRIs	Median	Mean±SD	95% Confidence Interval for Mean	DRIs	Median	Mean±SD	95% Confidence Interval for Mean
Energy (kJ)	9720	10550.71	11349.26±5764.41	CI [9885.37 to 12813.14]	8400	9127.90	10264.53± 6861.04	CI [9448.53 to 11080.53]
Total protein (g)	50	61.70	69.13±37.21	CI [59.68 to 78.58]	45	52.61	60.81±37.52	CI [56.35 to 65.27]
Total fat (g)	70	47.59	52.13±27.13	CI [45.24 to 59.02]	70	42.38	48.49±28.92	CI [45.05 to 51.93]
Cholesterol (mg)	11	140.62	182.50±195.60	CI [132.83 to 232.18]	11	119.01	169.48±179.32	CI [148.15 to 190.80]
Carbohydrate(g)	260	403.22	450.27±239.05	CI [389.56 to 510.98]	230	356.64	404.58±297.79	CI [369.16 to 439.99]
Total dietary fiber (g)	38	32.36	35.16±18.98	CI [30.34 to 39.98]	25	27.41	31.38±23.68	CI [28.56 to 34.19]
Micro-nutrients	NRVs	Median			NRVs	Median		
Ca (mg)	800	32.36	243.37±169.52	CI [200.32 to 286.42]	800	162.40	206.67±177.21	CI [185.59 to 227.75]
Fe (mg)	14	12.29	12.85±6.36	CI [11.23 to 14.46]	14	10.01	11.52±6.82	CI [10.71 to 12.33]
Na (mg)	1600	1147.48	1273.42±671.48	CI [1102.90 to 1443.95]	1600	1007.81	1150.36±739.46	CI [1062.41 to 1238.30]
Zn (mg)	10	11.45	13.00±6.63	CI [11.32 to 14.69]	10	9.93	11.37±7.33	CI [10.49 to 12.24]
Vitamin A (µg)	800	355.31	454.99±357.39	CI [364.23 to 545.75]	800	277.74	431.15±399.78	CI [383.60 to 478.69]
Folate (µg)	200	319.13	347.14±187.95	CI [299.41 to 394.87]	200	269.59	313.13±200.09	CI [289.33 to 336.92]
Vitamin C (mg)	80	12.11	46.15±95.10	CI [21.99 to 70.31]	80	15.85	44.94±119.99	CI [30.67 to 59.21]

4.5.2 Lifestyle habits

Table 4.21 shows the lifestyle score of participants, assessed by seven questions where very good indicates that participant is following all seven lifestyle habit recommendations correctly and very bad indicate that participant follows only one lifestyle habit recommendation or got only one correct answer. More than half of female (at 57.3 %) vs 38.7% of male participants had very good lifestyle habits, 19.4% of male vs 18.6% female participants had good lifestyle habits, and few of participants in both groups (at male = 6.5% vs female = 6.2%) had very bad lifestyle habits.

Table 4.21: Lifestyle habits score

Scoring		Male		Female		Total sample	
Interpretation	**Rating**	n = 62	%	n = 274	%	n = 336	%
Very good	7	24	38.7	157	57.3	181	54.1
Good	5 – 6	12	19.4	51	18.6	63	18.7
Fair	4	20	32.3	42	15.3	62	18.5
Bad	2 – 3	2	3.2	7	2.6	9	2.7
Very bad	1	4	6.5	17	6.2	21	6.3

Table 4.22 shows that 69.4% of male vs 72.6% of female participants eat three meals a day. Most participants in both groups consume breakfast daily (at male = 62.9% vs female = 74.5%). More than half of male (at 54.8%) vs 37.2% of female participants engaged in moderate exercise 2 to 3 times a week. The majority of participants in both groups (at male = 85.5% vs female = 90.1%) deso not smoke and the majority (at 88.0%) of female vs 59.7% of male participants does not consume alcohol.

Table 4.22: Lifestyle habits

	Male		Female		Total sample	
	n = 62	%	n = 274	%	n = 336	%
Eating three meals a day	43	69.4	199	72.6	242	72.0
Eating breakfast daily;	39	62.9	204	74.5	243	72.3
Engaging in moderate exercise 2 – 3 times a week;	34	54.8	102	37.2	136	40.5
Getting adequate sleep (7 – 8 hours per night);	45	72.6	214	78.1	259	77.1
Not smoking	53	85.5	247	90.1	300	89.3
No alcohol consumption	37	59.7	241	88.0	278	82.7
Maintaining a moderate/normal weight	43	69.4	144	52.6	187	55.7

4.6 Nutritional knowledge

Nutritional knowledge was assessed using the South African food-based dietary guidelines and knowledge on food fortification programmes. The overall level of nutrition knowledge is indicated in Table 4.23. The majority of participants in both groups (at male = 80.7 vs female

= 83.6%) had fair and poor nutritional knowledge. Few participants in both groups (at male = 19.4% vs female = 16.5%) had good nutritional knowledge.

Table 4.23: Level of nutritional knowledge

Knowledge score (%)	Interpretation	Male		Female		Total sample	
		n = 62	%	n = 274	%	n = 336	%
0 - 29.9	Poor	12	19.4	50	18.3	62	18.5
30 - 49.9	Fair	38	61.3	179	65.3	217	64.6
50 - 69.9	Good	10	16.2	31	11.4	41	12.2
70 - 89.9	Very good	2	3.2	14	5.1	16	4.8
90 – 100	Excellent	0	0	0	0	0	0

Table 4.24 shows the breakdown of nutrition knowledge of participants and it focuses on correct answers. More than a third in both groups (at male = 34% vs female = 35%) was aware that people should consume a variety of foods. A total of 15% male and 20% female participants knew the portion size of fruits to be served per day. Less than a quarter of participants in both groups (at male = 21% vs female = 23%) knew that starchy foods should be part of most meals. About 60% of participants in both groups have adequate knowledge of physical activity (at male = 60% vs female = 56%). More than half of participants in both groups knew that fat should be used sparingly (at male = 61% vs female = 54%). Almost all participants in both groups (at male = 100% vs female = 96%) knew that they should drink lots of clean, safe water daily.

Table 4.24: Knowledge on the South African food-based dietary guidelines

Question and response	Male		Female		Total sample	
	n = 62	%	n = 274	%	n = 336	%
Describe the SAFBDGs. **Answer**: Bases of healthy eating and encourages inclusion of a variety of foods such as milk, meat, vegetables, fruits, carbohydrates and fat. It also promotes a healthy lifestyle to prevent non-communicable diseases.	2	3.2	18	6.6	20	6.0
What does a variety of food mean? **Answer**: Different kinds of food, with different nutrients, colours and consistency.	21	33.9	95	34.7	116	34.5
How many portions of fruits and vegetables should be eaten daily? **Answer**: Eat plenty of vegetables and fruits every day, 5 portions or more	9	14.5	54	19.7	63	18.8
Mention one food group that should be part of most meals. **Answer**: Starch	13	21.0	62	22.6	75	22.3
Add other protein food to fish, chicken and lean meats that can be consumed daily. **Answer**: Eggs	26	41.9	119	43.4	145	43.2
How often should sugar, foods and drinks high in sugar be consumed? **Answer**: Sparingly	47	76	186	55.4	233	693
How often should one engage in physical activities in a week? **Answer**: Exercise for at least 30 minutes a day or three to four times a week.	37	59.7	152	55.5	189	56.3
How often should fats be used? **Answer**: Sparingly	38	61.3	148	54.0	186	55.4
What is the healthier option for fat? **Answer**: Plant fats	39	62.9	180	65.7	219	65.2
What is the daily recommended amount of salt consumption? **Answer**: 5 grams	8	12.9	37	13.5	45	13.4
Which drink should be consumed daily in large quantities? **Answer**: Water	62	100.0	264	96.4	326	97.0

Table 4.25 shows the knowledge of participants on food fortification programme and the table includes participants who knew the correct answers only. Participants who knew the correct answers are 21 male participants (at 32.3%), 149 female participants (at 54.3%) and total participants of 170 (at 50.6%). Very few participants in both groups (at males = 8.1% vs females = 13.1%) knew and could describe food fortification process, while 16.1% of male vs 29.2% of female participants could give two correct examples of fortified food items, e.g., bread and porridge. Ten percent (10%) of male and 11.6% of female participants could give only one correct example of a fortified food item.

Table 4.25: Knowledge on the South African food fortification programme

Question and answer	Male		Female		Total sample	
	n = 62	%	n = 274	%	n = 336	%
Food fortification description. **Answer:** Is the process of adding micronutrients such as iron, folate and B-vitamins in food items	5	8.1	36	13.1	41	12.2
Two correct examples of fortified food. **Answer**: Maize meal, bread flour, rice, salt, bread and porridge.	10	16.1	80	29.2	90	26.8
One correct example of fortified food. **Answer**: Maize meal, bread flour, rice, salt, bread and porridge.	6	9.7	33	12.0	39	11.6

4.7 Health status and association with gender

Metabolic syndrome risk indicates health status, no metabolic syndrome risk is good health status and metabolic risk syndrome is poor health status. Findings in figure 4.1 show an association between gender and BMI status. The findings show a significant association between gender and BMI (p =0.0001). Most of the female participants (at 69.6%) were obese, while 7.7% have normal weight. Just over a quarter of the male participants (at 25.8%) was obese and 30.6% had normal weight.

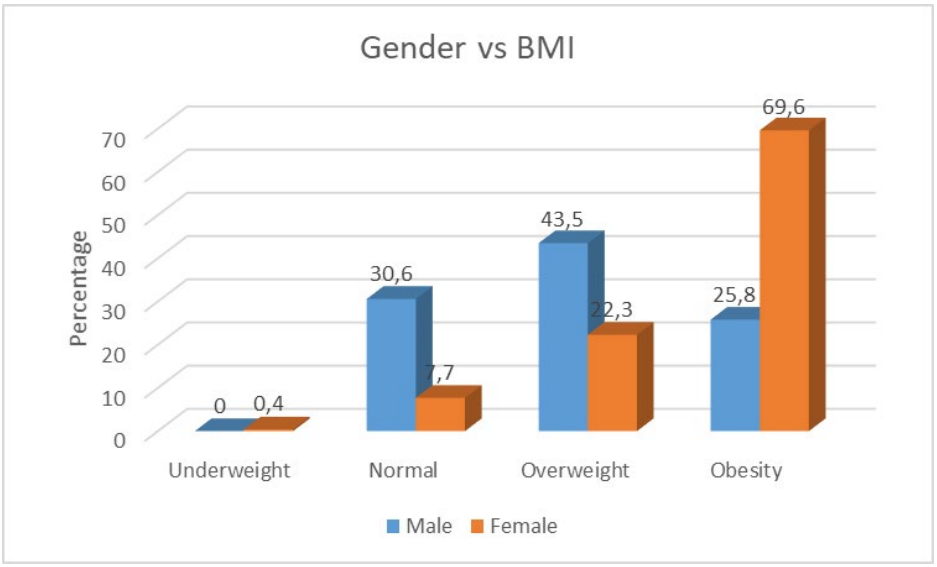

Figure 4.1: Association between gender and BMI status

- The findings show no association between the number of meals eaten in a day and biomedical and clinical parameters (p=0.673), BMI (p=0.589) and body fat percentage (p=0.764).
- The findings show no association between lifestyle and biochemical and clinical parameters (p=0.535), BMI (p=0.701), body fat percentage (p=0.678), and waist circumference (p=0.968).
- Cross tabulation shows an association between the number of meals and metabolic syndrome (p=0.673), BMI (p=0.589) and body fat percentage (p=0.764). The findings show no association between meals eaten at breakfast, while at work and metabolic syndrome (p=0.065), BMI (p=0.034), body fat percentage (p=0.833); and, lastly, waist circumference with (p=0.277).
- The findings show no association between the number of meals eaten in a day and biomedical and clinical parameters (p=0.673), BMI (p=0.589) and body fat percentage (p=0.764).
- Metabolic syndrome risk indicates health status, no metabolic syndrome risk is good health status, and metabolic risk syndrome is poor health status.
- The cross-tabulation analysis shows no association between nutritional knowledge and metabolic syndrome (p=0.560), BMI (p=0.550), body fat percentage (p=0.260) and waist circumference (p=0.620).

Figure 4.2. findings show an association between gender and predators of metabolic syndrome (p =0.000). Most of the female participants (at 62%) were at risk of predators of metabolic syndrome vs 30.6% of male participants (p =0.000). More than two-thirds of male

participants (at 69.4%) were not at risk for metabolic syndrome as compared to 38% of female participants (p =0.000).

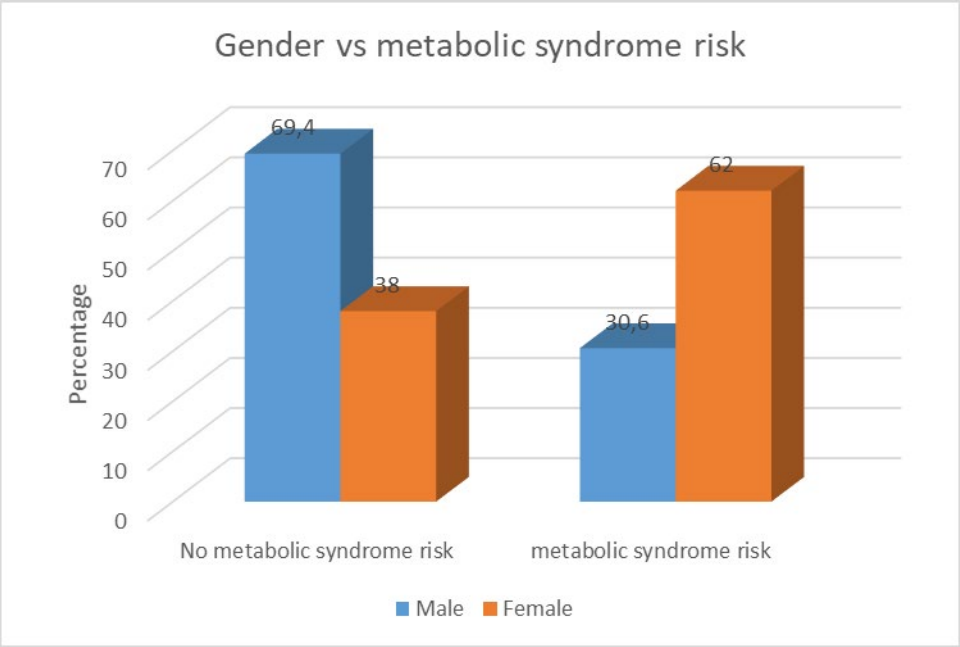

Figure 4.2: Association between gender and health status

4.8. Relationship between nutritional practices and health status

Figure 4.3 shows an association between nutritional status and health status (p = 0.004). Good nutritional practices, which are consumption of an adequate number of meals per day and good nutritional practice of minimum fast-foods consumption in a week, are related to an increased percentage of good health status (meals eaten per day = 70%; eating of fast foods = 42.9%) (p = 0.004). Participants with poor nutritional practices (meals eaten per day = 30.1%; eating of fast foods = 19.7%) have poor health status. The results show a relationship between nutritional practices and health status (p = 0.004).

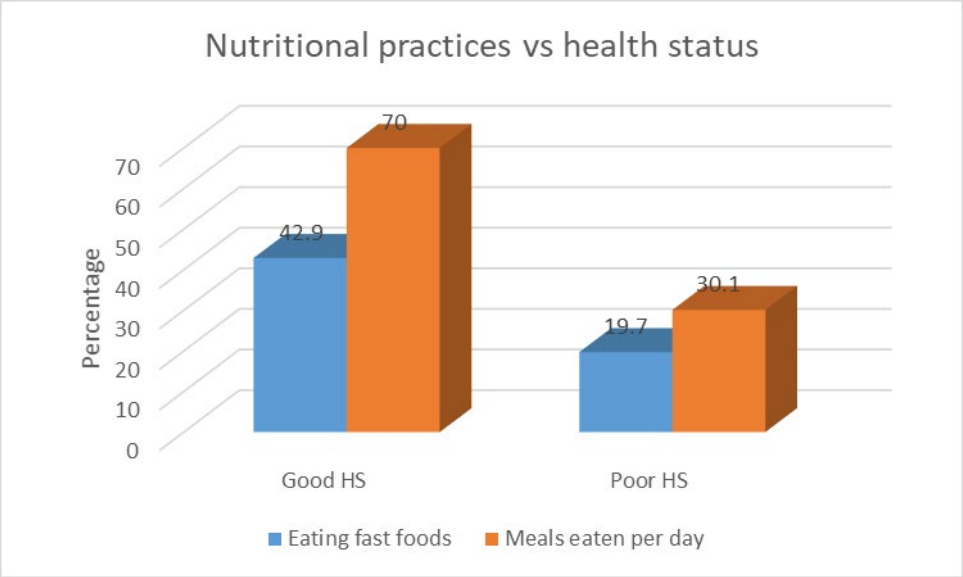

Figure 4.3: Two items of nutritional practices vs health status

The cross-tabulation analysis shows no association between nutritional knowledge and health status (p=0.560) as well as lifestyle habits and health status (p = 0.535).

CHAPTER 5
DISCUSSION OF THE RESULTS

5.1 Introduction

Findings of the study are discussed in this chapter and those findings are also compared with those of other studies. The discussion is guided by the results presented in the previous chapter and covers socio-demographic information, self-reported family history of diseases, self-reported disease profile, anthropometry status, biochemical parameters, clinical parameters, dietary patterns, nutrient intake, lifestyle habits and nutritional knowledge.

5.2 Socio-demographic information

In the current study, the majority of participants was female (at 82%) and very few were males (at 18%). This is not surprising as the majority of health professionals are females. The health care profession is dominated by females as society view caring for the sick as a women's job. This was also supported by the South African nursing council (2014) statistics, whereby they reported that 94% of nurses was female. Similar observations to the current study were made by Kunene and Taukobong (2017) in the Kwa-Zulu Natal district hospital wherein 83% of participants was females. The study by Goon *et al.,* (2013) and Adeoye *et al.* (2015) indicated that more than two-thirds of HCWs in the Limpopo province (at 68%) and Nigeria (at 67.2%) were females. These findings in the current study and previous studies show that the majority of HCWs are women.

The age of participants in the current study ranged from 23 to 63 years and they have 42.4±9.9SD mean age. A similar observation was made in the study done in Nigeria where the mean age of participants was 42.03±9.4 years, between 27 and 55 years (Adeoye *et al.,* 2015). The results of the current study reflect the acceptable employment age in South Africa as people enter the employment market at the age of 22 years and above. This links to the South African labour guide number 55 of 1998 that states that the minimum age for hazardous work which is likely to harm the health, safety and morals of children is 18 years. The age of participants in the current study complies with the South African Labour Act (75 of 1997), as amended: Section 43(1). A study conducted by Muluvhu (2019) in the Vhembe district also worked with participants from age 24 to 65 years, which is similar to the current study. These findings of the current and previous studies are in line with the South African labour law, which indicates that people should retire at the age of 65 years or below.

The majority of participants in the current study had undergraduate qualifications as it is the minimum requirement for health care professionals. However, very few participants in the

current study had acquired postgraduate qualifications. The majority of participants in the study was nurses, and this profession has several categories, including those that only require a certificate or a diploma to practice, hence the results of the current study indicate that most participants had certificates and diplomas. The current study is comparable to a study done in the Kwa-Zulu Natal province where participants had certificates, diplomas, bachelor's degrees and postgraduate diplomas (Peltzer, 2004).

In the current study, the majority of participants (at 70%) was nurses, 21% was Allied health care staff and 10% was medical officers and dentists. A similar observation was made in the Mpumalanga province where 69.5% of participants was nurses, 21.4% was Allied health care staff and 9% was Medical officers (Phetla & Skaal, 2017). Kunene and Taukong (2017) reported that 57% of participants was nurses, 25% was Allied health care staff and 15% Medical officers in the Kwa-Zulu Natal province. These findings in the current and previous studies reflect that the majority in the health care workforce is nurses when compared to other categories of HCWs.

5.3 Self-reported disease profile of participants

Mahan and Escott-Stump (2021:273) indicated that co-existing hypertension and diabetes mellitus in participants reduce the quality of life, as they are risk factors for metabolic syndrome. Furthermore, the consequences of metabolic syndrome increase the risk of heart disease, stroke and Type 2 diabetes mainly due to excess body fat around the waist and abnormal cholesterol or triglyceride levels (Mahan & Escott-Stump, 2012:273). Very few participants in the current study reported suffering from hypertension (at 20%) and diabetes mellitus (at 7%). A similar trend was observed in the study done by Phetla and Skaal (2017) where participants in Mpumalanga reported suffering from hypertension (at 14%) and diabetes mellitus (at 7%). Muluvhu *et al.,* (2019) found that 25% of participants in the Vhembe district municipality were suffering from hypertension. Findings from literature reported fewer people who suffer from hypertension and diabetes mellitus as shown in the current study.

5.4 Health status

Health status is a multidimensional concept, requiring multiple indicators, quality of life and perceived health (Turner, 2016). In this study, health status covers the anthropometric status and metabolic syndrome, which are discussed in this section.

5.4.1 Anthropometric status

Results of the current study show that 70% of female participants and 60% of total participants are obese looking at the body fat percentage and the BMI. The current study indicates an

association between gender and BMI status (p = 0.00). The study further shows that just above one-quarter of male and 70% of female participants were obese according to BMI. Similar results were observed in the Western Cape, South Africa, where 70% of female participants was obese (Schouw *et al.,* 2018).

One-quarter of the total participants in the current study were overweight of which 43.5% was male and 22% was female participants. A similar observation was made in previous studies conducted in the Capricorn and Vhembe districts where 27% of participants was overweight (Goon *et al*., 2013; Muluvhu *et al.,* 2019). Dalais *et al.* (2014) made a similar observation where 27.7% of participants in the Western Cape province was overweight. The study done in the Letaba municipality by Mbhenyane *et al.* (2017) reported that 31% of participants was overweight, which is slightly higher when compared to the results of the current study. These findings show that the prevalence of overweight is of a public health concern as it is widely acknowledged that being overweight is associated with an amplified risk of diseases, particularly if body fat is deposited within the abdomen (WHO, 2019). The odds of being overweight were noted among participants in the current study. Overweight and obesity are serious public health problems that impact the health of the population globally (Villies *et al.,* 2014). WHO (2016) reported that one in six adults is obese and up to 20% of the population in high income countries may suffer from obesity. Approximately 6.2 million South Africans are overweight and obese (Schouw *et al*., 2018). More than two-thirds of South African women (at 68%) are overweight or obese (SADHS, 2016). The study done earlier by Goon *et al.* (2013) observed that 79% of nurses in the Vhembe and Capricorn districts was obese. Muluvhu *et al*. (2019) reported that 61% of municipality employees in the Vhembe district was overweight and obese. A similar observation was made in the current study where 69.6% of female and 25.8% of male participants were obese. The study done in the greater Letaba municipality by Mbhenyane *et al.* (2017) reported that 52% of female participants was obese. On the contrary, findings of the study conducted in the Mpumalanga province shows only 20% of female participants was obese (Phetla & Skaal, 2017). From the above-reported studies, the researcher observed that overweight and obesity seem to be a challenge among women in the Limpopo province. These observations can be attributed to physical inactivity, consumption of foods high in sugar and fats, and, lastly, consumption of large portion sizes. It is culturally acceptable for women to be overweight or obese as it is associated with enjoying life or marriage.

The prevalence of underweight was identified among 0.4% of female participants only. Similar observations were found by the SADHS (2016) that indicated that 3% of South African women are underweight. South African men are more likely than women to be underweight (at 10%)

and less likely to be overweight or obese (at 31%) (SADHS, 2016). Women model themselves on the current beauty ideal than men and women are influenced by the current ideal of slenderness than their male counterparts. Regardless of women being underweight, they are more frequently dissatisfied with their body weight and consider themselves heavier than they actually are (Kiefer *et al*., 2000).

Most of the female participants in the current study had abdominal obesity or high WC and 24% were male participants. Similar observations were done in Littoral region of Cameroon where 71.2% of the total participants had elevated abdominal obesity, which made them be at high risk of developing metabolic syndrome (Tachang *et al*., 2012). A similar observation in female participants was made in Latinos of central America where 96% of female participants had abdominal obesity (Heiss *et al*., 2014). Other similar observations were done in the Western Cape, South Africa where 94% of obese participants had higher WC (Villies *et al*., 2014). Females have high WC, which, together with BMI, explain the anthropometric status of participants, which was high. The study by Muluvhu *et al., (*2019) in the Vhembe district also observed that 100% of females had high WC. High WC indicates android obesity and is the risk factor for metabolic syndrome and CVDs (Gandy, 2014:728). It is conceivable that those who eat more can have higher WC, even if it goes against my apriority expectations. Causes for these findings might be the consumption of large portion sizes during meal times, types of food that participants consume such as high fat and high sugar.

In the current study, 7.7% of female participants was of normal weight when compared with 30.6% of male participants. These results show that the majority of women has challenges in maintaining normal body weight. Women worry about their body image yet they fail to maintain a normal weight, which can be due to body composition because of fat deposits mainly around the abdomen: presumably energy reserves to support the demands of pregnancy and lactation (Escott-Stump, 2015:853). These affect their body weight because not every woman can lose additional body weight, which was gained during pregnancy. Furthermore, females have full access to food and they can eat anything at any time. Women are responsible for meal preparation, they can eat during cooking and also give themselves larger portion sizes when dishing food for all family members. Normal body weight of men is because their body structure does not have additional fat due to absence of breasts, absence of female hormone and fat for pregnancy preparations (Bredella, 2017).

5.4.2 Biochemical and clinical measurements

The current study indicated that above one-third of the total participants (at 37.8%) had glucose above the normal range. Elevated blood glucose levels cause long-term

complications in Type 2 diabetes, just as in Type 1 diabetes and are also the high-risk indication of developing diabetes mellitus (Mahan & Escott-Stump, 2012:771-3). The high blood glucose status of HCWs in the study is higher than the one for primary school educators in Cape Town (Dalais *et al.,* 2014).

A standard lipoprotein profile report includes measurement of total cholesterol, LDL cholesterol, HDL cholesterol and total triglycerides levels. The current study indicates participants (at male = 8.1% vs female = 18.2%) who had high triglycerides. Triglycerides abnormalities are the most prevalent type of dyslipidaemia in Northeast China (Zhang *et al.,* 2018). Hypertriglyceridemia parameter was measured and was found in 47–57% of men and 44–48% of women which is more than the results of the current study (Bruckert, 2021). Elevated triglycerides often accompany low HDL cholesterol (Ker, 2016).

The current study shows that 25.8% of both male and female participants had non-desirable (low) HDL cholesterol, comparable to the study in Paris among adults, where low HDL-cholesterol was present in 33% of female and 40% of male participants (Bruckert, 2021). Non-desirable HDL is a risk factor for heart-related diseases, its protection factor is anti-inflammatory. Health challenges of high cholesterol are tied to diabetes and high blood pressure, also linked with a higher risk of CVDs that include coronary heart diseases, stroke and peripheral vascular diseases (Lawes, 2010). Few participants in the current study had non-desirable total cholesterol (at 14.5% of males vs 32.5% of females) total cholesterol levels that are too high or too low are non-desirable and not healthy because it increases the risk of coronary artery disease.

About one-third (at 32.3%) of male and 54.4% of female participants had a higher range of LDL, which is an independent risk factor for CHD and is most common in metabolic syndrome (Escott-Stump, 2015:771-773). The current study indicates that 8.9% of total participants had high systolic pressure and 14.6% of total participants had high diastolic pressure, which is very low when compared to 50.3% of primary school educators in Cape Town, South Africa, who had high blood pressure (Dalais *et al.,* 2014). Systolic blood pressure is the blood pressure during the contraction phase of the cardiac cycle. In the current study, less than 20% of participants in both groups (at male = 16.9%; female = 17.5%) had high systolic blood pressure. Participants with high systolic blood pressure are most likely to have myocardial infarction or stroke and are associated with increased incidence of CVDs and renal diseases (Escott-Stump, 2015:866).

Metabolic syndrome predators is a cluster of metabolic abnormalities that includes hypertension, central obesity, insulin resistance, and atherogenic dyslipidemia (Rochlani, 2017). In the current study, 30.7% of male participants and 59% of female participants are at high risk of developing metabolic syndrome. Metabolic syndrome is strongly associated with an increased risk of developing atherosclerotic CVDs (Escott-Stump, 2015:579). The current study indicates that female participants are at higher risk of metabolic syndrome than males ($p = 0.000$). A similar observation was done in Nigeria where females had a higher frequency of metabolic syndrome (at 34.9%) compared with males counterparts (at 2.4%) (Adeoye *et al.,* 2015). The findings of the current study show an association between gender and metabolic syndrome risk ($p = 0.00$), where 62% of female participants have a risk of metabolic syndrome as compared to 30.6% of male participants. A similar study was observed in Botswana showing a strong association between female gender and high prevalence (at 55.7%) of the presence of Metabolic Syndrome (Garrido *et al*., 2009).

5.5 Nutritional practices

Good nutrition practices are an essential component of efforts to prevent or control diseases such as atherosclerosis, cancer, hypertension, diabetes, and osteoporosis (Thomas, 2020). Health care workers should respond to these increasing needs to decrease diseases as most of those conditions are risk factors for metabolic syndrome. Discussion in this section covers dietary patterns, nutrient intake and lifestyle habits.

5.5.1 Dietary patterns

Preparing meals is one of the primary components of household work and traditionally has been the responsibility of women. Flagg *et al.* (2013) reported that women are also tasked with learning individual family members' food preferences, meal preparation techniques, planning meals, serving meals and cleaning up after meals. The observation made from the current study is in line with the social and cultural norms where women are responsible for meal preparation. Hence the majority of female participants and less than half of male participants in the current study were responsible for preparing their meals. Furthermore, most male participants had reported that their spouses or household helpers were responsible for meal preparation. These findings reveal that the majority of females in the current study was responsible for meal preparation as it is reviewed culturally as one of the women's primary household chores.

In the current study, a significant number of participants both males (at 46%) and females (at 42%) skipped meals, more especially when they are at work. Kunene and Taukobong (2017) observed that 51% of the HCWs in the Kwa-Zulu Natal province skipped breakfast. On the

contrary, only 10% of participants in the current study skipped breakfast. The main reason for skipping meals given by participants in the current study was being busy with work or being unable to prepare meals themselves. Unhealthy eating habits such as skipping meals are among the leading critical risk factors for many diseases globally, and HCWs play a serious role in the health and well-being of the general population (Kunene & Taukobong, 2017). The health of South Africans depends on this sector of work force and, as such, they should be the drivers of healthy living for all (Phetla & Skaal, 2017).

In the current study, the majority of participants eat home-prepared meals (viz., breakfast and lunch) while at work. This is in line with the demographic location of where participants reside within the municipality, based on the vastness of the rural populace. The Makhado local municipality was reported to be predominately rural (Makhado local municipality, 2019), which contributes to the majority of participants eating home-prepared meals as they have limited food choice from where they can buy when at work as some health facilities are in remote areas. However, few of both males and female participants reported eating take aways or fast foods for breakfast and/or lunch while at work. One-quarter of male participants usually buys food from street vendors or supermarkets such as Spar and Shoprite compared to very few female participants.

5.5.2 Nutrient Intake

Each type of DRI refers to the average daily nutrient intake of individuals over time. The DRIs apply to the healthy population and HCWs fit well in this category because they were all assessed while at work. In the current study, both male and female participants are exceeding median DRIs for energy, protein, carbohydrates and cholesterol. High consumption of energy, protein, carbohydrates and cholesterol is a risk factor for being overweight, obese and increased risk of colon cancer and cardiovascular diseases (Wellman & Kamp, 2014).

In the current study, male participants had a lower intake of dietary fibre when compared to their female counterparts who exceeded DRIs. Low intake of fibre is the other risk factor of developing colon cancer as indicated in Escott-Stump (2015:894). Dietary fibre also helps to maintain bowel health, lowers cholesterol levels, helps control blood sugar levels, aids in achieving a healthy weight and can help participants to live longer (Dodd & Bayerrl, 2015).

In the current study, both male and female participants do not meet the NRVs for micro-nutrient of public concern such as iron and vitamin A. Low iron intake may result in iron deficiency anaemia leading to fatigue, weakness, dizziness and shortness of breath (Gandy *et al*., 2014:95,927), which could affect the overall health of HCWs and service delivery to

patients. In the current study, vitamin C consumption of both male and female participants is below the NRVs, these worsen iron deficiency anaemia as the absorption of iron is compromised. In addition, a persistent lack of vitamin C in the diet can lead to a condition called scurvy, which causes tiredness, weakness, muscle and joint pains in participants (Carr, 2020).

The relationship between anthropometric status and nutrient intake indicates the majority of participants who had lower than adequate nutrient intake (at 67.3%–100% of recommendation), participants with normal weight had a higher intake of all nutrients ($p<0.05$), energy was significantly high in obese and overweight participants (Alam *et al.,* 2011). Mertens *et al*. (2017) indicated nutrient intake of British population as follows: total energy intake, kcal/day 1989.8 +/- 529.0, 35.7g average; fat g/day (%TE) 79 +/- 24.1; carbohydrates g/day (%TE) 238.0 +/- 70.4 (47.8 average; protein 12g average; fibre g/day 20.6+/- 6.5; and sodium mg/day 2327.0 +/- 615.8. The unique nutrition transition is the shifts in diet and activity patterns that determine the speed and timing of changes in body composition (Popkin *et al*., 2012). Steyn and Mchiza (2014) indicated that overall socioeconomic status, gender, age, parity, physical inactivity, and increased energy, fat and sugar intake are powerful predators of obesity. Most HCWs in the Makhado municipality are obese, followed by overweight and very few have normal weight.

5.5.3 Lifestyle habits

A healthy lifestyle is a way of living that lowers the risk of being seriously ill or dying early, not all diseases are preventable, but a large proportion of deaths, particularly from coronary heart disease can be avoided (WHO, 2015). Health care workers are role models in their communities and should be champions of a healthy lifestyle (Phetla & Skaal, 2017). The findings of the current study indicate 38.7% of male and 57.3% of female participants had very good lifestyle habits. Living a healthier lifestyle means fewer health problems and a lower risk of developing diseases of the lifestyle such as CVDs. Participants with very good lifestyle habits have better mental health and improved mood, they also save money because eating junk food, smoking and drinking sugary drinks or alcohol are all expensive habits. Furthermore, above half (at 54.1%) of the total study population had very good lifestyle habits, followed by those who had good and fair lifestyle habits.

Sehole and van Der Heer (2017) reported South Africa to be undergoing epidemiological transition where communities are adopting unhealthy lifestyles associated with consumption of typical westernized diet, physical inactivity, tobacco use as well as the use of harmful alcohol. The participants of the current study also show trends of very bad lifestyle habits

such as physical inactivity, where only 54.8% male and 37.2% female participants engage in moderate exercise two to three times a week. These lifestyle habits put people at higher risk of developing non-communicable diseases like hypertension and heart diseases. Non-communicable diseases are cause of concern, even though only 6% of the total sample engaged in very bad lifestyle habits.

Pollard *et al.* (2015) found that conversely, smokers than non-smokers have a high intake of nutrients such as dietary fibre from fruits and vegetables. Adults who do not smoke and do not consume alcohol, consume a healthy diet and engage insufficient physical activity substantially reduce their risk for early death (Ford *et al.,* 2014). The current study shows that the majority of participants (with male = 85.5%, female = 90.1%) does not smoke; and 59.7% male and 88% female did not consume alcohol. These findings mean that HCWs in the current study are at a lesser risk of developing non-communicable diseases such as stroke and CVDs.

5.6 Nutritional knowledge

Both male (at 80.7%) and female (at 83.6%) participants in the current study had fair and poor Nutritional Knowledge. The health implication of the observation is that participants have challenges in adjusting their diet and eating patterns for health and wellbeing, which can lead to misconceptions regarding actual body weight status and health challenges (Dalais, 2014). The current study clearly shows that there is an undeniable misalignment of HCWs actual and perceived nutritional knowledge, they say they are knowledgeable but most of them are not knowledgeable (Parker *et al.,* 2010). A similar observation was done in the Western Cape, South Africa where participants had insufficient nutritional knowledge (Dalais *et al.,* 2014). These findings indicate gaps in nutritional education on HCWs, although others might have been educated, they might be ignorant or selective on what to know because at health care facilities there are opportunities to receive nutrition information. The current study also found few participants with good nutritional knowledge (with male = 16.2% vs female = 11.4%), which confirms that HCWs can be knowledgeable about nutrition. Medical and nursing education lack adequate practical nutrition training to fit in the clinical reality that HCWs face, such deficit creates HCWs with poor nutrition knowledge (Sunguya, 2013).

5.7 Association of health status and nutritional practices

Aspects of nutritional practices are associated with health status where most participants (at 70%) had good health status in the current study ($p = 0.000$). Participants who eat three meals or more per day are perceived to eat small frequent meals, which is promoted by nutrition fraternity and it also improves the metabolic rate, preventing the body to have access to nutrient stores, especially fat which increases overweight and obesity (Escott-Stump,

2015:385). Eating fast foods more than twice a week is linked with the consumption of excess fat, sugar and salt, which causes deterioration of health (Van den Berg *et al.,* 2015). Results of the current study confirm the theory that says consumption of fast food more than once a week is linked to a higher risk of obesity, while eating fast food more than twice a week was associated with a higher risk of metabolic syndrome, type 2 diabetes and death from coronary heart disease (Dingman *et al.,* 2014).

5.8 Study limitations

Participation in the study was voluntary and participants could withdraw from the study at any time. As a result of voluntary participation, 6.3% of the 336 participants refused to be pricked even after the researcher had explained the importance of measuring biochemical parameters to each participant. The researcher was hoping that participants who received the explanation would be convinced and thus allow to be pricked, but some agreed and some did not. The participants who refused to be pricked to assess other biochemical measurements of the non-fasting sugar level agreed to be taken finger prick blood sample of non-fasting sugar level and their questionnaires were compliant.

Non-fasting glucose was measured after two to three hours of eating. Non-fasting tests do not require a person to fast beforehand and a test is administered to determine the average blood sugar level of an individual over a period of two to three months to indicate whether or not a person is prediabetic or diabetic. The current research was not a follow-up study.

Health status assessed by metabolic syndrome parameters should be measured on three different occasions or three times on different days in order to diagnose participants with metabolic syndrome. The current study focused on determining the risk of developing metabolic syndrome by measuring metabolic syndrome parameters once.

CHAPTER 6
CONCLUSION AND RECOMMENDATIONS

6.1. Introduction

This chapter presents the conclusion and recommendations of the study. The purpose of the study was to determine the nutritional practices and health status of health care workers in Makhado local municipality, South Africa.

6.2. Conclusion

The socio-demographic data of the present study was comparable to that in other studies done in developing or rural areas. Like any other HCWs, the participants had diplomas and degrees; and most of them had five years and more experience working in public health facilities. Furthermore, a considerable number of participants were married. The majority of participants was nurses, which reflects the profile of HCWs in most health facilities.

Very few study participants had a normal BMI status, and 0.4% were underweight. Most female participants were obese and few were overweight compared to their male counterparts. The majority of obese participants has higher waist circumference and they also have an obese body fat percentage, followed by those who were overweight. The prevalence of abdominal obesity (at 72.0%) is equivalent to obese body fat percentage (at 67.6%).

Abnormalities of biochemical measurements in participants are reflected in the risk of metabolic syndrome, also known as health status, which is concluded to be poor among participants of the current study. Very few participants had normal blood glucose (less than 20%), while less than 50% of participants had abnormalities in clinical measurements.

Dietary patterns of HCWs in the present study shows that the majority of participants prepare their meals and they usually eat home-prepared foods. Few of the participants consume food from fast-food restaurants more than twice per week. A considerable number of HCWs in both genders skipped meals while at work, where 37% male and 25% females skipped meals mostly because of lack of appetite and busy work schedule.

A majority of participants showed to have good and very good lifestyle habits. Most of the participants who were overweight considered themselves to have a normal weight. The current study illustrates that lifestyle habits of the participants are not linked to the risk of developing metabolic syndrome. Most participants are at risk of metabolic syndrome, females being more at risk than males. The risk of developing metabolic syndrome in total study

participants (58.2%) is equivalent to the prevalence of obesity in the same study participants (59.6%). The study concludes that being obese is one of the risk factors that predispose a person to metabolic syndrome. The majority of study participants has poor health status and they are at risk of developing preventable diseases of the lifestyle mostly NCDs.

The current study shows consumption of macro-nutrients (i.e., energy, protein and carbohydrates) that exceeds the DRIs among both male and female participants. High consumption of macro-nutrients places participants at a high risk of being overweight and obese. The current findings show less consumption of sodium which is below the NRVs, indicating an excellent practice for the reduction and management of high blood pressure/hypertension.

More than half of participants in both male and female groups had fair nutritional knowledge and around 20% had poor nutritional knowledge. Results of nutritional knowledge conclude that most HCWs in the Makhado local municipality do not have good nutritional knowledge, have high nutrient intake, average nutritional practices and poor health status.

Regarding the association of variables in the study, findings show an association between gender and body fat percentage; waist circumference and gender; and metabolic syndrome and gender.

6.3 Recommendations

The key recommendation is to prevent gradual weight gain over time by making small decreases in food and beverage calories. To increase physical activities because health is an individual responsibility.

Other recommendations are as follows:

- Health care workers should lead by example in healthy eating and lifestyle habits to the community. Nutrition professionals should coordinate employee awareness and wellness programs across health facilities where they are based to ensure total coverage of nutritional aspects, such as, promoting consumption of indigenous foods; and increased consumption of vegetables and fruits to reduce overweight and obesity that are prevalent among HCWs;
- Cafeterias inside health facilities, especially hospital premises in the Makhado local municipality health facilities, should regularly be trained by dietitians and

food-service managers on healthy meal options and preparations to promote healthy eating in the work place and the provision of healthy meals;

- The current study focused on HCWs, who were professionals, other researchers should conduct studies on the topic focusing on professional workers and the general population from health facilities in the Makhado local municipality and/or different areas;
- The district and municipality health offices should have a policy on health and nutrition in-service training to empower HCWs; and
- Nutrition professionals should conduct in-service training regularly to address the identified gap in HCWs, aiming at improving the quality of their nutritional practices and health status.

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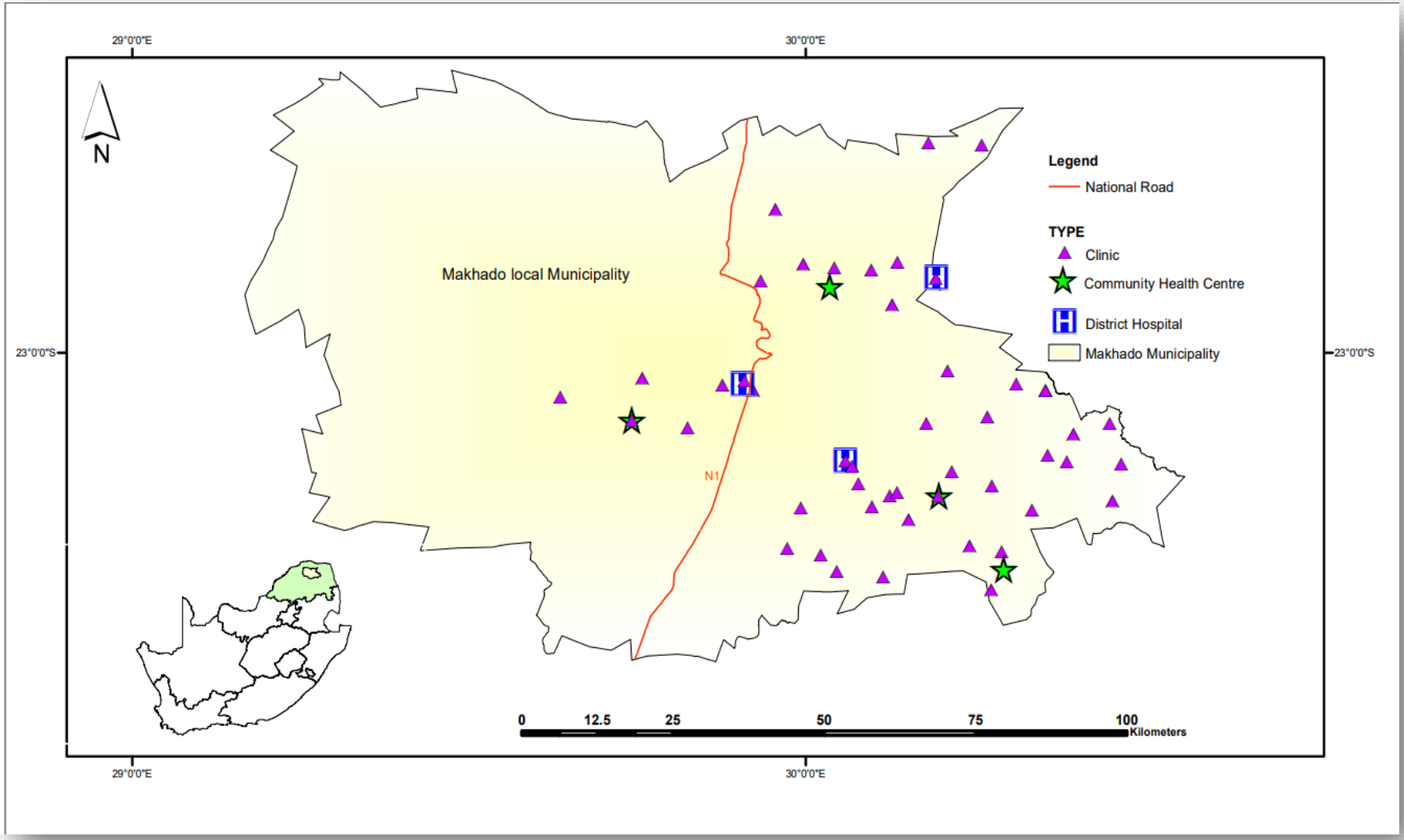
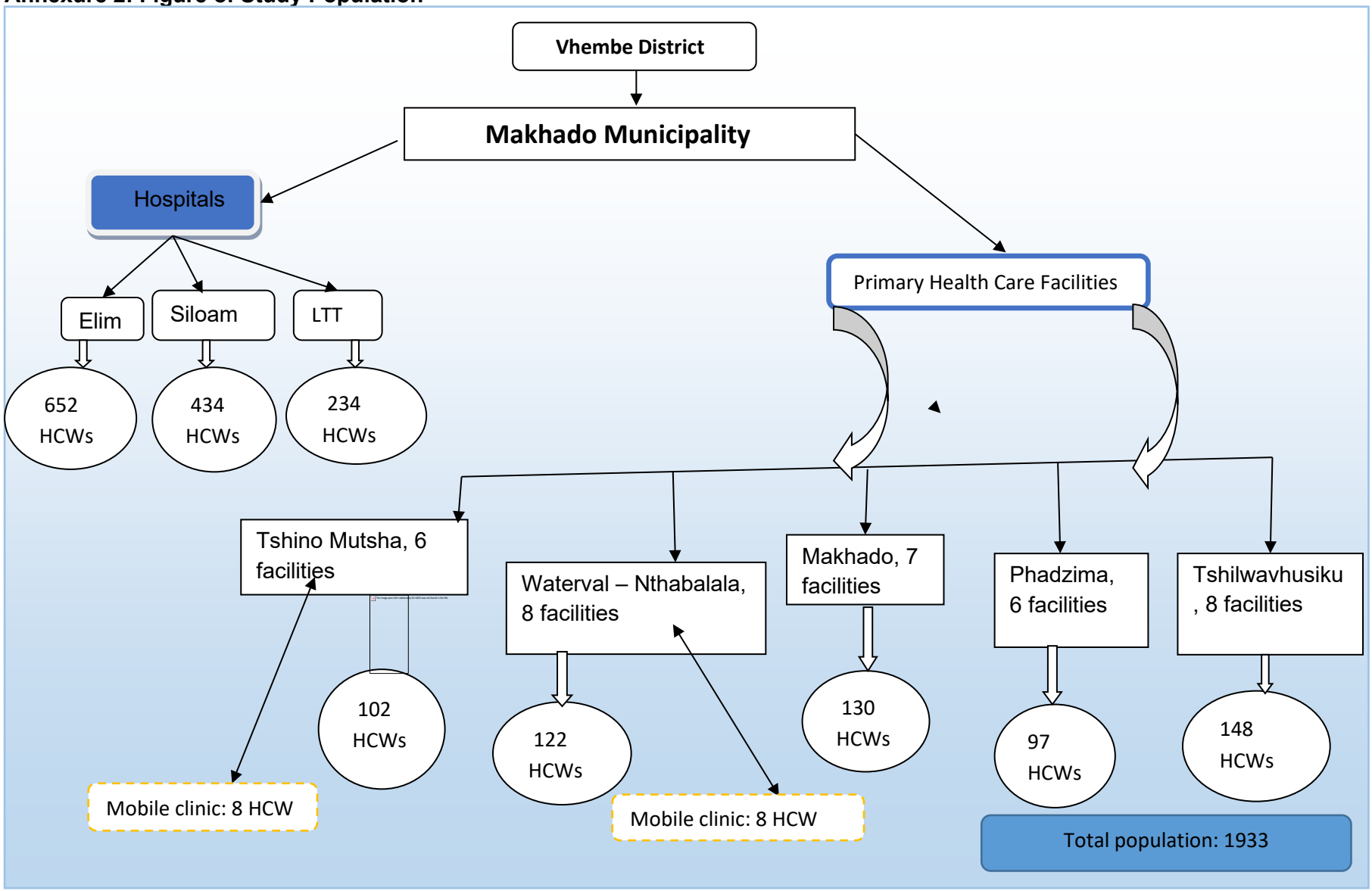
Annexures

Annexure 1: Makhado Local Municipality Map, Indicating Health Care Facilities.
Annexure 2: Figure of Study Population
Annexure 3: Provincial Permission Letter
Annexure 4: District Permission Letter
Annexure 5: Information Sheet
Annexure 6: Informed Consent Form
Annexure 7: Ethical Clearance Letter
Annexure 8: Questionnaire
Annexure 9: Language Editor's Letter

Annexure 1: Makhado Local Municipality Map, Indicating Health Care Facilities



Annexure 2: Figure of Study Population



Annexure 3: Provincial Permission Letter

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

Enquiries: Stander SS (015 293 6650)

Ref:LP 201806 002

MASALA IF
UNIVERSITY OF VENDA

Greetings,

RE: Nutritional practices and health status of health care workers in Makhado municipality of Limpopo Province, South Africa

The above matter refers.

1. Permission to conduct the above mentioned study is hereby granted.
2. Kindly be informed that:-
   - Research must be loaded on the NHRD site (http://nhrd.hst.org.za) by the researcher.
   - Further arrangement should be made with the targeted institutions, after consultation with the District Executive Manager.
   - In the course of your study there should be no action that disrupts the services, or incur any cost on the Department.
   - After completion of the study, it is mandatory that the findings should be submitted to the Department to serve as a resource.
   - The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
   - The above approval is valid for a 3 year period.
   - If the proposal has been amended, a new approval should be sought from the Department of Health.
   - Kindly note, that the Department can withdraw the approval at any time.

Your cooperation will be highly appreciated.

Head of Department

23/05/2018
Date

Private Bag X9302 Polokwane
Fidel Castro Ruz House, 18 College Street. Polokwane 0700. Tel: 015 293 6000/12. Fax: 015 293 6211.
Website: http/www.limpopo.gov.za

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Annexure 4: District Permission Letter

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OFHEALTH
VHEMBE DISTRICT

Ref: S5/6
Enq: Muvari MME
Date: 19July 2018

Dear Sir/ Madam:

PERMISSION TO CONDUCT RESEARCH ON " Nutritional practices and health status of health care workers in Makhado Municipality of Limpopo Province, South Africa" : Masala I.F

1. The above matter bears reference
2. Your letter received on the 19/07/2018 requesting for permission to conduct research in our facilities is hereby acknowledged
3. The District has no objection to your request.
4. Permission is therefore granted for the request to be conducted within Vhembe District.
5. You are however advised to make the necessary arrangements with the facilities concerned.
6. Wishing you success in your research in the Vhembe health facilities.

.....
CHIEF DIRECTOR

.....
DATE 25/7/2018

Private Bag X5009 THOHOYANDOU 0950
OLD parliamentary Building Tel (015) 962 1000 (Health) (015) 962 4958 (Social Dev) Fax (015) 962 2274/4623
Old Parliamentary Building Tel: (015) 962 1848, (015) 962 1852, (015) 962 1754, (015) 962 1001/2/3/4/5/6 Fax (015) 962 2373, (015) 962 227

The heartland of Southern Africa – development is about people

Annexure 5: Information Sheet

Investigator: Masala I.F.
Division of Human Nutrition, Faculty of Health Sciences
University of Venda

Dear Study Participant

You are invited to take part in a study for research. I am conducting this study to investigate nutritional practices and health status of Health Care Workers in the Makhado Municipality

What will be expected of you?
To avail yourself for the study purpose
The research project will involve the following procedures:

1. Completion of questionnaire on socio-demographic data, Nutritional Knowledge, dietary patterns and lifestyle habits.
2. Measurement of weight, height, Waist Circumference and Total Body Fat percentage.
3. Measurements and taking readings for Blood Pressure, Blood Glucose, triglycerides, total cholesterol, LDL and HDL.

Are there any benefits to your taking part in this study?
As a participant in the study you will receive a full summary of your nutritional and health report. Dietary recommendations will be made available at the end of the study according to the report, to benefit anthropometrical measures and dietary intake. You will also be informed of the overall findings of the study after completion.

Are there any risks involved in your taking part in this study?
There are no risks above what you normally have in a daily life

How will your confidentiality be protected?
Your study information will be stored in a computer database that can only be used by the study researchers, and confidentiality will be assured. Anonymity will also be ensured when the findings are published.

Other important ethical considerations:
This study was approved by the Human Research Ethics Committee of UNIVEN (Ethics Ref: SHS/18/NUT/02/1603). This means that the research is ethical and that it is safe for any person to take part in the study. The study will be performed in accordance with the principles of the Declaration of Helsinki, Good Clinical Practice (GCP) and the laws of South Africa. Participation in this study is by your own free choice. You have the right to withdraw from the study at any time without stating a reason.

Contact Information:
For any other questions regarding this study, please contact:
Dr Mushapi L.F. on 015 962 8334; Lindelani.Mushaphi@univen.ac.za (Supervisor) ;and
Ms Masia T.A. on 015 962 8906; Tirhani.Masia@univen.ac.za (Co-Supervisor).

Annexure 6: Informed Consent Form

Research on the assessment of nutritional practices and health status of Health Care Workers in Makhado Municipality (Ethics Ref: .../2018)

Investigator: Masala Itani Faith; UNIVEN.

Declaration by participant:

By signing below, I…… *(Write in your name and surname)* agree to take part in this research study. I confirm that the exact procedures and nature of the study detailed in the Information Sheet have been explained to me. I have had the opportunity to ask questions about it and my questions have been answered to my satisfaction. I understand that I may ask questions at any time during the procedures. The decision to take part in this study is my own. I realise that I am free to withdraw from the study without prejudice at any time, should I choose to do so. I have carefully read the accompanying Information form and understand the nature, purpose and procedure of this study.

……
Your signature

……..
Date

Declaration by investigator:

I declare that I did not force the participant to take part in this study and that I will do no harm to the participant. I will ensure that their personal information is kept confidential and that their privacy will be protected.

Signature …… Date…….
Masala Itani Faith
(Investigator name)

Annexure 7: Ethical Clearance Letter

RESEARCH AND INNOVATION
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:
Ms IF Masala

Student No:
16016419

PROJECT TITLE: Nutritional practices and health status of health care workers in Makhado municipality of Limpopo Province, South Africa.

PROJECT NO: SHS/18/NUT/02/1603

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
Dr LF Mushaphi	University of Venda	Supervisor
Mrs TA Masia	University of Venda	Co - Supervisor
Ms IF Masala	University of Venda	Investigator – Student

ISSUED BY:
UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE

Date Considered: March 2018
Decision by Ethical Clearance Committee Granted
Signature of Chairperson of the Committee: .....
Name of the Chairperson of the Committee: Senior Prof. G.E. Ekosse

UNIVERSITY OF VENDA
DIRECTOR
RESEARCH AND INNOVATION
2018 -03- 16
Private Bag X5050
Thohoyandou 0950

University of Venda
PRIVATE BAG X5050, THOHOYANDOU, 0950 LIMPOPO PROVINCE SOUTH AFRICA
TELEPHONE (015) 962 8504/8313 FAX (015) 962 9060
"A quality driven financially sustainable, rural-based Comprehensive University"

Annexure 8: Questionnaire

QUESTIONNAIRE FOR HEALTH CARE WORKERS WITH MORE THAN ONE YEAR WORKING IN HEALTH FACILITIES IN MAKHADO MUNICIPALITY, LIMPOPO.

Research topic: Nutritional Practices and Health Status of Health Care Workers in Makhado Municipality, Limpopo Province

FOR OFFICIAL PURPOSES ONLY

Data Collector: _____

Code:		
CHC	Clinic	Hosp

Date Collected: _____
(DD/ MM/ YYYY)

Informed Consent Received:

Y	N

Instructions
1. Answer ALL questions as directed
2. Answer as honestly as possible
3. Do not write your name on any paper of this questionnaire
4. All answers will be kept confidential
5. Put a tick (√) on the respective box provided of your response

SECTION A: Socio-demographic
Below are some questions about you

1. Gender

1	Male	
2	Female	

2. Date of birth

DD	MM	YY

3. Age in years:

1	Below 28	
2	29-39	
3	40-50	
4	51 and above	

4. Ethnicity:

1	Venda	
2	Tsonga	
3	N-Sotho	
4	Tswana	
5	Other; specify	

5. Marital status

Single	1	
Married	2	
Divorced	3	
Widowed	4	
Other: specify	5	

6. Highest education level:

1	Certificate	
2	Diploma	
3	Bachelor degree	
4	Master's degree	
5	PhD	

7. Years working in public health facility:

1	Above 1 year - 2years	
2	3 - 4 years	
3	5 – 9 years	
4	10 – 14 years	
5	≥ 15 years	

8. Designation _____
9. Name of Health Facility currently at: _____
10. Indicate your family history on the following diseases; you can mark one or more.

		Yes	No
Hypertension	1		
Diabetes Mellitus	2		
Cardio vascular (heart) diseases	3		
Ulcer	4		
Cancer	5		
Allergy	6		
Renal diseases	7		
Arthritis	8		
Other, specify	9		

11. Do you have any of the following conditions?

		Yes	No
Hypertension	1		
Diabetes Mellitus	2		
Cardio vascular (heart) diseases	3		
Ulcer	4		
Cancer	5		
Allergy	6		
Renal diseases	7		
Arthritis	8		
Other, specify	9		

SECTION B: Dietary patterns

12. Who usually prepare the meals/food?

		Yes	No
1	Self		
2	Spouse/partner		
3	Child		
4	Siblings		
5	Friend		
6	Domestic helper		
7	Mother		

13. How many times do you eat per day?

1	Once	
2	Two times	
3	Three times	
4	Four times	
5	More than 4 times	
6	Other, specify:	

14. Do you usually skip meal?

1	Yes	
2	No	

If the answer is <u>NO</u> do not answer question15 and 16

15. If yes which meals do you usually skip_____?
16. Why do you skip?

1	No appetite	
2	No appetite due to illness	
3	Don't feel hungry	
4	Don't feel hungry due to having a big previous meal	
5	No one could cook for me	
6	Lack of money to purchase	
7	Always busy working	
8	I don't feel eating alone	
9	Not applicable	
10	Others ; specify:	

17. What do you usually eat for breakfast while at work?

1	Home prepared	
2	Take-aways	
3	I do not eat	
4	I eat at home	
5	Other, specify	

18. What do you usually eat on your lunch while at work?

1	Home prepared	
2	Take aways	
3	I do not eat	
4	I eat at home	
5	Other, specify	

19. In a week, how many times do you eat or buy foods from the fast food (take away) restaurants?

1	Once	
2	Two times	
3	Three times	
4	Four times	
5	Daily	
6	Not applicable	
7	Other, specify	

20. Kindly specify restaurant (take-away) that you usually buy or eat food from.

		Yes	No
1	KFC/Chicken Licken/ Hungry Lion		
2	Chicken dust/ Nandos/ Barceló's/ gallitos/ Mochachos		
3	Romans/ Debonairness/ steers		
4	Food cooked by street vendors		
5	Food from Shoprite, Spar		
6	Not applicable		
7	Other, specify		

SECTION C: Lifestyle habits

21. Indicate with YES or NO (those applicable to you)

		Yes	No
1	Eating three meals a day;		
2	Eating breakfast daily;		
3	Engaging in moderate exercise 2 – 3 times a week;		
4	Getting adequate sleep (7 – 8 hours per night);		
5	Not smoking		
6	Consuming no alcohol		
7	Maintaining a moderate/normal weight		

22. In the past 7 days, what did you normally do at lunch (besides eating lunch)?

Sat down (talking, reading, working)	1	
Stood around or walked around	2	
Ran or played a little bit	3	
Ran around and play quite a bit	4	
Ran around and played hard most of the time	5	

23. In the past 7 days, on how many days did you do sport, walked briskly, dance, or play games in which you were very active after work?

None	1	
One time last week	2	
2 or 3 times last week	3	
4 times last week	4	
5 times last week	5	

24. How many hours do you sleep in a day (24hrs)?

Four hours	1	
5 hours	2	
6 hours	3	
7 hours	4	
8 hours	5	
9 or more	6	

25. If you smoke how long you have been smoking?

I do not smoke/ Not Applicable	1	
1 months now	2	
6 months now	3	
1 year now	4	
\1 year 6 months	5	
More than 1 year 6 months	6	

26. If you drink alcohol, how often do you drink?

I do not drink / Not Applicable	1	
Daily	2	
Every second day	3	
On weekends	4	
On holidays	5	
On events	6	

27. What amount of alcohol do you drink; unit= 340ml beer or Tot of spirit (30ml) or 250 ml of wine?

I do not drink/ Not Applicable	1	
In moderation (1 unit females and 2 units males per day	2	
More than 2 units daily	3	
More than 2 units on weekends	4	
More than 2 units on events	5	
More than 6 units weekly	6	

SECTION D: Nutritional Knowledge

28. According to your own understanding, describe the South African Food based Dietary Guidelines:

_____
_____
_____

29. What does variety of foods mean?

_____
_____

30. Daily, how many portions of fruits and vegetables can be eaten:

_____
_____

31. What is food fortification? _____

_____
_____

32. Give example of two food products that are fortified:

_____

33. How often should one engage in physical activities in a week? _____

Choose one of the most correct answer.

34. Indicate one food group that should be part of most meals?

Fats	1	
Proteins / body building	2	
Starch / Carbohydrates	3	
Protective (fruits and vegetables)	4	
All of the above	5	

35. Legumes, dry beans, split peas, lentils and soya, how often can those be consumed?

Regularly	1	
Frequently	2	
Sometimes	3	
None of the above	4	

36. Choose one most correct health benefit of legumes (peas, beans, soya and lentils):

Promotes healthy digestion	1	
Increase lipids in the body	2	
Keep eyes healthy	3	
None of the above	4	

37. What amount of salt can be consumed daily?

2g	1	
5g	2	
8g	3	
None of the above	4	

38. How often should milk/maas or yoghurt be consumed? __

Daily	1	
Monthly	2	
Weekly	3	
None of the above	4	

Choose one of the most correct answer and fill the gap

39. Fish, chicken, lean meats and _____can be consumed daily.

Eggs	1	
Beans	2	
Nuts	3	
All of the above	4	

40. Drink clean safe _____ daily.

Tea	1	
Water	2	
Alcohol	3	
None of the above	4	

41. Sugar, foods and drinks high in sugar should be consumed _____.

Frequently	1	
Sparingly	2	
Regularly	3	
None of the above	4	

42. _____ fat is healthier.

Animal	1	
Plant	2	
Synthetic	3	
None of the above	4	

43. Fat should be used _____.

Frequently	1	
Sparingly	2	
Regularly	3	
None of the above	4	

SECTION E: Anthropometric assessments of HCW

44.

Height (m):	Weight(kg):	BMI :	Waist Circumference:
Height (m):	Weight(kg):	BMI :	Waist Circumference:
Height(m):	Weight(kg):	BMI :	Waist Circumference:

SECTION F: Biochemical parameters

45. Total Body Fat %: …….
46. Non-Fasting Blood sugar levels: ……
47. Triglycerides:……
48. HDL: …….
49. Total cholesterol: ……
50. LDL …….

SECTION G: Clinical assessments

51. Systolic Blood Pressure: 1……2……3……Av……..
52. Diastolic Blood Pressure: 1……..2……3……Av……

FOOD FREQUENCY QUESTIONNAIRE

CODE				

23. What type of foods do you usually eat?

Food item	Per week				Per day				Portion size estimation				Comments relating to *Time at work, at home or bought from vendors *Frequencies that needed to be explored further (seemed unlikely high) *preparation
									Standard (std)	Portion size			
Starchy food													
maize dishes-Pap	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use flour model	¼ cup	½ cup	1 cup	
Samp	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use flour model	¼ cup	½ cup	1 cup	
Rice- white	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use flour model	¼ cup	½ cup	1 cup	
Pasta	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use flour model	¼ cup	½ cup	1 cup	

Bread-brown	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Bread DAEK pictures	Thin	Med	Thick	
Bread-white	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Bread DAEK pictures	Thin	Med	Thick	
Other please specify…….	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day					
Protein food													
Chicken pieces	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Wing Std = DAEK picture	< Std	= Std	> Std	
	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Thy Std = DAEK picture	< Std	= Std	> Std	
	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Drumstick Std DAEK picture	< Std	= Std	> Std	
	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Ribcage (one size only)	20g			
Beans	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	
Beef stew	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	

Beef grill	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use flour model of matchboxes(mbox)	X1 mbox	X2 mbox	X3 mbox	
Boerewors	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use DEAK picture, indicate in centimeters	……cm			
Fish pilchards	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	
Fish fried	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	
Eggs	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	
Ground nuts	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	
Other please specify……..	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day					
Vegetables													
Cabbage	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	
Spinach	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	

Chinese's leaves	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	
Beetroot	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	
Butternut	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	
Carrots	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	
Guxe/ Delele (jew's mallow)	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	
Other please specify…….	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day					
Fruits													
Apple	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use DEAK pictures	Small	Med	Large	
Banana	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use DEAK pictures	Small	Med	Large	
Avocado	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use DEAK pictures	Small	Med	Large	

orange	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use DEAK pictures	Small	Med	Large	
Naartjie	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use DEAK pictures	Small	Med	Large	
Mango	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use DEAK pictures	Small	Med	Large	
Pear	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use DEAK pictures	Small	Med	Large	
Other please specify……	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day					
Dairy products													
Milk full cream	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Std=1full mug/ glass use mug/ glass kit	½ x std	1x std	1 ½ x std	
Milk low fat	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Std=1full mug/ glass use mug/ glass kit	½ x std	1x std	1 ½ x std	
Sour milk	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Std=1full mug/ glass use mug/ glass kit	½ x std	1x std	1 ½ x std	
Yoghurt	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Use unit volume	75 ml	100 ml	125 ml	

Cheese	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	1 slice Std = DEAK pictures	½ x std	1x std	1 ½ x std	
Other please specify…….	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day					
Fatty food and sweets													
Potato chips	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Unit weight				
Pizza	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Std = DEAK picture	½ x std	1x std	1 ½ x std	
Fat cakes	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Std= DEAK picture	½ x std	1x std	1 ½ x std	
Atchaar	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Spoons: DEAK pictures or wood spoon in kit	Tea sp	Tab sp	Ladle	
Margarine	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Card	Thin	Med	Thin k	
Peanut butter	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Card	Thin	Med	Thin k	
Jam	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Card	Thin	Med	Thin k	

Cool drink	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Std = 1 full mug / glass	½ x std	1x std	1 ½ x std	
100% fruit juice	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day	Std = 1 full mug / glass	½ x std	1x std	1 ½ x std	
Other please specify……	Did not eat	1-2 per week	3-4 per week	5-6 per week	1 per day	2 per day	3 per day	4 per day					

Annexure 9: Language Editor's Letter

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Private Bag x 1106
Sovenga
0727

21 February 2022

To Whom It May Concern:

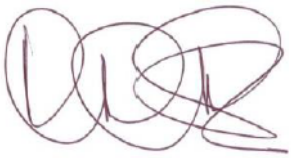
LANGUAGE EDITING CONFIRMATION: IF MASALA's DISSERTATION

This letter is meant to acknowledge that I, MM Mohlake, as a professional editor, have meticulously edited the dissertation of Itani Faith Masala entitled "Nutritional Practices and Health Status of Health Care Workers in Makhado Municipality of Limpopo Province, South Africa".

Thus I confirm that the readability of the work in question is of a high standard.

For any queries please contact me.

Regards



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Disclaimer: Subsequent alterations are the sole responsibility of the author.