Meaning in life in relation to healthy eating, weight status and physical activity among South African National Defence Force members at Lenz Military Base

MM Ngoepe

orcid.org/ 0000-0003-4884-3528

Dissertation submitted in fulfilment of the requirements for the degree Master of Science in Dietetics at the North West University

Supervisor: Prof HS Kruger

Co-supervisor: Dr E Deacon

Graduation: May 2019

Student number: 27456382

ACKNOWLEDGEMENTS

I would like to thank God for the opportunity to complete my master's degree; His grace carried me through this whole process.

A special thanks to my husband Marcus; thank you for always being there for me and helping fund this process; you have been my inspiration and source of strength. Your support and kind heart is highly appreciated.

My supervisors, Prof Kruger and Dr Deacon; thank you for the guidance and wisdom you gave since the birth of the project until the end. Your ongoing support kept me motivated and determined throughout and I have learnt a lot from you. You made my journey a pleasant one, thank you.

A special thanks to the members of Lenz Military Base; without you this project would have not been successful.

Thank you to the Officer Commanding Lenz Military Base, Col Mkhize for allowing this project to be a success.

Pamela Mngadi, thank you for always listening and for your continuous support. You are highly appreciated.

To the Dietetic Department of Area Military Health Unit Gauteng; thank you for your support

Lt Col Bielfeld, your guidance and support ensured that I followed the correct military procedures throughout this project; thank you.

Thank you to Mss Lindiwe Mazibuko and Koketso Mohlopi for your assistance. Your hard work and support is highly appreciated.

Thank you to my friends and family who supported me throughout this process. Your love and support is highly appreciated.

This dissertation is the original work of the student and has not been submitted to another institution for examination. The article in this dissertation will be submitted to the Health SA Gesondheid, a journal of interdisciplinary health sciences for publication. Permission has been granted by the co-authors that this manuscript be submitted for the attainment of the MSc degree.







MM Ngoepe Prof HS Kruger Dr E Deacon

ABSTRACT

Good health behaviours such as physical activity and healthy eating are central to both the prevention and management of non-communicable diseases. However, even with nutrition knowledge, practice and maintenance of good health behaviours remain a challenge. Many factors such as socio-economic factors, lack of time, taste preference and lack of self-efficacy have been linked to poor adherence to good health behaviours. A sense of meaning in life which provides self-efficacy and can lead to motivation to attain personal goals has been associated with physical health and good health behaviours. If a link between meaning in life and health behaviours can be identified, interventions focusing on meaning in life may be incorporated as part of health interventions in groups at risk of non-communicable diseases.

The aim of this cross-sectional study was to assess the association between meaning in life and healthy eating, weight status and physical activity of the members of the South African National Defence Force at Lenz Military Base. Data on sense of meaning, sociodemographic information, healthy food (fruit, vegetables, meat, chicken, eggs or fish, milk or maas) and unhealthy food (cold drinks, sugar in tea, cookies or cakes, salty snacks, sweets or chocolates and fast foods) intake, anthropometric measurements and physical activity was collected. Data was collected on 80 adult participants.

Obesity prevalence was 42.1% and 35.7% for women and men respectively. Thirty one percent of men were overweight as compared to 26.3% of women. More men (71.2%) met the recommended weekly physical activity as compared to women (44.7%). In terms of healthy eating, the presence of meaning in life showed a marginal positive association in men with frequency of fruit intake ($p=0.07$), a significant association in women with frequency of fruit intake ($p=0.03$) and a significant association with frequency of milk intake in women only ($p=0.046$). Search for meaning in life showed no association with frequency of healthy and unhealthy food intake in both men and women. No association between search for meaning and weight status or physical activity was found in men or women, but a positive association between presence of meaning and body mass index was seen in men ($p=0.013$). Presence of meaning showed a weak negative association with physical activity in men ($p=0.069$). The presence of meaning may play an important role in facilitating or hindering health promoting behaviours.

Keywords: meaning in life, healthy eating, physical activity, weight status, health behaviours

TABLE OF CONTENTS

ACKNOWLEDGEMENTS……I

Abstract……ii

List of abbreviations……vii

List of tables ……viii

List of figures……ix

CHAPTER 1: INTRODUCTION……1

1.1 Background……1

1.2 Problem statement……2

1.3 Hypothesis, aim and objectives……2

1.3.1 Hypothesis……2

1.3.2 Aim……2

1.3.3 Objectives……2

1.4 Significance of the study……3

1.5 Contribution of the team members……3

1.6 Structure of the mini-dissertation……4

REFERENCE LIST……5

CHAPTER 2: LITERATURE REVIEW……6

2.1 Introduction……6

2.2 The prevalence of NCDs ……6

2.2.1 The prevalence of NCDs in South Africa……6

2.2.2 The prevalence of NCDs in military personnel……7

2.3 Mortality and NCDs in South Africa……...7

2.4 The role of nutrition in the development of NCDs……...8

2.5 The role of overweight and obesity in the development of NCDs……..10

2.6 The role of physical activity in the development of NCDs……...11

2.7 Barriers to maintaining healthy lifestyles……12

2.8 Background on the concept of meaning in life……...13

2.9 Conceptualisation of meaning in life……....14

2.10 Measuring meaning in life……...15

2.11 Meaning in life and physical health……17

2.12 Summary of the literature review……18

REFERENCE LIST……19

CHAPTER 3: METHODOLOGY……27

3.1 Introduction……...27

3.2 Study design……27

3.3 Population and setting……27

3.4 Study site and infrastructure……....27

3.5 Inclusion and exclusion criteria……....27

3.6 Recruitment plan……...28

3.7 Sample size……...28

3.8 Data collection procedure……..28

3.8.1 Questionnaires……28

3.8.2 Anthropometric measurements……30

3.9 Data capturing, quality assurance and statistical analysis……..31

3.10 Data management and monitoring……..32

3.11 Ethical aspects……..33

3.11.1 Legal authorisation……33

3.11.2 Participant written informed consent……...33

3.11.3 Expertise, skills and legal competencies……...33

3.11.4 Privacy and confidentiality…… ……..33

3.11.5 Reporting, dissemination and publication of results……..34

3.11.6 Conflict of interest……..34

3.11.7 Protocol violations……34

REFERENCE LIST……36

CHAPTER 4: ARTICLE……37

Article cover letter…….. 37

Abstract……....39

4.1 Introduction……40

4.2 Methodology……...41

4.2.1 Study population……...42

4.2.2 Procedures……...42

4.2.3 Statistical analysis……...43

4.3 Results……...44

4.4 Discussion……..……...50

4.5 Conclusion……...53

4.6 Acknowledgements……..54

REFERENCE LIST……55

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS……59

5.1 Introduction……...59

5.2 Main findings……....59

5.3 Conclusion……61

5.4 Limitations……...61

5.5 Recommendations……..61

REFERENCE LIST……63

APPENDICES……..65

APPENDIX 1: MEANING IN LIFE QUESTIONNAIRE……65

APPENDIX 2: HEALTHY AND UNHEALTHY FOOD SURVEY……66

APPENDIX 3: SOCIODEMOGRAPHIC AND HEALTH QUESTIONNAIRE……67

APPENDIX 4: GPAQ……...69

APPENDIX 5: PERMISSION LETTER……....71

APPENDIX 6: NORTH-WEST UNIVERSITY HREC APPROVAL……72

APPENDIX 7: 1MHREC APPROVAL……73

APPENDIX 8: INFORMED CONSENT FORM……...75

LIST OF ABBREVIATIONS

BMI	Body Mass Index
EST	Rosenberg self esteem inventory
GPAQ	Global Physical Activity Questionnaire
HREC	Health Research Ethics Committee
1MHREC	1 Military Hospital Health Research Ethics Committee
LRI	Life Regard Index
METs	Metabolic Equivalents
MIL	Meaning In Life
MIL-P	Presence of meaning in life
MIL-S	Search for meaning in life
MIL-Q	Meaning in life questionnaire
NCDs	Non-Communicable Diseases
PIL	Purpose in life test
SANDF	South African National Defence Force
SADHS	South African Demographic and Health Survey
SANHANES	South African National Health And Nutrition Survey
SWL	Satisfaction With Life scale
SOC	Sense of Coherence scale
WHO	World Health Organization

LIST OF TABLES

Table 1.1 Contribution of team members……3

Table 4.1 Categorical variables of the study participants……...43

Table 4.2 Descriptive characteristics of participants……....44

Table 4.3 Multiple regression model with healthy and unhealthy food intake as dependant variables……47

Table 4.4 Multiple regression model with body mass index, waist circumference and physical activity as dependant variables……48

LIST OF FIGURES

Figure 2.1 Chronic disease prevention model……..10

Figure 2.2 Conceptualisation of the possible role of meaning in life on health outcomes……..16

Figure 4.1 Median frequency intake of healthy and unhealthy foods of men and women……...45

Figure 4.2 Body mass index categories for men and women……46

CHAPTER 1: INTRODUCTION

1.1 Background

Non-communicable diseases (NCDs) are becoming more prevalent in sub-Saharan African countries and South Africa is amongst the four sub-Saharan African countries with the highest rate of NCDs (Dalal *et al*., 2011). NCDs contributed to the biggest cause of years of life lost in South Africa with 32% of years of life lost in 2009 attributable to NCDs (Day *et al*., 2014). Statistics South Africa reported a rise in deaths due to NCDs, with 55.5% of death attributable to NCDs in 2015 (Stats SA, 2017). Cerebrovascular, hypertension and ischaemic heart disease have a high rate of mortality in all the metros in South Africa (Day *et al.*, 2014). Abdominal obesity contributes significantly to the prevalence of cardiovascular diseases (Dalal *et al.*, 2011). NCDs can be prevented by dealing with the major risk factors like physical inactivity, unhealthy diet, tobacco smoking and excessive alcohol intake (World Health Organization [WHO], 2013). Behaviour change is crucial in ensuring that there is adherence to healthy lifestyle guidelines to prevent and reduce a high prevalence of NCDs. However, effective behaviour change is difficult to initiate and maintain, even in individuals who are well informed of the health benefits of such behaviour change (Panter-Brick *et al.*, 2006).

Steger (2013) defines meaning in life as a web of connections, understanding and interpretations that helps us understand our experience and help us create plans directing our energies to achieve our desired future, speaking to the presence of meaning in life (MIL-P) and search for meaning in life (MIL-S). People experience the presence of meaning when they understand themselves and the world, and how they uniquely fit into the world; thus their purpose for life (Steger *et al.*, 2008). Search for meaning refers to the strength, intensity and activity of people's desires and efforts to establish their understanding of the meaning, significance and purpose of their lives (Steger *et al.,* 2008). People are oriented towards the desire to find and fulfil their purpose in life in every situation that they face (Frankl, 1985). They find meaning even in difficult tragedies that motivate them to be able to carry on and strive towards their better selves. Meaning can be discovered by creating work or doing a deed, or in experiencing something or someone even in hopeless situations (Frankl, 1985:141-142). The available evidence on meaning does not support health causality, however; a sense of meaning is associated with psychological effects such as self-efficacy, optimism and positive affect which have positive effects on physical health and health promoting behaviours (Roepke *et al*., 2014).

1.2 Problem statement

Finding the association between meaning in life (MIL) and health behaviours creates new opportunities in understanding the role of psychological factors such as MIL on adaptation and maintenance of health promoting behaviours in healthy lifestyle promotion. Meaning in life is strongly associated with positive psychological well-being (Zika & Chamberlain, 1992). However, the research base to the link between MIL and physical health outcomes is still underdeveloped (Roepke *et al*., 2014).

This study was done to establish the association and relation of MIL with known health promoting behaviours such as maintaining healthy eating habits, a healthy weight and physical activity.

1.3 Hypothesis, aim and objectives

1.3.1 Hypothesis

The hypothesis formulated for this study was that MIL is associated with higher frequency of healthy foods intake (fruit, vegetables, milk or maas and meat, chicken, egg or fish); lower frequency of unhealthy foods intake (sweets, chocolates, cold drinks, cookies or cakes, chips and fast foods); lower body mass index (BMI) and waist circumference and regular physical activity level of South African National Defence Force (SANDF) members at Lenz Military Base.

1.3.2 Aim

The aim of this study was to assess whether MIL is associated with healthy eating, weight status and physical activity of SANDF members at Lenz Military Base. The study will provide insight on the relationship between MIL and certain health behaviours and therefore highlight the importance of this psychological factor in promoting healthy lifestyles.

1.3.3 Objectives

The objectives of the study were:

- To assess the relationship between MIL and healthy eating measured as the frequency of intake of healthy foods versus unhealthy foods.
- To assess the relationship between MIL and weight status as measured by BMI and waist circumference.
- To assess the relationship between MIL and physical activity as measured using the Global Physical Activity Questionnaire (GPAQ).

A secondary objective was to present the prevalence of abnormal weight status as the proportion of participants in the underweight, overweight and obese categories, and physical inactivity as the proportion of participants not meeting WHO recommendations on physical activity for health (respondents doing less than 600 metabolic equivalents [METs] minutes per week in members of the Lenz Military Base).

1.4 Significance of the study

The research base for the association of MIL and physical health is still developing. Though MIL has been found to be associated with the likelihood of good health behaviours such as healthy eating and physical activity, there were no studies that investigated the association of MIL and weight status. This study will identify and highlight the relationship and correlation between frequency of eating unhealthy foods and healthy foods respectively, BMI and waist circumference respectively and physical activity and MIL. This study will shed light on the potential role and association of MIL and markers of healthy living.

1.5 Contribution of team members

Table 1.1

Researchers name	Contribution to the research project
Prof HS Kruger	Research project supervisor, formulated the project, coordinated the study, statistical analysis and interpreted data.
Dr E Deacon	Research project co-supervisor, formulated the project and interpreted MIL data.
Mrs MM Ngoepe	MSc student, primary research of the project. Formulated, planned, wrote the literature review, collected data, recorded and entered data, interpreted the data and wrote dissertation.

1.6 Structure of the dissertation

This dissertation is presented in the following chapters:

Chapter 1: Introduction: This chapter includes background, the problem statement, the aim and objectives, significance of the study and contribution of the research team members.

Chapter 2: Literature review: This chapter include the review of literature on NCDs, background on the concept of MIL, a meaning making model and current research on the effects of MIL and physical health.

Chapter 3: Methodology: This chapter explains the methods used in the study in detail.

Chapter 4: Article: This chapter is an article that includes an abstract, background information, methodology, results, discussions and recommendations. The article will be submitted to the Health SA Gesondheid, a journal of interdisciplinary health sciences for publication.

Chapter 5: Conclusions and recommendations: This chapter is a summary of the study and includes general discussions, conclusions and recommendations for future studies.

REFERENCE LIST

Dalal, S., Beunza, J.J., Volmink, J., Adebamowo, C., Bajunirwe, F., Njelekela, M., Mozaffarian, D., Fawzi, W., Willett, W., Adami, H.O. & Holmes, M.D. 2011. Non-communicable diseases in sub-Saharan Africa: what we know now. *International journal of epidemiology*, 40(4):885-901.

Day, C., Groenewald, P., Laubscher, R., Chaudhry, S., Van Schaik, N. & Bradshaw, D. 2014. Monitoring of non-communicable diseases such as hypertension in South Africa: challenges for the post-2015 global development agenda. SAMJ: *South African medical journal*, 104(10):680-687.

Frankl, V.E. 1985. Man's search for meaning. New York, Washington: Simon and Schuster.

Panter-Brick, C., Clarke, S.E., Lomas, H., Pinder, M. & Lindsay, S.W. 2006. Culturally compelling strategies for behaviour change: a social ecology model and case study in malaria prevention. *Social science & medicine*, 62(11):2810-2825.

Roepke, A.M., Jayawickreme, E. & Riffle, O.M. 2014. Meaning and health: a systematic review. *Applied research in quality of life*, 9(4):1055-1079.

Stats SA (Statistics South Africa). 2017. Mortality and cause of death in South Africa, 2015: findings from death notifications. Pretoria: Statistics South Africa. http://www.statssa.gov.za/publications/P03093/P030932015.pdf Date of access: 25 July 2017.

Steger, M.F., Kashdan, T.B., Sullivan, B.A. & Lorentz, D. 2008. Understanding the search for meaning in life: personality, cognitive style, and the dynamic between seeking and experiencing meaning. *Journal of personality*, 76(2):199-228.

Steger, M.F., 2013. Experiencing meaning in life: Optimal functioning at the nexus of well-being, psychopathology, and spirituality. *The human quest for meaning*. 2nd Ed. New York, NY: Routledge.p. 211-230.

World Health Organization (WHO). 2013. 10 Facts on Non-Communicable Diseases. http://www.who.int/features/factfiles/noncommunicable_diseases/facts/en/ Date of access: 29 June 2016.

Zika, S. & Chamberlain, K. 1992. On the relation between meaning in life and psychological well-being. *British journal of psychology*, 83(1):133-145.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Non-communicable diseases (NCDs) are a rising epidemic and account for 65% of all deaths world-wide (Lobstein & Brinsden, 2014). The major NCDs include cancer, cardiovascular diseases, diabetes and chronic pulmonary disease (Alwan *et al.*, 2010; Lobstein & Brinsden, 2014). Cardiovascular diseases account for the biggest portion of death that is attributed to NCDs (Hunter & Reddy, 2013). Mortality from NCDs was found to be more prevalent in adults 50 years and older than in younger adults at 41% (Tollman *et al*. (2008). NCDs affect both males and females equally with 80% of all deaths due to NCDs occurring in low and middle income countries (WHO, 2013). More than 9 million deaths of all deaths due to NCDs worldwide occur before the age of 60 (WHO, 2013). Risk factors that contribute to the high prevalence of NCDs include tobacco smoking, unhealthy diet, physical inactivity and excessive alcohol intake (Khatib, 2004; Hunter & Reddy, 2013; Kontis *et al*., 2014).

South Africa is among the countries with the highest rate of NCDs in the sub-Saharan African countries (Dalal *et al.,* 2011). NCDs are the biggest contributors to years of life lost in South Africa (Day *et al.,* 2014). In South Africa, cerebrovascular disease, hypertension and ischaemic heart disease had the highest rate of mortality in all metros in 2009 (Day *et al.,* 2014). Prevention of NCDs is possible if major risk factors such as physical inactivity, unhealthy eating habits, tobacco smoking and excessive alcohol intake are dealt with (WHO, 2013). This chapter reviews the literature available on NCDs, meaning in life and the possible role of meaning in life on physical health and health promoting behaviours.

2.2 The prevalence of NCDs

2.2.1 The prevalence of NCDs in South Africa

The prevalence of diabetes mellitus in Africa has more than doubled from 1980 to 2014, with the prevalence reported to have increased from 3.4% to 8.5% in men and 4.1% to 8.9% in women (Kengne *et al*., 2017). The mean BMI has also increased from 21 kg/m^2 to 23 kg/m^2 in men and from 21.9 kg/m^2 to 24.9 kg/m^2 in women from 1980 to 2014 in Africa (Kengne *et al*., 2017).

NCDs were the largest comprehensive cause of years of life lost in South Africa with years of life lost due to NCDs at 32% in 2009 relative to injuries, tuberculosis, HIV, maternal and perinatal related deaths (Day *et al.*, 2014).

In 2009 Bertram *et al*. (2012) reported that 9% of people 30 years and older have type 2 diabetes mellitus, and that of all the cases of diabetes identified, 55% did not know that they have diabetes mellitus. Shisana *et al.* (2014) reported in the 2012 South African National Health and Nutrition Survey (SANHANES-1) that 18.4% had impaired glucose homeostasis and diabetes was diagnosed in 9.5% of the participants of the survey.

The National Income Dynamics Study reported the prevalence of hypertension to be 31% and 36% for men and women respectively in South Africa (Ardington & Case, 2009). The prevalence of hypertension for adults older or equal to 25 years was reported to be over 40% in 2010 (Day *et al.*, 2014). This high prevalence of hypertension was coupled with low treatment coverage and poor control, Day *et al*. (2014) reported that only 36.4% of hypertensive cases on treatment are controlled and there is a very low treatment coverage of 35.7%. The SANHANES-1 2012 found the prevalence of hypertension in South Africa to be at 31.8% (Shisana *et al*., 2014). South Africa has the highest prevalence of hypertension at 78% in adults 50 years and older world-wide (Lloyd-Sherlock *et al.*, 2014).

One in four people aged 15 years and older was found to have high total cholesterol and low-density lipoproteins (LDL)-cholesterol levels (Shisana *et al.*, 2014). Even though 80% of cardiovascular diseases can be prevented by a healthy lifestyle (Alwan, 2011), cardiovascular diseases including heart disease and stroke are the second largest killers in South Africa (Msemburi *et al*., 2014).

2.2.2 The prevalence of NCDs in military personnel

The data on the prevalence of non-communicable diseases in the SANDF is not available. There is some available data on the prevalence of NCDs in military personnel in other countries but none are not from the African region. The prevalence of overweight and obesity in the Royal Thai Army was found to be 27.1% and 4.9% respectively (Napradit *et al.*, 2007). Gattis (2011) reported that 16% of active duty United States of America military personnel are obese. The prevalence of overweight and obesity was reported to be 62% and 17% respectively in US Navy, and 55% and 12% respectively in the US Air Force (Gattis, 2011). In the United Kingdom, obesity among armed forces under 25 years is reported to be 6.2% and 12% for men and women respectively whereas the obesity prevalence for armed forces over the age of 35 years is 24.5% and 25% for men and women respectively (Fear *et al.*, 2011).

2.3 Mortality and NCDs in South Africa

Mortality due to NCDs is on the rise in South Africa, the burden of NCDs in South Africa is said to be two to three times higher than that of high income countries (Mayosi *et al.*, 2009). Non-

communicable diseases contribute to 38% and 33% of premature mortality in rich and poor districts of South Africa respectively (Schneider *et al.*, 2009). Schneider *et al*. (2009) reported that 27.2% and 34% of years of life lost are due to NCDs in males and females respectively. Cardiovascular diseases are a major cause of NCD-related premature mortality accounting for 40% and 35.8% respectively of years of life lost in poor and rich districts (Schneider *et al.*, 2009). Naghavi and Forouzanfar (2013) reported a 46% increase in deaths due to NCDs from 1990 to 2010 in sub-Saharan Africa. Most recently Statistics SA reported a rise in deaths in 2015 due to NCDs, with 55.5% of deaths attributable to NCDs in South Africa (Stats SA, 2017).

Non-communicable diseases are a cause of 28% of the total burden of diseases measured by disability adjusted life years in 2014 (Mayosi *et al.*, 2009). Diabetes mellitus and cerebrovascular diseases were reported to be amongst the three leading causes of deaths in South Africa (Stats SA, 2017). Forty eight percent of deaths and 26% risk of premature death in South Africa are attributable to NCDs (WHO, 2017).

Heart disease, diabetes and stroke together are the second most important causes of death in adult South Africans (Mayosi *et al.*, 2009). The most common cardiovascular diseases in the rich communities are stroke accompanied by ischaemic heart disease, while the most common cardiovascular diseases in the poor communities are stroke accompanied by hypertensive heart disease (Schneider *et al.*, 2009).

In 2000 high blood pressure contributed to 9% of all deaths in South Africa (Norman *et al.*, 2007). High blood pressure is a major contributor to other cardiovascular diseases with 50% of stroke, 42% of ischaemic heart disease, 72% of hypertensive disease and 22% of other cardiovascular diseases attributable to high blood pressure (Norman *et al.*, 2007). NCDs such as hypertensive diseases, heart disease and ischaemic heart disease contributed to the rise in deaths due to NCDs attributing to 60% of the ten leading underlying causes of death (Stats SA, 2017).

2.4 The role of nutrition in the development of NCDs

Due to the dietary intake changes typically seen during the nutrition transition, NCDs has become more prevalent (Temple & Steyn, 2016). These changes in the energy intake and macronutrient profile of available foods are likely to increase the risk factors of NCDs especially since this is accompanied by a decrease in physical activity due to the availability of different modes of transport (Temple & Steyn, 2016).

High sodium intake is associated with increased high blood pressure and therefore the WHO recommends that salt intake should be limited to less than 5 g per day (2 g sodium) (WHO, 2012).

South Africans have a high salt intake of 6-11 g per day which is more than double the recommended intake (Wentzel-Viljoen *et al.*, 2013).

A high sugar intake has also been associated with the development of obesity and diabetes (Steyn & Temple, 2012). Vorster *et al*. (2014) reported that people who had an added sugar intake of more or equal to 10% of energy, had a greater increase over 5 years of BMI and waist circumference when compared to those who had an added sugar intake of less than 10% of energy intake.

A high intake of soft drinks is associated with increased prevalence of overweight, obesity and diabetes (Basu *et al.*, 2013). This translate into an additional 2.3 billion, 1.1 billion and 192 million adults worldwide who are overweight, obese and new diabetes cases respectively over the next five years if intake of soft drinks continues to be on the rise (Basu *et al.*, 2013). Funtikova *et al*. (2015) also found that intake of soft drinks is associated with increased waist circumference and abdominal obesity.

Populations living in Africa were found to have one of the lowest mean regional fruit and vegetable intake world-wide (Lock *et al*., 2005). In the North West Province, South Africa, MacIntyre *et al*. (2002) found a low intake of fruit and vegetables. Low intake of fruit and vegetables has been found to contribute to the world-wide burden of NCDs (Lock *et al*., 2005). The same study reported that increasing fruit and vegetable intake to 600 g per day could decrease the total burden of NCDs by 1.8% and reduce the burden of ischaemic heart disease and ischaemic stroke by 31% and 19% respectively (Lock *et al*., 2005). Greater variety of fruit and vegetables has been associated with a decreased risk for the development of type 2 diabetes mellitus and higher intake of vegetables but not fruit was also found to be associated with decreased risk of diabetes (Cooper *et al*., 2012). Other studies have also found that low intake of fruit and vegetables increased the risk of NCDs (Dauchet *et al*., 2006; He *et al*., 2006; Pomerleau *et al*., 2006).

Intake of milk and milk products was found to be low except in farm dwellers in the North West Province, South Africa (MacIntyre *et al*., 2002). Pereira *et al*. (2002) reported that increased milk and milk products intake may reduce the risk of developing obesity and metabolic syndrome in overweight people. A higher intake of milk and milk products, especially low fat milk and milk products has been associated with lower risk of developing type 2 diabetes mellitus in men (Choi *et al*., 2005). Another study found an inverse association between the risk of developing hypertension and intake of low fat milk and milk products (Wang *et al*., 2008).

Figure 2.1 below, based on the chronic disease prevention model, shows the role of nutrition in the development of NCDs (Cecchini *et al*., 2010).

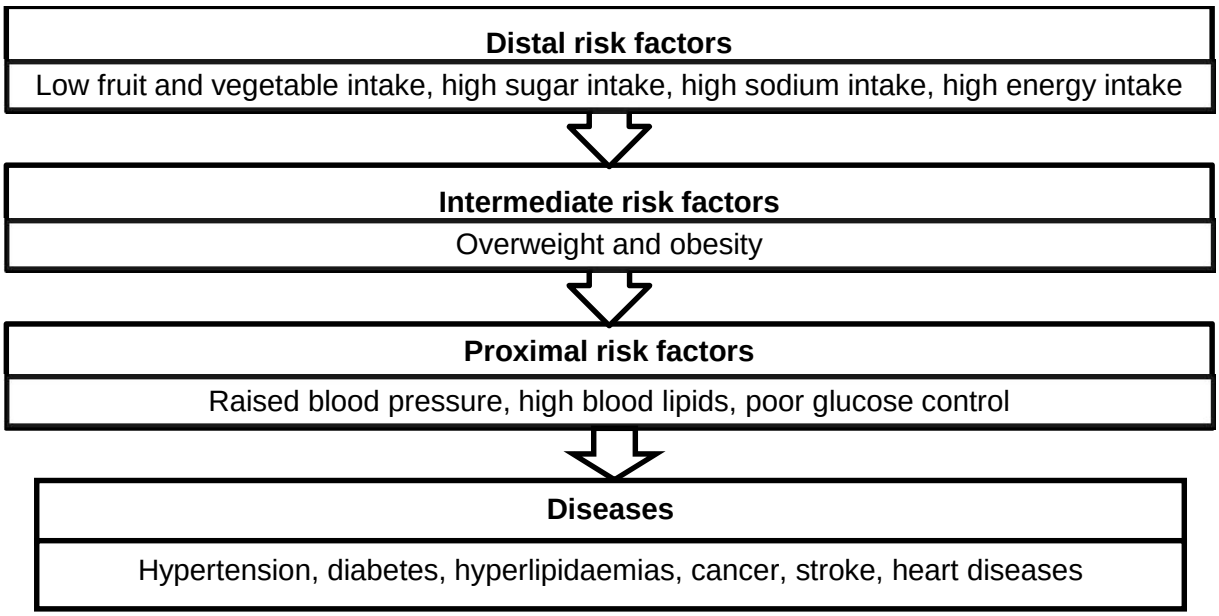

Figure 2.1 Chronic disease prevention model (Cecchini *et al*., 2010)

2.5 The role of overweight and obesity in the development of NCDs

A shift in dietary intake from a diet low in fat and rich in fibre to a diet with more meat, dairy and highly refined foods in South Africa is a possible contributor to overweight and obesity (Bourne *et al*., 2002; Kruger *et al*., 2005). Socio-economic factors such as ethnicity, low education level and high income have been associated with an increasing BMI. Black and mixed ancestry individuals and individuals with lower education level were most likely to be overweight and obese when compared to other ethnic groups and those with higher education level respectively (Senekal *et al*., 2003). Higher income has also been associated with an increased risk of overweight and obesity (Kruger *et al*., 2002).

Overweight and obesity can be seen as a reflection of well-being, dignity, respect, beauty and health especially in black and/or rural South African women (Mvo, 1999; Puoane *et al*., 2005). Overweight and obesity was regarded as acceptable and not linked to dietary intake by women in rural KwaZulu-Natal, South Africa (Faber & Kruger, 2005). A moderate overweight shape was preferred by participants as it reflects beauty and health in an urban black township of South Africa (Puoane *et al*., 2005). In an urban township married women were likely to have a greater BMI and waist circumference than unmarried women (Malhotra *et al.*, 2008). Overweight women showed low perception of the threat of obesity to health and were satisfied with their weight and therefore not willing to lose weight (Okop *et al*., 2016).

Nguyen (2008) reported that obesity is associated with hypertension, diabetes and dyslipidaemia, with the prevalence of these conditions increasing substantially with increasing BMI. The SANHANES-1 2012 survey found the prevalence of overweight and obesity combined in South Africa to be at 64% in females and 30.7% in males respectively. The survey also reported 68.2% of females and 20.2% of males had a high waist circumference with increased risk of metabolic complications and that more than two thirds of participants who had high blood pressure were also overweight or obese (Shisana *et al.*, 2014). More recently the prevalence of overweight and obesity combined in South Africa was reported to be 68% and 31% for females and males respectively with severe obesity (BMI more or equal to 35 kg/m^2) reported at 20% for females and 3% for males South African Demographic and Health Survey (Stats SA, 2017).

Napradit *et al*. (2007) reported that obesity was associated with increased prevalence of hypertension and physical inactivity in Royal Thai Army personnel. Kruger *et al*. (2001) found that obesity, especially abdominal obesity is associated with high blood pressure, lower high density lipoprotein- cholesterol (HDL-C), higher levels of triglycerides and fasting glucose levels in African women. The prevalence of dyslipidaemia was 19% in class 3 obesity as compared to 8.9% in normal weight (Nguyen, 2008). In Soweto South Africa, individuals who were overweight were three times more likely to have hypercholesterolemia than those with normal weight (Tibazarwa *et al*., 2009).

Obesity is also a major risk factor for hypertension and cardiovascular disease (Nguyen & Lau, 2012). Increasing BMI was correlated with increasing blood pressure (Tibazarwa *et al*., 2009). Ekoru *et al*. (2018) reported a strongest association between waist circumference and at least two cardio-metabolic risk factors such as components of dyslipidaemia, raised blood pressure and raised glycaemic levels for both men and women as compared to BMI and waist hip ratio. The prevalence of hypertension was 52.3% in class 3 obesity as compared with 18.1% of people with normal weight. Severe obesity poses a higher risk of heart diseases, diabetes and other conditions compared to overweight and obesity (SADHS 2016, 2017).

Waist circumference is reported to be an independent risk factor for the development of type 2 diabetes mellitus (Levitt *et al*., 1993; Motala *et al*., 2008). Obesity is associated with an increased risk of developing type 2 diabetes and insulin resistance (Kahn *et al.*, 2006). The prevalence of diabetes was 14.2% in class 3 obesity as compared to 2.4% in normal weight (Nguyen, 2008).

2.6 The role of physical inactivity in the development of NCDs

Physical inactivity is a risk factor for overweight and obesity (Kruger *et al*., 2002). Individuals with lower physical activity levels were most likely to have a higher BMI than those who are physically

active (Senekal *et al*., 2003). In South Africa, 49% of women and 43% of men reported inadequate physical activity (Joubert *et al.,* 2007).

Physical inactivity contributes to 6% of the burden of diseases from coronary heart diseases and 9% of premature deaths worldwide (Lee *et al*., 2012). In South Africa, 30% of ischaemic heart disease, 22% of ischaemic stroke, 20% of type 2 diabetes and 3.3% of all deaths were attributable to physical inactivity in 2000 (Joubert *et al*., 2007).

2.7 Barriers to maintaining a healthy lifestyle/diet

Socio-economic factors have also been identified to contribute to health behaviours (Conner & Norman, 2005). Conner and Norman (2005) also reported that younger, wealthier, better educated individuals with low stress levels and good support system are more likely to practice positive health behaviour. Other factors that influence health behaviour are cultural values, emotional factors, health behaviour instilled from early life and knowledge about the link between health behaviour and health (Conner & Norman, 2005).

In a survey done in college students, Silliman *et al.* (2004) reported lack of time as the most commonly named barrier to healthy eating and physical activity. This survey also reported lack of motivation and lack of will power as barriers to healthy eating and activity (Silliman *et al.,* 2004). Another survey by Eikenberry and Smith (2004), reported lack of time, lack of discipline and laziness as the top three barriers to healthy eating. Cost and money was listed as a barrier for healthy eating for the lower income group (Eikenberry & Smith, 2004). Rao *et al*. (2013) also found in a systematic review that healthy food choices are more expensive than the less healthy food choices.

Though healthy foods availability in Cape Town South Africa was not found to be a barrier to healthy eating, increasing food prices is a barrier especially in low income communities (Temple & Steyn, 2009). When the rural towns of the Western Cape Province in South Africa were studied, the healthier food choices were found to be more expensive as compared to the commonly consumed foods (Temple *et al.*, 2011).

More than a quarter (27.6%) of young adults in Johannesburg, South Africa was found to buy fast foods two to three times a week (Van Zyl *et al.*, 2010). The main reasons for frequent fast foods intake were found to be time limitations, convenience and taste (Van Zyl *et al.*, 2010).

Self-efficacy (a person's confidence to carry out a specific behaviour) is an important precondition for behaviour change and management (Lorig & Holman, 2000). Lee *et al*. (2008) reported a strong association between exercise, self-efficacy and the amount of time spent in physical

activity. Health self-efficacy was found to be associated with increased engagement in health promoting behaviours (Jackson *et al*., 2007).

2.8 Background on the concept of meaning in life

The concept of meaning in life was first explained by Viktor Frankl, a psychiatrist and a Nazi concentration camp holocaust survivor. Frankl explains that people are oriented towards the desire to find and fulfil their purpose in life in every situation that they face (Frankl, 1985). They find meaning even in difficult tragedies that motivate them to be able to carry on and strive towards their better selves. He explains that meaning can be discovered by creating work or doing a deed, or in experiencing something or someone even in hopeless situations (Frankl, 1985:141-142).

Meaning in life can be defined as connections and interpretations that help us understand the world, how we fit into the world and help us to achieve our future goals (Steger *et al*., 2013). King *et al*. (2006) defines meaning in life as a sense of one's life having a purpose or investing time and energy into the attainment of cherished goals, speaking to the presence of MIL and search for MIL. Meaning can also be defined as a sense for meaning, purpose and/or coherence that one currently experiences or possesses (Roepke *et al*., 2014). People are motivated to have and to search for meaning in life. Search for meaning can be defined as efforts, desires, strength and intensity people have to understand their meaning and purpose in life. Search for meaning is not merely an absence of meaning but rather a process for seeking new opportunities and growth (Steger *et al.*, 2008).

Viktor Frankl formulated the theory of logotherapy, which literally means healing through meaning. This theory recognizes the will of man to find meaning in life as a primary driving and motivating force. Logotherapy focuses on the future, on what one may accomplish and fulfil in the future regardless of what their current situation may be (Frankl, 1992:44-69). Applying this theory in therapy assists individuals to be aware of their meaning in life through their experiences, including tragic experiences and therefore drives them to persevere even in impossible circumstances and look forward to their future (Frankl, 1992: 44-69).

Logotherapy can be applied by differentiating the patient from symptoms, attitude modification, symptom reduction and maintenance through future orientated and facilitation of awareness of goals (Schulenberg *et al.*, 2008:451).

Differentiating the patient from symptoms

This implies that the therapist can see that the patient above his/her presenting symptoms and that the patient has the ability to overcome those symptoms and challenges and experience life meaning (Schulenberg *et al.*, 2008:451).

Attitude modification

This implies to shifting of attitudes about the presenting symptoms, from seeing them as problems, to awareness of the available options for control and management of the symptoms (Schulenberg *et al.*, 2008:451).

Symptom reduction

This phase happens automatically when attitudes are changed towards available options for control and management. In other cases coping skills and self-efficacy techniques might be necessary to facilitate symptom reduction (Schulenberg *et al.*, 2008:451).

Maintenance through future orientated and facilitation of continued awareness of goals

This phase involves facilitation of awareness of set future goals in order to keep maintaining wellness (Schulenberg *et al.*, 2008:451).

2.9 Conceptualisation of meaning in life

There are various models in literature to explain the development of meaning in life. Frankl (1985) proposes that meaning can be found through giving or contributing something through work, through experiencing something or someone and through choosing a positive courageous attitude towards tragic and difficult situations. This theory suggests that every individual has the will and desire to meaning and is able to choose to find meaning in life because meaning can be found in all situations (Frankl, 1985). Wong (2012b) proposes that people develop meaning in life if they know what they want and how they can achieve their goals, if they know their fears and know how to overcome those fears and if they are able to make sense of their life experiences. He explains this meaning making model as the dual system of meaning making (Wong, 2012b). The dual system model consists of three key components, the approach system, avoidance system and mindfulness (Wong, 2012b). This model suggests that the approach system and the avoidance systems are interdependent and that people can still find meaning and satisfaction from the negative situations that they would naturally want to avoid. The approach system represents the positive behaviours and goal orientated motivations whereas the avoidance system represents the defence mechanisms against negative effects and threats (Wong, 2012b). Mindful awareness comes into play when a person is not engaged in either the approach or the avoidance system. The mindful awareness represents the full awareness of our current situations that brings us to

an openness to new discoveries to fulfil our goals and meaning (Wong, 2012b). For positive outcomes and a sense of meaning both systems need to interact for example, if an individual requires positive affect and motivation to overcome the negative events in life. However mindful awareness brings us to acceptance and new ways of fulfilling our purpose (Wong, 2012b). This implies that people can experience meaning when they realise that their failures, negative events and challenges they encounter in their journey to meaning contribute positively towards their personal growth and thus their meaning in life (Wong, 2012b).

Steger *et al*. (2008) proposes that searching for meaning is an important component to meaning making. This implies that search for meaning does not necessarily suggest lack of sense of meaning. Though search for meaning is related to negative perceptions, search for meaning facilitates openness to ideas about life that leads to experiencing meaning (Steger *et al*., 2008). Because search for meaning has a dual nature, searching for meaning can be either healthy or unhealthy depending on who is searching (Steger *et al*., 2008).

Park's meaning making model is discrepancy based. It implies that people's perception of the discrepancies between their beliefs and desires and specific situations in their lives create distress which in turn creates the need to close those discrepancies and reduce distress (Park, 2013). The meaning making model specifies two levels of meaning: the global meaning and situational meaning (Park, 2013). Global meaning speaks to the individual's general orientation and views of many situations whereas the situational meaning speaks to the individual's orientation and view in specific instances (Park, 2013). This model proposes that the discrepancies between the global meaning and situational meaning create distress which in turn leads to efforts taken to decrease distress and discrepancies and thus meaning made (Park, 2013).

Figure 2.2 below is based on Steger's theory for presence and search for meaning and explains the possible role of presence and search for meaning in life in promoting good health behaviours (Steger *et al*., 2008).

2.10 Measuring MIL

There are many scales available in literature that measure sense of meaning. These include Purpose in Life (PIL) test, Life Regard Index (LRI), Sense of Coherence Scale (SOC), Satisfaction with Life (SWL) scale, Meaning In Life Questionnaire (MIL-Q) and Rosenberg Self–Esteem Inventory (EST). Chamberlain and Zika (1988), found that the best scale to measure general sense of meaning is PIL when compared to LRI and SOC. Life Regard Index was found to not be a transferable tool to measure MIL in the South African context without adjustments (De Klerk *et al*., 2009). Steger *et al*. (2006) reported MIL-Q to be a better tool to measure meaning because it

includes a measure for search of meaning, has no overlap with distress measures and has a better discriminant validity when compared to PIL, LRI, SWL and EST. The MIL-Q showed good internal consistence reliability and has been validated to assess MIL within the South African context (Khumalo *et al*., 2014 & Temane *et al*., 2012).

The MIL-Q is a ten item measure of the presence and search for MIL. The possible scores for both presence and search for MIL range from five to 35. If the participant scores above 24 for presence of MIL and above 24 for search of MIL, the participant is considered to have a sense of meaning in life and yet still openly exploring that meaning. A score of above 24 for presence of MIL and below 24 for search of MIL indicates that the participants has a sense of MIL and is not seeking or exploring MIL. A score of below 24 for presence and above 24 for search of MIL indicates that the participant has no sense of meaning and is actively searching for MIL. A score of below 24 for both presence and search of MIL indicate that the participant has no sense of MIL and yet are not seeking for MIL (Steger, 2006).

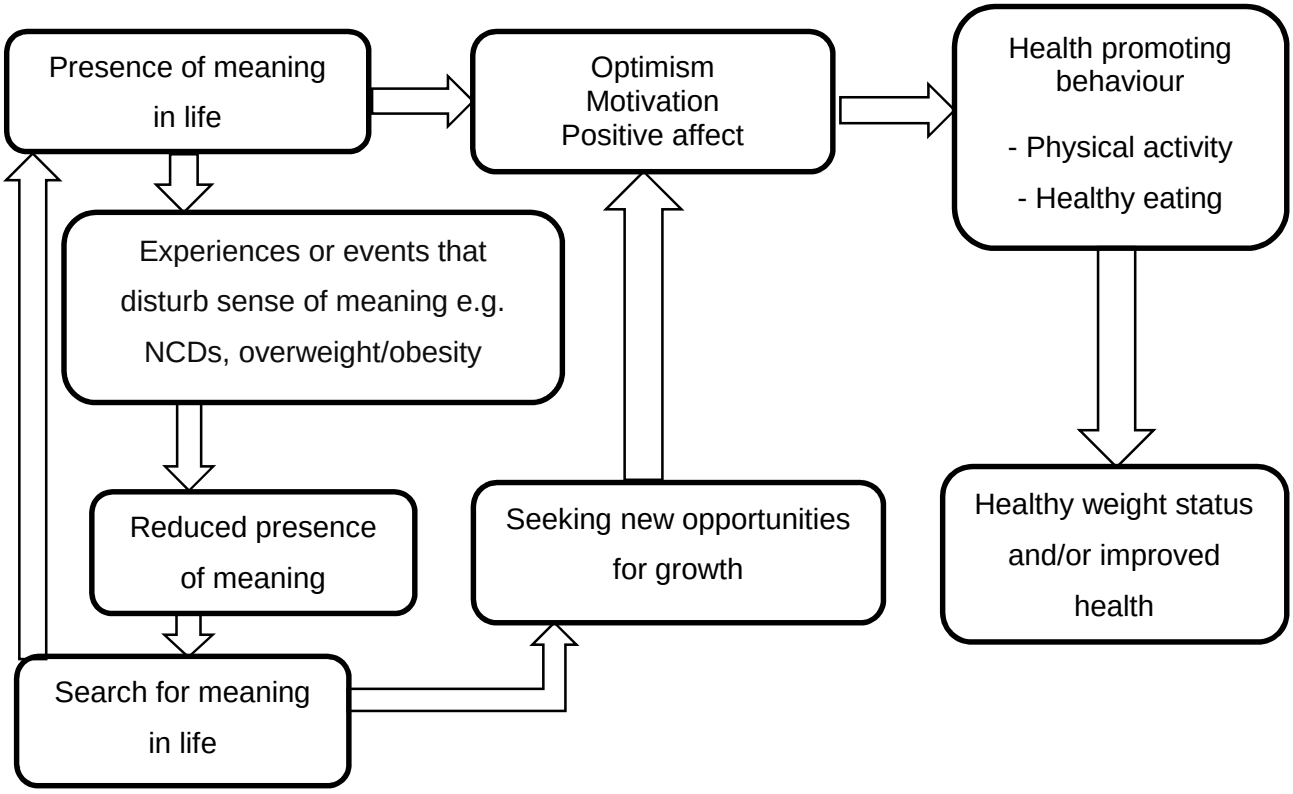

Figure 2.2: Conceptualisation of the possible role of MIL on health outcomes

2.11 Meaning in life and physical health

People who have a higher presence of MIL are most likely to engage in health promoting behaviours and report better health (Steger *et al.*, 2015). The drive to health promoting behaviours may be facilitated by a positive orientation towards health which in turn reduces the likelihood to engage in health-risking behaviours (Steger *et al.*, 2015). The available evidence on meaning does not support health causality, however; a sense of meaning is associated with psychological effects such as self-efficacy, optimism and positive affect which have positive effects on physical health and health promoting behaviours (Roepke *et al*., 2014).

The sense of MIL and purpose has been associated with less likelihood of all-cause mortality (Boyle *et al*., 2009), better health related quality of life (Eakman *et al*., 2010), lower levels of inflammatory markers (Friedman *et al*., 2007), less reduction in physical health in women with polio (Harrison & Stuifbergen, 2006) and more physical activity (Holahan *et al*., 2011).

A strong sense of MIL has also been found to have a positive association with general health and lower mortality in the elderly (Krause, 2004; Krause, 2009). Having a sense of purpose has also been associated with reduced risk of mortality throughout adulthood (Hill & Turiano, 2014). Cohen *et al*. (2016) also reported an association between reduced risk of all-cause mortality and cardiovascular event and higher sense of meaning.

Homan and Boyatzis (2010) reported a positive association between MIL and the likelihood of engaging in health promoting behaviours such as physical activity and healthy eating. Holahan *et al*. (2011) supported this findings when they found that women in early mid-life are better able to meet the acceptable levels of physical activity if they have a sense of purpose. Brassai *et al.* (2015) also supported the above statement when they reported that MIL is a predictor of healthy eating and physical activity in adolescents. A higher sense of purpose in life was associated with both self-reported and measured physical activity (Hooker & Masters, 2016). Meaning in life also encourages people to participate in health promoting behaviours and they are therefore more likely to have healthy eating habits (Piko & Brassai, 2016; Steger, 2015).

This evidence provides a possible link between MIL and markers of good physical health. In a systematic review Roepke *et al*. (2014) conclude that high levels of MIL are related to improved physical health.

Meaning in life may facilitate a more positive attitude and orientation towards health and therefore encourages health promoting behaviours (Steger, 2015). People with a higher sense of purpose are more likely to use preventative health care services and therefore such adults 50 years and older are most likely to enhance health and minimise health care costs (Kim *et al.*, 2014). A higher sense of meaning has also been associated with a lower risk of myocardial infarctions in older

adults with coronary heart disease and lower risk of stroke in older adults (Kim *et al*., 2013a; Kim *et al*., 2013b).

Roepke *et al*. (2014) proposes two mechanisms at which meaning contribute to positive physical health, better physiological regulation of immune and stress response and sense of control. People with a higher sense of meaning have low stress responses, this was shown by lower levels of inflammatory markers in women who had higher scores for purpose in life (Friedman *et al*., 2007). One study found that positive affect was only associated with lower levels of inflammatory markers in women but not in men (Steptoe *et al*., 2007). Having a sense of control over an individual's own life brings self-efficacy, optimism and positive affect which through meaning can facilitate improvement of physical health by encouraging health promoting behaviours (Roepke *et al*., 2014).

Although MIL has been associated with better eating habits and physical activity (Holahan *et al.,* 2011; Brassai *et al.,* 2015; Homan and Boyatzis, 2010), studies linking MIL to difference in weight status and prevalence of NCDs were not found.

2.12 Summary of the literature review

The prevalence of NCDs is on the rise globally (Lobstein & Brinsden, 2014). In South Africa, the prevalence of NCDs is among the highest in sub-Saharan Africa (Dalal *et al*., 2011). NCDs contribute to over 50% of deaths in South Africa (Stats SA, 2017). Obesity is a major risk factor for the development of NCDs and has been associated with high blood pressure, diabetes and heart diseases (SADHS 2016, 2017). Dietary factors such as high sugar intake, high sodium intake, a shift to a more westernised diet and low fruit and vegetable intake in South Africa are associated with the increased risk of developing NCDs (Cooper *et al.*, 2012; Steyn & Temple, 2012; Temple & Steyn, 2016; Vorster *et al*., 2014; WHO, 2012).

With the increasing prevalence of NCDs, preventable risk factors such as physical inactivity, overweight and obesity and unhealthy diet are important in preventing and reducing the burden of NCDs. However adherence to health promoting behaviours such as physical activity and healthy eating is often difficult to initiate and sustain (Panter-Brick *et al*., 2006).

Many studies have found that people with a greater sense of meaning are most likely to use preventative health services, eat better and engage in more physical activity than those without or with a lower sense of meaning (Brassai *et al*., 2015; Kim *et al*., 2014; Piko & Brassai, 2016; Steger, 2015). Meaning in life can therefore facilitate better adherence to health promoting behaviours. Meaning in life is thought to promote adherence to health promoting behaviours by facilitating positive affect, optimism and self-efficacy (Roepke *et al*., 2014).

REFERENCE LIST

Alwan, A., MacLean, D.R., Riley, L.M., d'Espaignet, E.T., Mathers, C.D., Stevens, G.A. & Bettcher, D. 2010. Monitoring and surveillance of chronic non-communicable diseases: progress and capacity in high-burden countries. *The Lancet,* 376(9755):1861-1868.

Alwan, A., 2011. *Global status report on noncommunicable diseases 2010*. World Health Organization.

Ardington, C. & Case, A. 2009. Health: Analysis of the NIDS Wave 1 Dataset. Discussion Paper no. 2.

Basu, S., McKee, M., Galea, G. & Stuckler, D., 2013. Relationship of soft drink consumption to global overweight, obesity, and diabetes: a cross-national analysis of 75 countries. *American journal of public health*, *103*(11): 2071-2077.

Bertram, M.Y., Jaswal, A.V., Van Wyk, V.P., Levitt, N.S. & Hofman, K.J. 2013. The non-fatal disease burden caused by type 2 diabetes in South Africa, 2009. *Global health action*, 6(1):206-212.

Brassai, L., Piko, B.F. & Steger, M.F. 2011. Meaning in life: Is it a protective factor for adolescents' psychological health? *International journal of behavioural medicine*, 18(1):44-51.

Brassai, L., Piko, B.F. & Steger, M.F. 2015. A reason to stay healthy: The role of meaning in life in relation to physical activity and healthy eating among adolescents. *Journal of health psychology*, 20(5):473-482.

Bourne, L.T., Lambert, E.V. & Steyn, K. 2002. Where does the black population of South Africa stand on the nutrition transition? *Public health nutrition*, 5(1a):157-162.

Boyle, P.A., Barnes, L.L., Buchman, A.S. and Bennett, D.A. 2009. Purpose in life is associated with mortality among community-dwelling older persons. *Psychosomatic medicine*, *71*(5):574.

Cecchini, M., Sassi, F., Lauer, J.A., Lee, Y.Y., Guajardo-Barron, V. & Chisholm, D. 2010. Tackling of unhealthy diets, physical inactivity, and obesity: health effects and cost-effectiveness. *The Lancet,* 376(9754):1775-1784.

Chamberlain, K. & Zika, S. 1988. Measuring meaning in life: an examination of three scales. *Personality and individual differences*, 9(3):589-596.

Choi, H.K., Willett, W.C., Stampfer, M.J., Rimm, E. & Hu, F.B. 2005. Dairy consumption and risk of type 2 diabetes mellitus in men: a prospective study. *Archives of internal medicine*, 165(9):997-1003.

Cohen, R., Bavishi, C. & Rozanski, A. 2016. Purpose in life and its relationship to all-cause mortality and cardiovascular events: a meta-analysis. *Psychosomatic medicine*, 78(2):122-133.

Conner, M. & Norman, P. 2005. Predicting health behaviour. United Kingdom: McGraw-Hill Education.

Cooper, A.J., Sharp, S.J., Lentjes, M.A., Luben, R.N., Khaw, K.T., Wareham, N.J. & Forouhi, N.G. 2012. A prospective study of the association between quantity and variety of fruit and vegetable intake and incident type 2 diabetes. *Diabetes care*, (112388):1-9.

Dalal, S., Beunza, J.J., Volmink, J., Adebamowo, C., Bajunirwe, F., Njelekela, M., Mozaffarian, D., Fawzi, W., Willett, W., Adami, H.O. & Holmes, M.D. 2011. Non-communicable diseases in sub-Saharan Africa: what we know now. *International journal of epidemiology*, 40(4):885-901.

Day, C., Groenewald, P., Laubscher, R., Chaudhry, S., Van Schaik, N. & Bradshaw, D. 2014. Monitoring of non-communicable diseases such as hypertension in South Africa: Challenges for the post-2015 global development agenda. *SAMJ: South African medical journal*, 104(10):680-687.

Dauchet, L., Amouyel, P., Hercberg, S. & Dallongeville, J. 2006. Fruit and vegetable consumption and risk of coronary heart disease: a meta-analysis of cohort studies. *The Journal of nutrition*, 136(10):2588-2593.

De Klerk, J.J., Boshoff, A.B. & Van Wyk, R. 2009. Measuring meaning in life in South Africa: validation of an instrument developed in the USA. *South African journal of psychology*, 39(3):314-325.

Eakman, A.M., Carlson, M.E. & Clark, F.A. 2010. Factor structure, reliability, and convergent validity of the engagement in meaningful activities survey for older adults. *The occupational therapy journal of research: occupation, participation and health*, 30(3):111-121.

Eikenberry, N. & Smith, C. 2004. Healthful eating: perceptions, motivations, barriers, and promoters in low-income Minnesota communities. *Journal of the American dietetic association*, 104(7):1158-1161.

Ekoru, K., Murphy, G.A.V., Young, E.H., Delisle, H., Jerome, C.S., Assah, F., Longo-Mbenza, B., Nzambi, J.P.D., On'Kin, J.B.K., Buntix, F. & Muyer, M.C. 2018. Deriving an optimal threshold of waist circumference for detecting cardiometabolic risk in sub-Saharan Africa. *International journal of obesity*, 42(3):487.

Faber, M. & Kruger, H.S. 2005. Dietary intake, perceptions regarding body weight, and attitudes toward weight control of normal weight, overweight, and obese black females in a rural village in South Africa. *Ethnicity and disease*, 15(2):238-245.

Fear, N.T., Sundin, J. & Rona, R.J. 2011. Obesity in the United Kingdom Armed Forces: prevalence based on measured and self-reported data. *Military medicine*, 176(1):44-49.

Frankl, V.E. 1985. Man's search for meaning. New York, Washington: Simon and Schuster.

Frankl, V.E., Lasch, I. & Allport, G.W. 1963. Man's search for meaning: An introduction to logotherapy. New York.

Frankl, V.E. 1992. Meaning in industrial society. *International forum for logotherapy*, 15(2):66-70.

Funtikova, A.N., Subirana, I., Gomez, S.F., Fitó, M., Elosua, R., Benítez-Arciniega, A.A. & Schröder, H. 2015. Soft drink consumption is positively associated with increased waist circumference and 10-year incidence of abdominal obesity in Spanish adults. *The Journal of nutrition*, 145(2):328-334.

Gattis, V.M. 2011. Obesity*:* A threat to national security? U.S. Army War College. Carlisle Barracks: PA.

Friedman, E.M., Hayney, M., Love, G.D., Singer, B.H. & Ryff, C.D. 2007. Plasma interleukin-6 and soluble IL-6 receptors are associated with psychological well-being in aging women. *Health Psychology*, 26(3):305.

Homan, K.J. & Boyatzis, C.J. 2010. Religiosity, sense of meaning, and health behavior in older adults. *The International journal for the psychology of religion*, 20(3):173-186.

Harrison, T.C. & Stuifbergen, A.K. 2006. Life purpose: Effect on functional decline and quality of life in polio survivors. *Rehabilitation nursing*, 31(4):149-154.

He, F.J., Nowson, C.A. & MacGregor, G.A. 2006. Fruit and vegetable consumption and stroke: meta-analysis of cohort studies. *The Lancet*, 367(9507):320-326.

Hill, P.L. & Turiano, N.A. 2014. Purpose in life as a predictor of mortality across adulthood. *Psychological science*, 25(7):1482-1486.

Holahan, C.K., Holahan, C.J., Velasquez, K.E., Jung, S., North, R.J. & Pahl, S.A. 2011. Purposiveness and leisure-time physical activity in women in early midlife. *Women & health*, 51(7):661-675.

Hooker, S.A. & Masters, K.S. 2016. Purpose in life is associated with physical activity measured by accelerometer. *Journal of health psychology*, 21(6):962-971.

Hunter, D.J. & Reddy, K.S. 2013. Non-communicable diseases. *New England journal of medicine*, 369(14):1336-1343.

Jackson, E.S., Tucker, C.M. & Herman, K.C. 2007. Health value, perceived social support, and health self-efficacy as factors in a health-promoting lifestyle. *Journal of American college health*, 56(1):69-74.

Joubert, J., Norman, R., Lambert, E.V., Groenewald, P., Schneider, M., Bull, F., Bradshaw, D. & Collaboration, S.A.C.R.A. 2007. Estimating the burden of disease attributable to physical inactivity in South Africa in 2000. *South African medical journal*, 97(8):725-731.

Kahn, S.E., Hull, R.L. & Utzschneider, K.M. 2006. Mechanisms linking obesity to insulin resistance and type 2 diabetes. *Nature*, 444(7121):840-846.

Khatib, O. 2004. Non communicable diseases: risk factors and regional strategies for prevention and care.

Khumalo, I.P., Wissing, M.P. & Schutte, L. 2014. Presence of meaning and search for meaning as mediators between spirituality and psychological well-being in a South African sample. *Journal of psychology in Africa*, 24(1):61-72.

Kim, E.S., Sun, J.K., Park, N., Kubzansky, L.D. & Peterson, C. 2013a. Purpose in life and reduced risk of myocardial infarction among older US adults with coronary heart disease: a two-year follow-up. *Journal of behavioral medicine*, 36(2):124-133.

Kim, E.S., Sun, J.K., Park, N. & Peterson, C. 2013b. Purpose in life and reduced incidence of stroke in older adults: 'The Health and Retirement Study'. *Journal of psychosomatic research*, 74(5):427-432.

Kim, E.S., Strecher, V.J. and Ryff, C.D. 2014. Purpose in life and use of preventive health care services. *Proceedings of the National Academy of Sciences*, *111*(46):16331-16336.

King, L.A., Hicks, J.A., Krull, J.L. & Del Gaiso, A.K. 2006. Positive affect and the experience of meaning in life. *Journal of personality and social psychology*, 90 (1):179.

Kontis, V., Mathers, C.D., Rehm, J., Stevens, G.A., Shield, K.D., Bonita, R., Riley, L.M., Poznyak, V., Beaglehole, R. and Ezzati, M. 2014. Contribution of six risk factors to achieving the 25× 25 non-communicable disease mortality reduction target: a modelling study. *The Lancet*, *384*(9941):427-437.

Krause, N. 2004. Stressors arising in highly valued roles, meaning in life, and the physical health status of older adults. *The Journals of gerontology series B: psychological sciences and social sciences*, 59(5):S287-S297.

Krause, N. 2009. Meaning in life and mortality. *The Journals of gerontology series B: psychological sciences and social sciences*, 64(4):517-527.

Kruger, H.S., Venter, C.S. & Vorster, H.H. 2001. Obesity in African women in the North West Province, South Africa is associated with an increased risk of non-communicable diseases: the THUSA study. *British journal of nutrition*, 86(6):733-740.

Kruger, H.S., Venter, C.S., Vorster, H.H. & Margetts, B.M. 2002. Physical inactivity is the major determinant of obesity in black women in the North West Province, South Africa: the THUSA study. *Nutrition*, 18(5):422-427.

Kruger, H.S., Puoane, T., Senekal, M. & Van der Merwe, M.T. 2005. Obesity in South Africa: challenges for government and health professionals. *Public health nutrition*, 8(5):491-500.

Lee, L.L., Arthur, A. & Avis, M. 2008. Using self-efficacy theory to develop interventions that help older people overcome psychological barriers to physical activity: a discussion paper. *International journal of nursing studies*, 45(11):1690-1699.

Lee, I.M., Shiroma, E.J., Lobelo, F. & Puska, P. 2012. Impact of physical inactivity on the world's major non-communicable diseases. *The Lancet*, 380(9838):219-229.

Levitt, N.S., Katzenellenbogen, J.M., Bradshaw, D., Hoffman, M.N. & Bonnici, F. 1993. The prevalence and identification of risk factors for NIDDM in urban Africans in Cape Town, South Africa. *Diabetes care*, 16(4):601-607.

Lloyd-Sherlock, P., Beard, J., Minicuci, N., Ebrahim, S. & Chatterji, S. 2014. Hypertension among older adults in low-and middle-income countries: prevalence, awareness and control. *International journal of epidemiology*, 43(1):116-128.

Lock, K., Pomerleau, J., Causer, L., Altmann, D.R. & McKee, M. 2005. The global burden of disease attributable to low consumption of fruit and vegetables: implications for the global strategy on diet. *Bulletin of the World Health Organization*, 83:100-108.

Lorig, K. & Holman, H. 2000. Self-Management Education: Contexts, Definitions, and Outcomes and Mechanisms. Palo Alto: Stanford Patient Education Research Center.

Lobstein, T. & Brinsden, H. 2014. Symposium report: the prevention of obesity and NCDs: challenges and opportunities for governments. *Obesity reviews,* 15(8):630-639.

MacIntyre, U.E., Kruger, H.S., Venter, C.S. & Vorster, H.H. 2002. Dietary intakes of an African population in different stages of transition in the North West Province, South Africa: the THUSA study. *Nutrition research*, 22(3):239-256.

Malhotra, R., Hoyo, C., Østbye, T., Hughes, G., Schwartz, D., Tsolekile, L., Zulu, J. & Puoane, T. 2008. Determinants of obesity in an urban township of South Africa. *South African journal of clinical nutrition*, 21(4):315-320.

Mayosi, B.M., Flisher, A.J., Lalloo, U.G., Sitas, F., Tollman, S.M. & Bradshaw, D. 2009. The burden of non-communicable diseases in South Africa. *The Lancet,* 374:934-947.

Motala, A.A., Esterhuizen, T., Gouws, E., Pirie, F.J. & Omar, M.A. 2008. Diabetes mellitus and other disorders of glycaemia in a rural South African community: prevalence and associated risk factors. *Diabetes care*, 31(9):1783-1788.

Msemburi, W., Pillay-van Wyk, V., Dorrington, R.E., Neethling, I., Nannan, N., Groenewald, P., Laubscher, R., Joubert, J., Matzopoulos, R., Nicol, E. and Nojilana, B. 2014. Second national burden of disease study for South Africa: Cause-of-death profile for South Africa, 1997–2010. *Cape Town: South African Medical Research Council*, 1-23.

Mvo, Z. 1999. Perceptions of overweight African women about acceptable body size of women and children. *Curationis*, *22*(2):27-31.

Naghavi, M. & Forouzanfar, M.H. 2013. Burden of non-communicable diseases in sub-Saharan Africa in 1990 and 2010: Global burden of diseases, injuries, and risk factors study 2010. *The Lancet*, 381:S95.

Napradit, P., Pantaewan, P., Nimit-arnun, N., Souvannakitti, D. & Rangsin, R. 2007. Prevalence of Overweight and Obesity in Royal Thai Army Personnel. *Journal of the Medical association of Thailand,* 90(2):335-340.

Stats SA (Statistics South Africa). 2017. National Department of Health (NDoH). South African Medical Research Council (SAMRC) and ICF. South Africa Demographic and Health Survey 2016: key indicators.

NCD Risk Factor Collaboration (NCD-RisC) – Africa Working Group. 2017. Trends in obesity and diabetes across Africa from 1980 to 2014: an analysis of pooled population-based studies. *International journal of epidemiology*, 46(5):1421-1432.

Nguyen, N.T., Magno, C.P., Lane, K.T., Hinojosa, M.W. & Lane, J.S. 2008. Association of hypertension, diabetes, dyslipidemia, and metabolic syndrome with obesity: findings from the National Health and Nutrition Examination Survey, 1999 to 2004. *Journal of the American college of surgeons*, 207(6):928-934.

Norman, R., Gaziano, T., Laubscher, R., Steyn, K., Bradshaw, D. & Collaboration, S.A.C.R.A. 2007. Estimating the burden of disease attributable to high blood pressure in South Africa in 2000. *South African medical journal*, 97(8):692-698.

Okop, K.J., Mukumbang, F.C., Mathole, T., Levitt, N. and Puoane, T., 2016. Perceptions of body size, obesity threat and the willingness to lose weight among black South African adults: a qualitative study. *BMC public health*, *16*(1):365.

Panter-Brick, C., Clarke, S.E., Lomas, H., Pinder, M. & Lindsay, S.W. 2006. Culturally compelling strategies for behaviour change: a social ecology model and case study in malaria prevention. *Social science & medicine*, 62(11):2810-2825.

Park, C.L. 2013. The meaning making model: a framework for understanding meaning, spirituality, and stress-related growth in health psychology. *European health psychologist*, 15(2):40-47.

Piko, B.F. & Brassai, L. 2016. A reason to eat healthy: The role of meaning in life in maintaining homeostasis in modern society. *Health psychology open*, 3(1):2055102916634360.

Pereira, M.A., Jacobs Jr, D.R., Van Horn, L., Slattery, M.L., Kartashov, A.I. & Ludwig, D.S. 2002. Dairy consumption, obesity, and the insulin resistance syndrome in young adults: the CARDIA Study. *Journal of American Medical Association*, 287(16):2081-2089.

Pomerleau, J., Lock, K. & McKee, M. 2006. The burden of cardiovascular disease and cancer attributable to low fruit and vegetable intake in the European Union: differences between old and new member states. *Public health nutrition*, 9(5):575-583.

Puoane, T., Steyn, K., Bradshaw, D., Laubscher, R., Fourie, J., Lambert, V. & Mbananga, N. 2002. Obesity in South Africa: The South African Demographic and Health Survey. *Obesity research*, (10):1038-1048.

Puoane, T., Fourie, J.M., Shapiro, M., Rosling, L., Tshaka, N.C. & Oelefse, A. 2005. 'Big is beautiful' – an exploration with urban black community health workers in a South African township. *South African journal of clinical nutrition*, 18(1):6-15.

Rao, M., Afshin, A., Singh, G. & Mozaffarian, D. 2013. Do healthier foods and diet patterns cost more than less healthy options? A systematic review and meta-analysis. *British medical journal open*, 3(12):e004277.

Roepke, A.M., Jayawickreme, E. & Riffle, O.M. 2014. Meaning and health: a systematic review. *Applied research in quality of life,* 9(4):1055-1079.

Senekal, M., Steyn, N.P. & Nel, J.H. 2003. Factors associated with overweight/obesity in economically active South African populations. *Ethnicity & disease*, 13(1):109-116.

Schneider, M., Bradshaw, D., Steyn, K., Norman, R. & Laubscher, R. 2009. Poverty and non-communicable diseases in South Africa. *Scandinavian journal of public health,* 37:176-186.

Schulenberg, S.E., Hutzell, R.R., Nassif, C. & Rogina, J.M. 2008. Logotherapy for clinical practice. *Psychotherapy: theory, research and practice*, 45(4):447.

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., Reddy, P., Parker, W., Hoosain, E., Naidoo, P., Hongoro, C., Mchiza, Z., Steyn, N.P., Dwane, N., Makoae, M., Maluleke, T., Ramlagan, S., Zungu, N., Evans, M.G., Jacobs, L., Faber, M. & the SANHANES-1 Team. 2014. South African National Health and Nutrition Examination Survey (SANHANES-1): 2014 edition. Cape Town: HSRC Press.

Steger, M.F., Frazier, P., Oishi, S. & Kaler, M. 2006. The meaning in life questionnaire: Assessing the presence of and search for meaning in life. *Journal of counseling psychology*, 53(1):80.

Steger, M.F., Kashdan, T.B., Sullivan, B.A. & Lorentz, D. 2008. Understanding the search for meaning in life: Personality, cognitive style, and the dynamic between seeking and experiencing meaning. *Journal of personality*, 76(2):199-228.

Steger, M.F., 2013. Experiencing meaning in life: Optimal functioning at the nexus of well-being, psychopathology, and spirituality. *The human quest for meaning*. 2nd Ed. New York, NY: Routledge.p. 211-230.

Steger, M.F., Fitch-Martin, A.R., Donnelly, J. & Rickard, K.M. 2015. Meaning in life and health: Proactive health orientation links meaning in life to health variables among American undergraduates. *Journal of happiness studies*, 16(3):583-597.

Steptoe, A., O'donnell, K., Badrick, E., Kumari, M. & Marmot, M. 2007. Neuroendocrine and inflammatory factors associated with positive affect in healthy men and women: the Whitehall II study. *American journal of epidemiology*, 167(1):96-102.

Steyn, N.P. & Temple, N.J. (2012). Evidence to support a food-based dietary guideline on sugar consumption in South Africa. *BMC Public Health*, 12(1):502

Silliman, K., Rodas-Fortier, K. & Neyman, M. 2004. A survey of dietary and exercise habits and perceived barriers to following a healthy lifestyle in a college population. *Californian journal of health promotion*, 18:281.

Sol, B.G., Van der Graaf, Y., Van Petersen, R. & Visseren, F.L. 2011. The effect of self-efficacy on cardiovascular lifestyle. *European journal of cardiovascular nursing*, 10(3):180-186.

Tibazarwa, K., Ntyintyane, L., Sliwa, K., Gerntholtz, T., Carrington, M., Wilkinson, D. & Stewart, S. 2009. A time bomb of cardiovascular risk factors in South Africa: results from the Heart of Soweto Study "Heart Awareness Days". *International journal of cardiology*, 132(2):233-239.

Temane, L. 2012. Validation of the Meaning in Life Questionnaire in an African context. (Doctoral theses, North-West University).

Temple, N.J. & Steyn, N.P. 2009. Food prices and energy density as barriers to healthy food patterns in Cape Town, South Africa. *Journal of hunger & environmental nutrition*, 4(2):203-213.

Temple, N.J., Steyn, N.P., Fourie, J. & De Villiers, A. 2011. Price and availability of healthy food: a study in rural South Africa. *Nutrition*, 27(1):55-58.

Temple, N.J. & Steyn, N. 2016. Community nutrition for developing countries. Athabasca University Press and UNISA Press: 55-62.

Tollman, S.M., Kahn, K., Sartorius, B., Collinson, M.A., Clark, S.J. & Garenne, M.L. 2008. Implications of mortality transition for primary health care in rural South Africa: a population-based surveillance study. *The Lancet*, 372(9642):893-901.

Van Zyl, M.K., Steyn, N.P. & Marais, M.L. 2010. Characteristics and factors influencing fast food intake of young adult consumers in Johannesburg, South Africa. *South African journal of clinical nutrition*, 23(3):124-130.

Vorster, H.H., Kruger, A., Wentzel-Viljoen, E., Kruger, H.S. & Margetts, B.M. 2014. Added sugar intake in South Africa: findings from the Adult Prospective Urban and Rural Epidemiology cohort study. *The American journal of clinical nutrition*, 99(6):1479-1486.

Wang, L., Manson, J.E., Buring, J.E., Lee, I.M. & Sesso, H.D. 2008. Dietary intake of dairy products, calcium, and vitamin D and the risk of hypertension in middle-aged and older women. *Hypertension*, 51(4):1073.

Wentzel-Viljoen, E., Steyn, K., Ketterer, E. & Charlton, K.E. 2013. "Use salt and foods high in salt sparingly": a food-based dietary guideline for South Africa. *South African journal of clinical nutrition*, 26(3):S105-S113.

Wong, P.T. 2012a. The human quest for meaning: theories, research, and applications. (*In* Wong, P.T. *ed*. From logotherapy to meaning-centered counselling and therapy. 2nd ed. New York, NY: Routledge. p. 619-647).

Wong, P.T. 2012b. The human quest for meaning: theories, research and applications. (*In* Wong, P.T. *ed*. Toward a dual-systems model of what makes life worth living. 2nd ed. New York, NY: Routledge. p. 49-68).

World Health Organization (WHO). 2012. Guideline: sodium intake for adults and children. http://www.who.int/nutrition/publications/guidelines/sodium_intake/en/ Date of access: 7 April 2016.

World Health Organization (WHO). 2013. 10 Facts on Non-Communicable Diseases. http://www.who.int/features/factfiles/noncommunicable_diseases/facts/en/ Date of access: 7 April 2016.

World Health Organization (WHO). 2017. Non-communicable diseases: progress monitor 2017. Geneva.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter explains detailed methods used to collect, interpret and analyse data and includes study design, study population and setting, study site and infrastructure, inclusion and exclusion criteria, recruitment plan and data saturation, sample size, data collection procedures, data capturing, quality assurance and statistical analysis, data management and monitoring and ethical aspects.

3.2 Study design

This study was a cross-sectional study where participants' frequency of intake from food groups, weight status, and physical activity were assessed and the relationship between these variables and meaning in life was determined.

3.3 Study population and setting

The study was conducted at Lenz Military Base in Lenasia, Johannesburg. Lenz Military Base is home to Army Support Base Johannesburg Unit (72%), 11 Maintenance Unit (15%), Signal squadron (6%) and Lenz Sickbay and Hospice (7%). The age of the members of Lenz Military Base ranges between 21 and 64 years with 61% of males and 39% of females. About 30% of the members of Lenz Military base live in the base and get their meals from the mess. Most members at Lenz Military Base are uniform members with only 5% civilians. The sample was a convenience sample where all the members of Lenz Military Base were invited to participate.

3.4 Study site and infrastructure

The study was a single site study and was conducted at the Lenz sickbay in the community centre. The study used the dietician's office for measurements for privacy. Data collection for a few participants (five) was collected in the participant's offices on the participants' request. The researcher is a registered dietician who is an employee of the SANDF based at Lenz Military Base.

3.5 Inclusion and exclusion criteria

The participants were included in the study if they were active members of any subsections of Lenz Military Base regardless of their age groups, gender, ethnicity, rank or subsection. Participants was excluded if they were pregnant, had health conditions that prevent normal walking and standing for example people with physical disability, amputated limbs or have hearing

loss, which will make it difficult to complete questionnaires or take anthropometrical measurements. The researcher's current patients were not included in the study.

3.6 Recruitment plan

Participants were recruited by posting advertisements on major entry points in the Lenz Military Base, such as the main gate and notice boards at every subsection in the Lenz Military Base. Participants who were interested to participate in the study enlisted their names and contact numbers by contacting the contact numbers on the advertisement or by enlisting their names at the dietician's office in the Lenz Military Base Sickbay. The researcher also had presentations at the subsections and the members who were interested in participating in the study enlisted their names and contact numbers. Participants who have enlisted their names were contacted via telephone to arrange for informed consent and data collection appointments.

3.7 Sample size

Lenz Military Base is a support base with about 425 administrative workers, hospitality workers, procurement officers, protection personnel, facility personnel, mechanics, human resource personnel and medical personnel working at the base. The age range of the members working at Lenz Military Base is 21 to 64 years with 61% male members and 39% female members. A total of 129 participants enlisted to participate in the study. The participants who enlisted for the study were phoned to arrange for an appointment and reminder messages were sent on the day before the appointment. Data was collected from 80 participants, 33 participants agreed to a data collection appointment but did not turn up, six participants could not be reached, five participants withdrew from the study and stated that they were no longer interested in participating, four participants moved to different military bases and one participant was excluded because he was the researcher's current patient. The initial response rate was therefore only 30%.

3.8 Data collection procedure

The data collected included questionnaires and anthropometric measurements.

3.8.1 Questionnaires

The following questionnaires were administered to participants:

- Meaning in life questionnaire (MIL-Q) (Appendix 1)
- The healthy and unhealthy food intake survey (Appendix 2)
- Socio-demographic and health questionnaire (Appendix 3)
- Global Physical Activity Questionnaire (GPAQ) (Appendix 4)

The socio-demographic and health questionnaire was administered first, followed by the GPAQ, the healthy and unhealthy food intake survey and then the MIL-Q.

The Meaning in Life questionnaire

The MIL-Q developed by Michael Steger was used to evaluate the presence and search for MIL. The questionnaire showed good internal consistence reliability within the South African context with Cronbach alpha values of 0.85 for presence of MIL and 0.84 for search of MIL (Khumalo *et al.,* 2014). Temane *et al.* (2012) also reported the MIL questionnaire as a reliable and valid tool to assess MIL in an African context. The questionnaire was administered by asking participants questions and the scale of the questionnaire was shown to participants when the questionnaire was administered. The score was evaluated by entering the participants' answers into a formulated excel sheet that worked out the scores.

The possible scores for both presence and search for MIL range from five to 35. If the participant scores above 24 for presence of MIL and above 24 for search of MIL, the participant is considered to have a sense of meaning in life and yet still openly exploring that meaning. A score of above 24 for presence of MIL and below 24 for search of MIL indicates that the participants has a sense of MIL and is not seeking or exploring MIL. A score of below 24 for presence and above 24 for search of MIL indicates that the participant has no sense of meaning and is actively searching for MIL. A score of below 24 for both presence and search of MIL indicate that the participant has no sense of MIL and yet are not seeking for MIL (Steger, 2006).The researcher who administered the MIL questionnaire was trained by Dr Deacon, who is the co-supervisor of the student and a psychologist and the team member who supervised the MIL data collection and interpretation of data.

The healthy and unhealthy food intake survey

The questionnaire used to collect data on frequency of intake of healthy and unhealthy food groups was based on the questionnaires used in the studies from Burkina Faso and South Africa (Dabone *et al.,* 2013; Larsen *et al.,* 2015; Wentzel-Viljoen *et al.,* 2011; WHO, 2008;). The food groups included reflected foods reported to be eaten by South African adults (Faber & Kruger, 2005; MacIntyre *et al.,* 2002). The questionnaire included four groups of healthy foods (fruit; vegetables; meat, chicken, egg and fish; milk or maas) and six groups of unhealthy foods (cold drinks (sugary drinks); sugar in tea or coffee; cookies and cake; chips, cheese puffs and NikNaks; sweets or chocolate and fast foods). To assess the frequency of intake of the above food groups, intake of food groups was grouped into five categories with 0 days as no intake per week and seven days per week as daily intake.

The face validity for the healthy and unhealthy food intake survey was assessed among six dieticians with experience in dietary assessment employed at North-West University and University of Pretoria before the study commenced. The dieticians made recommendations about adding processed meat to the fast food group. This recommendation was implemented in the final questionnaire used in this study.

The sociodemographic questionnaire

The sociodemographic questionnaire, which included information on age, gender, ethnicity, rank, arm of service, section, if member is in uniform or a civilian, race, language, education level, use of vitamin and mineral supplements and smoking habits, was administered to all participants by an interviewer. The questionnaire was administered by asking participants questions. The data was evaluated by using data codes and capturing them into a formulated excel sheet.

The Global Physical Activity Questionnaire

To assess physical activity of the participants, the GPAQ was used. The GPAQ is validated as a global tool appropriate to assess physical activity in low and middle income countries including South Africa (Armstrong & Bull, 2006). Activity show cards were used when administrating the GPAQ to help participants identify the intensity of their daily activity. The physical activity scores were evaluated by entering the data into a formulated excel sheet that adds up activity scores and sedentary time. The researcher who administered the GPAQ was trained by the supervisor (Prof HS Kruger).

3.8.2 Anthropometric measurements

All the anthropometric measurements were taken three times and the average of the two closest readings was recorded on the data sheet as the measurement of the participants. The measurements taken were body weight, height, BMI and waist circumference by a dietician trained according to International Society for the Advancement of Kinanthropometry (ISAK) standards (Marfell-Jones *et al*., 2012). Instruments that were used (measuring scales and stadiometer) were checked and calibrated before use to ensure quality of measurement. A checklist was used to ensure that all questionnaires and measurements were completed.

Body weight

The Seca body weight scale (Model 786 2021994, Hamburg, Germany) was used to measure body weight. The scale was calibrated using a calibration weight before measurement day and placed on a flat even uncarpeted area. Participants were asked to remove heavy clothing and measured with light indoor clothing and without shoes. Participants were asked to step on the

scale and stand upright looking straight ahead with their arms freely hanging at their sides (Marfell-Jones *et al*., 2012).

Height

The Seca stadiometer (Model 786 2021994, Hamburg, Germany) was used to measure height. Participants were asked to remove heavy clothes, shoes and hats when taking height measurements. The stadiometer was placed on a flat even uncarpeted area. Participants were asked to step on the stadiometer facing forward with the head in the Frankfort position, standing straight with knees together, legs straight, shoulders relaxed and the headpiece was moved down until it touched the crown of their heads (Marfell-Jones *et al*., 2012).

Body mass index

Body mass index was calculated by using the formula: weight (kg) divided by the height (m) squared. The average weight and height was used to calculate the BMI (Marfell-Jones *et al*., 2012).

Waist circumference

Waist circumference was measured using a tape measure (Seca non-elastic tape measure, Hamburg, Germany). The waist measurements were taken at the narrowest point between the lower costal and the iliac crest and if there was no obvious narrowing the measurements were taken at the midpoint between the lower costal and the iliac crest according to ISAK standards (Marfell-Jones *et al*., 2012).

3.9 Data capturing, quality assurance and statistical analyses

Before data was entered into the secure database, all questionnaires were screened for possible problematic answers. Data was captured by researchers using Excel Windows XP and cleaned by checking minimum and maximum values, unrealistic values, typing errors and quantitation errors. After data entry missing values were checked against hard copies of questionnaires and completed, data processing and statistical analysis was performed using SPSS and Excel Windows XP by the supervisor (Prof HS Kruger). Data was tested for normality by means of visual inspection of Q-Q plots and the Kolmogorov-Smirnov test.

All continuous variables had a non-normal distribution, except weight, height and BMI. Because most data had a non-normal distribution, data were expressed as medians (25th percentile, 75th percentile). The descriptive statistics were used to summarise all participant characteristics. To assess the relation between MIL and healthy eating, correlation between the variables (MIL and frequency of healthy and unhealthy food intake) was determined. To assess the relation between

MIL and weight status, correlation between the variables (MIL and BMI and waist circumference, respectively) were determined. To assess the relation between MIL and physical activity, correlation between the variables (MIL and Physical activity in METs minutes per week) was determined. The Spearman correlation coefficient was presented.

Linear regression analysis was used to determine the association between MIL and the main outcomes (frequency of intake of healthy and unhealthy foods, waist circumference and BMI, respectively), with adjustment for age, smoking, educational status and physical activity. Separate models were applied for men and women. Linear regression analysis was used to determine the association between MIL and physical activity, with adjustment for age, smoking and educational status in separate models for men and women.

3.10 Data management and monitoring

All the hard copies of the data collected was stored in a locked cupboard in the researcher's office at Lenz Military Base's Sickbay in the community centre during the data collection period and the electronic data was saved on the researcher's password protected computer and a copy was emailed to the supervisor. The hard copies were then taken to the supervisor's office for storage and for assessment of completeness and errors on the collected data, after the data collection period was completed. The hard copies will be kept for ten years and then shredded. Progress reports were submitted to the Health Research Ethics Committee (HREC) and 1MHREC 6 monthly throughout the study.

3.11 Ethical aspects

3.11.1 Legal authorisation

The study was approved by the HREC of the Faculty of Health Sciences of the North-West University, Potchefstroom Campus (NWU-00073-17-A1). The study was also approved by the 1 Military Hospital Health Research Ethics Committee (1MHREC 01.09.2017) and Defence Intelligence. Approval was also obtained from the General Officer Commanding Area Military Health Formation to conduct research in military personnel (AMHF/R/104/32-04.07.2016). The approval certificates are attached (Appendix 5, Appendix 6 and Appendix 7).

3.11.2 Participant written informed consent

Individuals who were interested to participate in the study enlisted their names and were contacted via telephone to arrange for an appointment. The participants received information on the study activities and were given an opportunity to ask questions about the study process. The participants had the full right to decide not to participate in the study and could withdraw from the study at any stage. Two independent persons (Mss Mazibuko and Mohlopi) provided information about the study and study activities. The researcher was available to give further clarity and answer any questions necessary when the independent person was providing information. Once the participants have decided to participate in the study, they signed the informed consent form in the presence of the independent person. The copy of the informed consent form is found in Appendix 8.

3.11.3 Expertise, skills and legal competencies

All the members of the research team were experienced in their fields. The anthropometric measurements and questionnaires were conducted by a researcher who is a registered dietician. The co-supervisor (a registered psychologist) trained the researcher to administer the MIL questionnaire and to give feedback on MIL scores. The independent persons who assisted participants on informed consent were trained by the researcher.

3.11.4 Privacy and confidentiality

Participants each received a participant number that was used throughout the data collection period and no names or force numbers were used for data collection. Participants were only asked to provide name and contact number when they were enlisting to participate in the study. Data is kept safe by keeping hard copies in the supervisor's office and the electronic data kept on a password protected computer. Privacy of the participants was ensured by using the dietician's office when anthropometric measurements are taken. Participants' measurements for both males

and females were taken in the same room, however; they were taken one participant at a time to ensure privacy.

3.11.5 Reporting, dissemination and publication of results

Measurements that were immediately available were verbally reported back to participants on data collection day. The participants received their body weight, height, BMI and waist circumference verbally and in writing. The information about these measurements was communicated and explained to participants by the researcher. The MIL scores were also verbally communicated to participants on data collection day.

The results of this study will be communicated to all participants and members of Lenz Military base by means of a presentation. The presentation will be given by the researcher at Lenz Military Base during the communication period. The findings will also be forwarded to the General Officer Commanding Area Military Health Formation and ancillary health directorate as report back on research conducted on military personnel. The findings of the study was forwarded to the Defence Intelligence and 1MHREC.

The findings are presented in a form of a dissertation. An article will be submitted to be published in a peer-reviewed academic journal and presented at the South African Military Health Service's Surgeon General's Academic days.

3.11.6 Conflict of interest

The researcher, Mrs MM Ngoepe, is an employee of the South African National Defence Force and none of the members of the study team has any conflict of interest. The researcher is also a registered dietician serving the Lenz Military Base and surrounding units and therefore participants could also be the current or previously seen patients of the researcher. Current patients of the researcher were not included in the study**.**

3.11.7 Protocol violations

No protocol violations occurred but the following protocol deviations occurred:

The sample size in the protocol was 360, however; data was collected on only 80 participants. The reason for a lower sample size was poor response and not many people enlisting to participate in the study. Recruitment continued for a period of six months until all available members of Lenz Military Base were informed and had the opportunity to participate.

The independent person mentioned in the protocol (Ms Dikotla) was not available and therefore Ms Mazibuko (Patient Administrative Clerk at Lenz Military Base Sickbay) and Ms Mohlopi (Community Service Dietician at Doornkop Military Base) were the independent persons assisting participants with informed consent.

REFERENCE LIST

Armstrong, T. & Bull, F. 2006. Development of the world health organization global physical activity questionnaire (GPAQ). *Journal of public health*, 14(2):66-70.

Dabone, C., Delisle, H. & Recceveur, O. 2013. Predisposing, facilitating and reinforcing factors of healthy and unhealthy food consumption in schoolchildren: a study in Ouagadougou, Burkina Faso. *Global health promotion*, 20(1):68-77.

Faber, M. & Kruger, H.S. 2005. Dietary intake, perceptions regarding body weight and attitudes toward weight control of normal weight, overweight and obese black females in a rural village in South Africa. *Ethnicity and disease*, 15:238-245.

Khumalo, I.P., Wissing, M.P. & Schutte, L. 2014. Presence of meaning and search for meaning as mediators between spirituality and psychological well-being in a South African sample. *Journal of psychology in Africa*, 24(1):61-72.

Larsen, A.L., McArdle, J., Robertson, T. & Dunton, G. 2015. Four dietary items of the School Physical Activity and Nutrition (SPAN) questionnaire form a robust latent variable measuring healthy eating patterns. *Journal of nutrition education and behaviour*, 47:253-258.

MacIntyre, U.E., Kruger, H.S., Venter, C.S. & Vorster, H.H. 2002. Dietary intakes of an African population in different stages of transition in the North West Province, South Africa: the THUSA study. *Nutrition research*, 22(3):239-256.

Marfell-Jones, M.J, Steward, A.D. & De Ridder, J.H. 2012. International standards for anthropometric assessment. Wellington, New Zealand: International society for the advancement of kinanthropometry.

Temane, L. 2012. Validation of the Meaning in Life Questionnaire in an African context. (Doctoral dissertation, North-West University).

Wentzel-Viljoen, E., Laubscher, R., Kruger, A. 2011. Using different approaches to assess the reproducibility of a culturally sensitive quantified food frequency questionnaire. *South African journal of clinical nutrition*, 24(3):143-148.

World Health Organization (WHO). 2008 Chronic diseases and health promotion: Global school-based student health survey (GSHS) purpose and methodology. Switzerland: http://www.who.int/chp/gshs/methodology/en/index.html Date of access: 3 June 2016.

CHAPTER 4: ARTICLE

Meaning in life in relation to healthy eating, weight status and physical activity among members of the South African National Defence Force at Lenz Military Base.

Twitter handle: @HSAGjournal

Authors:

Mrs Mmatlala Margaret Ngoepe	Prof Herculina Salome Kruger	Dr Elmari Deacon
Registered Dietician at South African National Defence Force based at Lenz Military Base	Registered Dietician and Professor at Centre of Excellence for Nutrition at the North-West University Potchefstroom Campus	Clinical Psychologist and Senior Lecturer at North-West University Potchefstroom Campus, Optentia Research Focus Area.
12 Beufort Crescent Ormonde View Johannesburg	Centre of Excellence for Nutrition, NWU 11 Hoffman street Potchefstroom	Psychology Department, NWU 11 Hoffman street Potchefstroom
Mphomathiba@gmail.com	Salome.Kruger@nwu.ac.za	Elmari.Deacon@nwu.ac.za
011 212 5768	018 299 2482	018 299 1728
Masters student at the Centre of Excellence for Nutrition North-West University	PhD	PhD
Orcid.org/ 0000-0003-4884-3528	Orcid.org/0000-0002-5365 1777	Orcid.org/0000-0002-1914-4157
071 190 2123	072 737 2235	072 480 7901

*Corresponding author e-mail: Salome.kruger@nwu.ac.za

Author's contributions

Researchers name	Contribution to the research project
Prof HS Kruger	Research project principal supervisor, formulated the project, coordinated the study, statistical analysis and interpreted data.
Dr E Deacon	Research project co-supervisor, formulated the project and interpreted MIL data.
Mrs MM Ngoepe	MSc student, primary research of the project. Formulated, planned, wrote the literature review, collected data, recorded and captured data, interpreted the data and wrote the article.

Disclaimer

This article is the original work of the authors and the views expressed in this article are of the authors and not an official position of any institution.

Number of words:

Abstract: 254 words, excluding key words

Article: 5182 words

Pages:

15 pages

Tables/Figures:

Tables: 4 tables

Figures: 2 figures

Supplementary materials:

None

Meaning in life in relation to healthy eating, weight status and physical activity among members of the South African National Defence Force at Lenz Military Base

Mmatlala Margaret Ngoepe[1], Herculina Salome Kruger[1], Elmari Deacon[2]

[1]Centre of Excellence for Nutrition North-West University, [2]Optentia Research Focus Area North-West University

Abstract

Background: Meaning in life has been found to be associated with psychological factors such as self-efficacy, optimism and positive affect which have been positively associated with health promoting behaviours.

Aim: To investigate the association between meaning in life and weight status, healthy eating and physical activity among members based at Lenz Military Base.

Methods: This was a cross-sectional study where meaning in life, frequency of healthy and unhealthy food intake, BMI, waist circumference and physical activity level were measured.

Setting: The study was conducted on members of Lenz Military Base (n=80, 42 men and 38 women).

Results: Presence of meaning showed a marginal association in men and a significant association in women with frequency of fruit intake and a significant association with frequency of milk intake in women, but no association in men. Search for meaning in life showed no association with frequency of fruit and milk intake in both men and women. Search for meaning showed a marginal association with frequency of salty snacks intake only in women. No association between search for meaning and weight status or physical activity was found in both men and women, but an association between presence of meaning and BMI was seen only in men. Presence of meaning showed a weak negative association with physical activity in men.

Conclusion: The presence of meaning in life may contribute to facilitating or hindering health promoting behaviours and therefore its role on health behaviours and physical activity should be explored.

Keywords: meaning in life, healthy eating, physical activity, weight status

4.1 Introduction

A 46% increase in deaths due to NCDs has been reported between 1990 and 2010 in sub-Saharan Africa (Naghavi & Forouzanfar, 2013). South Africa is among the countries with the highest prevalence of NCDs in sub-Saharan Africa (Dalal *et al*., 2011). In South Africa, NCDs are among the most important contributors to mortality and disease burden (Day *et al*., 2014) and contributes to 55.5% of deaths (Stats SA, 2017). Behavioural risk factors such as tobacco smoking, unhealthy diet, physical inactivity and excess alcohol consumption contribute to the development of NCDs (Hunter & Reddy 2013).

Obesity has been associated with the increased risk of developing type 2 diabetes, high blood pressure and dyslipidaemia (Kruger *et al*., 2001; Kahn *et al*., 2006). The high overweight and obesity rate in South Africa of 68% and 31% for women and men respectively contributes to the rise of NCDs (SADHS 2016, 2017). The risk of development of NCDs increases substantially with increasing BMI with severe obesity posing a higher risk of the development of NCDs in comparison to overweight and obesity (SADHS 2016, 2017).

Decreased physical activity, high salt intake, high sugar intake and low intake of fruit and vegetables contribute to the development of NCDs (MacIntyre *et al*., 2002; Temple & Steyn 2016; Vorster *et al*., 2014 & Wentzel-Viljoen *et al*., 2013). Though health behaviours such as a healthy diet and physical activity are important to prevent and treat NCDs, adherence to these behaviours is often difficult to sustain (Panter-Brick *et al.,* 2006). Socio-economic factors, cultural values, lack of motivation, lack of will power and lack of self-efficacy has been identified as some of the barriers to health promoting behaviours (Conner & Norman 2005; Jackson *et al.,* 2007; Silliman, *et al.,* 2004).

Meaning in life is related to psychological factors such as self-efficacy, optimism and positive affect which have been positively associated with health promoting behaviours (Roepke *et al*., 2014). Studies have shown that people with a sense of meaning in life are most likely to engage in health promoting behaviours such as healthy eating and physical activity as compared to those without a sense of meaning (Holahan *et al.,* 2011; Steger, 2015).

The aim of this study was to determine the association between meaning in life and healthy eating, weight status and physical activity among South African National Defence Force members at Lenz Military Base.

4.2 Methodology

4.2.1 Study population

This study was a cross-sectional study where all members of Lenz Military Base were invited to participate. The study was approved by the Health Research Ethics Committee (HREC) of the Faculty of Health Sciences, North-West University, Potchefstroom Campus (NWU-00073-17-A1) and the 1 Military Hospital Health Research Ethics Committee (1MH/302/6/01.09.2017). After signing the written informed consent, sociodemographic information, anthropometric measurements, physical activity information, information on frequency of healthy and unhealthy food intake and information on sense of meaning of participants were collected. A total of 80 members from a pool of 129 who were recruited, participated in the study. The 49 recruited non-participants included 33 who agreed to a data collection appointment but did not turn up, 6 participants could not be reached, five stated that they were no longer interested in participating; one was excluded because he was a current patient of the researcher and four moved to different military bases. The initial response was 30% of members (n=425) who were interested to participate, but the final response rate was only 18.8%. The study participants reflected the study population in terms of sex (52.5% male, 47.5% female) and age range (21 – 61 years).

4.2.2 Procedures

Measurements of body weight in kilograms (kg) using the Seca scale (Hamburg, Germany), height in centimetres (cm) using the Seca stadiometer (Hamburg, Germany) and waist circumferences in centimetre (cm) using a Seca non-elastic tape measure (Hamburg, Germany) were taken by a registered dietician with training in anthropometry. Weight status was classified as underweight, normal weight, overweight or obese based on BMI cut-points proposed by the WHO (WHO, 2000).

A sociodemographic and health questionnaire was used to collect information on age, arms of service, meals at the mess, gender, rank, education level, language, race, smoking status and use of vitamin supplements. The Global Physical Activity Questionnaire was administered by a registered dietician trained by an experience researcher in the field of nutrition epidemiology to collect physical activity data. Participants were categorised as meeting the recommended weekly physical activity guideline if they had GPAQ scores of at least 600 METs minutes per week (WHO, 2010).

The MIL-Q was used to measure presence and search for meaning in life. The MIL-Q showed good internal consistence reliability within the South African context with Cronbach alpha values of 0.85 for presence of MIL and 0.84 for search of MIL (Khumalo *et al.,* 2014). Temane *et al.*

(2012) also reported the MIL questionnaire as a reliable and valid tool to assess MIL in an African context. The questionnaire was administered by a registered dietician trained by an experienced researcher in the field of psychology.

The healthy and unhealthy food intake survey was used to determine the frequency of health and unhealthy food intake. The questionnaire used to collect data on frequency of intake of healthy and unhealthy food groups was based on the questionnaires used in studies from Burkina Faso and South Africa (Dabone *et al.,* 2013; Larsen *et al.,* 2015; Wentzel-Viljoen *et al.,* 2011; WHO, 2008). The food groups included reflected foods reported to be eaten by South African adults (Faber & Kruger 2005; MacIntyre *et al.* 2002). The questionnaire included four groups of healthy foods (fruit; vegetables; meat, chicken, egg and fish; milk or maas) and six groups of unhealthy foods (cold drinks; sugar in tea or coffee; cookies and cake; chips, cheese puffs and NikNaks; sweets or chocolate; and fast foods).

To assess the frequency of intake of the above food groups, intake of food groups was grouped into five categories with 0 days as no intake per week and seven days per week as daily intake. The face validity for the healthy and unhealthy food intake survey was assessed among six dieticians with experience in dietary assessment employed at North-West University and University of Pretoria before the study commenced. The dieticians made recommendations about adding processed meat to the fast food group which was implemented in the final questionnaire used in this study. The questionnaire was administered by a registered dietician.

4.2.3 Statistical analysis

Data was tested for normality by means of visual inspection of Q-Q plots and the Kolmogorov-Smirnov test. Descriptive data was used to present sociodemographic and anthropometry information and categorical variables. All continuous variables had a non-normal distribution, except weight, height and BMI. Because most data had a non-normal distribution, data were expressed as medians (25th percentile, 75th percentile).

To assess the relation between MIL and weight status, physical activity and healthy eating respectively, Spearman correlation analysis between the variables (MIL, BMI, waist circumference, physical activity in METs minutes per week and frequency of healthy and unhealthy food intake) was determined.

Linear regression analysis was used to determine the association between MIL and the main outcomes (frequency of healthy and unhealthy foods intake, waist circumference and BMI, respectively), with adjustment for age, smoking, educational status and physical activity. Separate models were applied for men and women. Linear regression analysis was also used to determine

the association between MIL and physical activity, with adjustment for age, smoking and educational status in separate models for men and women. Two tailed statistical significance set at $p < 0.05$. Statistical analysis was performed using SPSS version 23 (IBM, Armonk, NY, USA) and Excel Windows XP.

4.3 RESULTS

Descriptive statistics was used to summarise all participant characteristics. Table 4.1 and 4.2 below summarise the descriptive statistics for men and women. Most of the participants (85%) were members of SA Army and 15% were members of the SA Military Health Services.

TABLE 4.1: Categorical variables of the study participants (n=80)

Variable		Frequency	Percentage
Section	Hospice/Sickbay	12	15
	Army Support Base Johannesburg	39	48.8
	11 Maintenance	22	27.5
	Signal Squadron	7	8.8
Places where meals are taken	Meals at mess	32	40
	Meals at home	48	60
Education	Primary School level	3	3.8
	Secondary School level	45	56.3
	Tertiary level	32	40
Rank	Privates	23	28.7
	Non Commissioned Officers	41	51.2
	Officers	13	16.3
	Civilians	3	3.8
Home Language	Setswana	15	18.8
	IsiZulu	14	17.5
	Sesotho	19	23.8
	Sepedi	5	6
	Xhosa	7	8.8
	English and Afrikaans	4	5
	Other (Venda, Tsonga, isiNdebele, SiSwati)	12	15

TABLE 4.2: Descriptive characteristics of the participants

	Men (n=42)		Women (n=38)	
Variable	**Median**	**Interquartile range**	**Median**	**Interquartile range**
Age (years)	48	40.2, 51	32	26, 45.2
MIL-P	33	31, 35	30.5	25.7, 33
MIL-S	32	32, 35	27	22.7, 32
Body mass index (kg/m^2)	27.52	24.3, 32.3	28.81	24.7, 32.1
Waist circumference (cm)	97.5	84.2, 106.9	83.15	77.6, 97.2
Sedentary time (minutes per day)	420	360, 510	540	465, 600
GPAQ score (MET min/week)	1180	520, 1180	480	160, 835
Smoking	**Number**	**Percentage**	**Number**	**Percentage**
Non smokers	29	69.48	31	81.58
Previous smokers	3	7.14	1	2.63
Current smokers	10	23.81	6	15.79

MIL-P: Presence of meaning in life, MIL-S: Search for meaning in life, GPAQ score: Global physical activity questionnaire score.

Among the 20% of current smokers they smoked a median of six cigarettes per day (range 1-14). Eleven participants (13.8%) reported use of vitamin supplements and they used mostly multivitamins (5%) and vitamin B-complex (5%).

Meaning in life

The reliability analysis of the MIL items showed good internal consistency of the MIL questionnaire with a Cronbach's alpha of 0.77 for the presence of MIL and 0.88 for the search of MIL items. Further analysis, while leaving one item out in each round, resulted in Cronbach's alphas ranging from 0.70 to 0.76 for the presence of MIL items and 0.84 to 0.88 for the search of MIL items. Most participants had a sense of meaning and were yet still openly exploring that meaning, thus they had both presence and search for meaning (88.1% of men and 60.5% of women). Fewer men (7.1%) reported only presence of meaning as compared to women (23.7%). More women (13.2%) reported search for meaning as compared to men (4.8%). Only one woman (2.6%) but no men reported lack of both presence and search for meaning.

Frequency of healthy and unhealthy food intake

There were few differences between the minimum and maximum frequency of healthy and unhealthy foods intake between men and women. The median frequency of healthy and unhealthy foods intake were the same for men and women for four food groups as shown in Figure 4.1. Men had a greater median frequency of intake of vegetables and milk than women, while women reported a greater median frequency of fast foods and salty snacks intake.

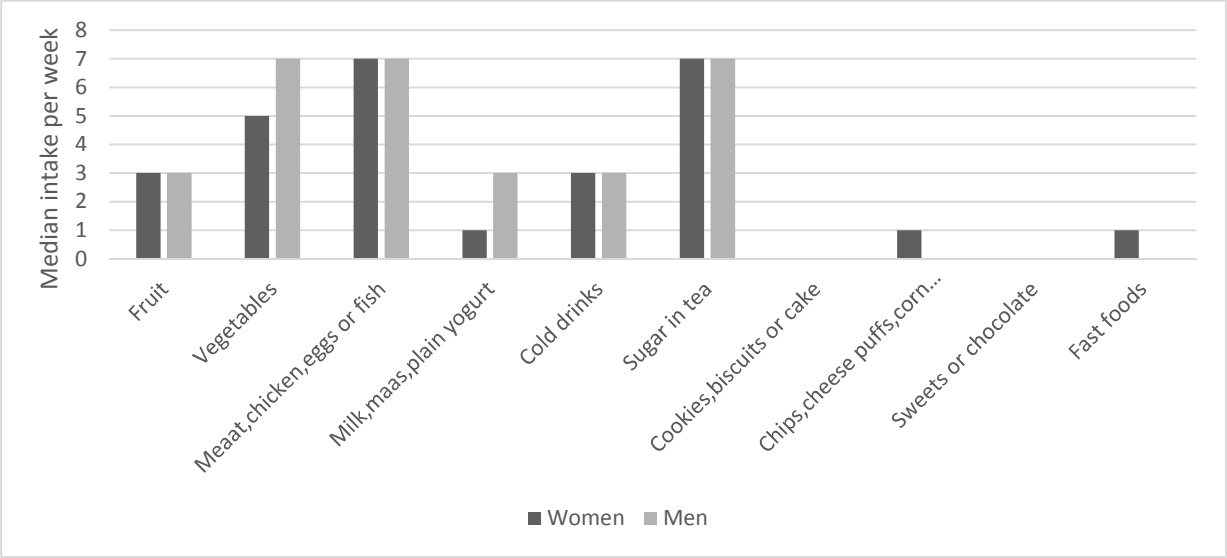

Figure 4.1: Median frequency intake of healthy and unhealthy foods of men and women

In women there were a significant negative correlation between the frequency of sugar added to tea and fruit intake (r=-0.42, p=0.006) as well as salty snacks (r=-0.32, p=0.049). The frequency of salty snacks intake was positively correlated with the frequency of cold drinks (r=0.48, p=0.002), cookies, cakes and biscuits (r= 0.49, p=0.02), as well as sweets/chocolates (r= 0.40, p=0.012) intake in women. No correlation was found between MIL-P and MIL-S and frequency of healthy and unhealthy food intake in women. In men MIL-P was positively correlated with frequency of fruit intake (r=0.32, p=0.041), but no correlation was found between frequency of fruit intake and MIL-S. A positive correlation was found between frequency of intake of fast food and cold drinks (r=0.42, p=0.005) and salty snacks (r=0.39, p=0.01) respectively, as well as a positive correlation between frequency of intake of cookies and sweets/chocolate (r=0.31, p=0.047) in men.

Weight status

Similar proportions of women and men were underweight, normal weight, overweight or obese respectively, as shown in Figure 4.2. In men, MIL-P but not MIL-S was positively correlated with BMI (r=0.35, p=0.021) and waist circumference (r=0.31, p=0.043), whereas in women MIL-S was

positively correlated with BMI (r=0.43, p=0.007) and waist circumference (r=0.44, p=0.012). No correlation between MIL-P and BMI and waist circumference was noted in women.

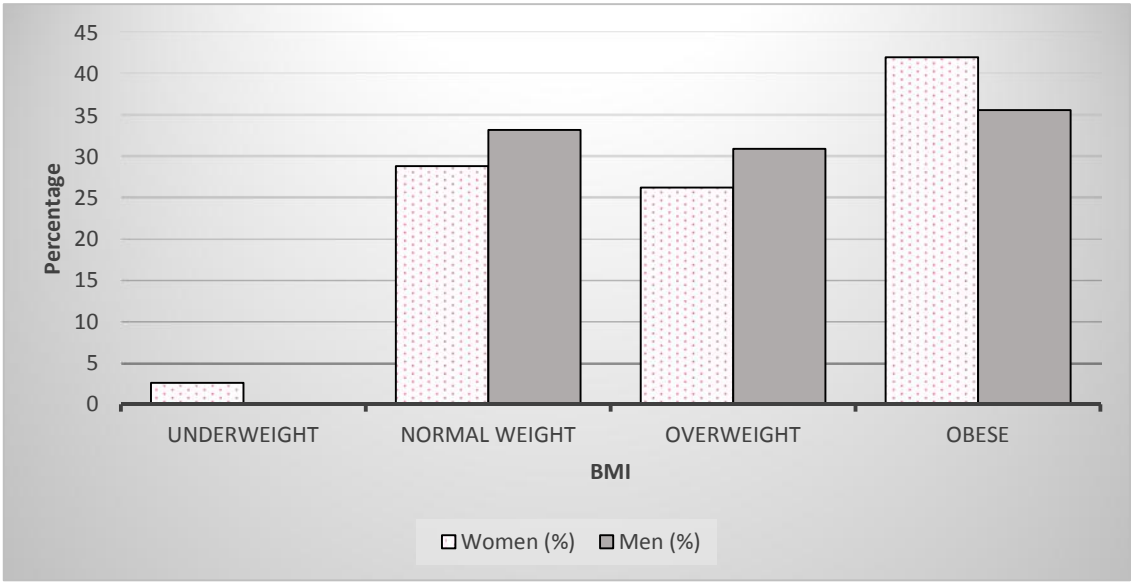

Figure 4.2: Body mass index categories for women and men.

Physical activity

Most men (71.4%) met the recommended physical activity level of at least 600 METs minutes per week, while more than half of the women (55.3%) did not meet the recommended physical activity level per week. MIL-S was positively correlated with GPAQ scores (r=0.34, p= 0.026) in men, whereas no correlation between MIL-S or MIL-P and GPAQ scores were found in women.

Multiple regression models to determine association between MIL and main outcomes

Those variables which showed significant correlations with outcomes were entered in multivariable regression models to determine associations between MIL and the main outcomes (healthy and unhealthy food intake, BMI, waist circumference and physical activity). Among the healthy food groups, only the fruit and milk products intake and among unhealthy food groups, only the salty snacks groups were included, because these groups showed the strongest correlation with MIL variables.

Table 4.3 shows the final multiple regression models with frequency of fruit intake, milk intake and frequency of salty snacks as dependent variables, adjusted for age, smoking, education level and physical activity to assess associations between the above dependent variables and MIL-P and MIL-S, respectively. When adjusted for age, smoking and GPAQ score, MIL-P showed a marginal positive association with frequency of fruit intake in men and significant positive associations with

frequency of fruit and milk intakes in women (p=0.03 and 0.046, respectively). MIL-S was not associated with frequency of intake of fruit, or milk in men or women, but there was a marginal positive association between MIL-S and frequency of salty snack intake in women (p=0.051). The adjusted R squares were low for all models, ranging from 0.01 to 0.18, indicating that the variables in the final models explained only one to 18% of variance in outcomes.

TABLE 4.3: Multiple regression models with frequency of healthy and unhealthy foods intake as dependent variables

Variables MIL-S*	**Standardised ß coefficient** *	**p-value**	**Standardised ß coefficient** *	**p-value**
	Men (n=42)		**Women (n=38)**	
Dependent variable: Frequency of fruit intake, **adjusted R^2 = 0.10**			**Adjusted R^2 = 0.05**	
Education level	0.343	**0.026**	0.214	0.197
Dependent variable: Frequency of milk intake, **adjusted R^2 = 0.01**			**Adjusted R^2 = 0.05**	
Age (years)	0.191	0.227	-	-
Smoking (non-smoking as reference)	-	-	0.278	0.10
Dependant variable: Frequency of salty snacks intake, **adjusted R^2 = 0.14**			**Adjusted R^2 = 0.16**	
Age (years)	-	-	-0.472	**0.006**
Education level	-0.402	**0.008**	-	-
MIL-S	-	-	0.327	**0.051**
MIL-P				
Dependent variable: Frequency of fruit intake, **adjusted R^2 = 0.01**			**Adjusted R^2 = 0.05**	
Education level	0.287	**0.059**	-	-
MIL-P	0.271	**0.07**	0.387	**0.033**
Dependent variable : Frequency of milk intake, **adjusted R^2 = 0.01**			**Adjusted R^2 = 0.05**	
MIL-P	-	-	0.342	**0.046**
Dependent variable : Frequency of salty snacks intake, **adjusted R^2 = 0.18**			**Adjusted R^2 = 0.10**	
Age (years)	-	-	-0.348	**0.032**
Education level	-0.351	**0.02**	-	-
MIL-P	-0.246	0.097	-	-

*MIL-S was only associated with salty snack intake and is therefore only shown in that model

Table 4.4 shows the final multiple regression models with BMI, waist circumference and physical activity as dependent variables, adjusted for age, smoking, education level and physical activity (in BMI and waist circumference models) to assess associations between the above dependent variable and MIL-P and MIL-S. MIL-S was not associated with BMI, waist circumference or physical activity in men or women. MIL-P was positively associated with BMI (p=0.01) and waist circumference (p=0.056) in men, and showed a weak negative association with waist circumference in women (p=0.09) and physical activity in men (p=0.07).

BMI was positively associated with age in women (p=0.002) whereas waist circumference was positively associated with age in both men and women (p=0.006 and p<0.0001 respectively). Both BMI and waist circumference were negatively associated with smoking in men (p=0.025 and 0.029 respectively). Physical activity showed a marginal negative association with smoking in men (p=0.075). The frequency intake of fruit was positively associated with education level in men (p=0.026). The frequency intake of salty snacks showed a negative association with age in women (p=0.032) and education in men (p=0.02).

TABLE 4.4: Multiple regression models with BMI, waist circumference and physical activity as dependent variables

Variables **MIL-S***	**Standardised ß coefficient ***	**p-value**	**Standardised ß coefficient ***	**p-value**
	Men (n=42)		Women (n=38)	
Dependant variable: BMI, adjusted R^2 = 0.10			Adjusted R^2 = 0.28	
Age (years)			0.55	**0.002**
GPAQ scores (METs mins/week)	-0.269	0.088	-	-
Smoking (non-smoking as reference)	-0.359	**0.025**	-	-
Dependent variable : Waist circumference, adjusted R^2 = 0.24			Adjusted R^2 = 0.40	
Age (years)	0.403	**0.006**	0.645	**<0.0001**
Smoking (non-smoking as reference)	-0.322	**0.029**	-	-
MIL-P **Dependant variable: BMI,** adjusted R^2 = 0.18			Adjusted R^2 = 0.28	
Age (years)	-	-	0.548	**<0.0001**
Smoking (non-smoking as reference)	-0.289	**0.048**	-	-
MIL-P	0.37	**0.013**	-	-
Dependent variable : Waist circumference, Adjusted R^2 = 0.26			Adjusted R^2 = 0.43	
Age (years)	0.388	**0.007**	0.62	**<0.0001**
Smoking (non-smoking as reference)	-0.260	0.062	-	-
MIL-P	0.265	0.056	-0.218	0.09
MIL-S **Dependant variable: Physical activity,** adjusted R^2 = 0.10			Adjusted R^2 = 0.28	
Smoking (smoking as reference)	-0.273	0.08	0.219	0.187
MIL-P **Dependent variable : Physical activity ,** adjusted R^2 = 0.10			Adjusted R^2 = 0.06	
Smoking (non-smoking as reference)	-0.270	0.075	0.219	0.187
MIL-P	-0.28	0.069	-0.258	0.139

*MIL-S was not associated with any of the outcome variables and is therefore not shown in any of the final models

4.4 Discussion

This study investigated the association between meaning in life and healthy eating, weight status and physical activity. Many studies have investigated the association between meaning in life and eating habits and physical activity (Holahan & Suzuki 2006; Holahan *et al*. 2008; Holahan *et al*. 2011), however; this is the first study to investigate the association between meaning in life and weight status to the knowledge of the researcher. Of the studies that investigated the relationship between meaning in life and health behaviour such as physical activity and healthy eating, only two included search for meaning (Brassai *et al*., 2011; Brassai *et al*., 2015).

The presence of meaning showed a positive association with fruit intake in both men and women and milk intake in women in this study. This result concurs with other studies that found that people with a higher sense of meaning are likely to eat healthier than those without meaning in life (Homan & Boyatzis, 2010; Piko & Brassai, 2009). No association between the presence of meaning in life and the frequency of vegetable intake or unhealthy foods was found. Presence of meaning is thought to facilitate health promoting behaviours by promoting positive attitudes, optimism, self-efficacy and orientation towards health (Steger & Frazier, 2005; Roepke *et al*., 2014). This study separated the healthy and unhealthy food intake when investigating association between presence and search for meaning and healthy eating unlike the studies above in which associations with healthy eating or nutrition scores were investigated (Homan & Boyatzis, 2010; Piko & Brassai, 2009). It is not clear why the presence of meaning was only associated with certain aspects of healthy food intake.

Many studies found that people with a greater sense of meaning are more likely to engage in physical activity than those with less or no sense of meaning (Holahan & Suzuki, 2006; Holahan *et al*., 2008; Holahan *et al*., 2011). A weak negative association between physical activity and presence of meaning was observed among men in this study, with a similar trend in women. These results contradict that of the studies mentioned above. A negative association or lack of association observed in this study could be an indication that physical activity or its effects on health is not seen as an important factor or part of individuals sense of purpose. Participants of this study are soldiers who sometimes participate in compulsory physical activities and therefore regardless of their sense of meaning in life would engage in physical activities.

When people understand themselves and the world and their purpose in life they experience presence of meaning (Steger *et al*., 2008). After all people will engage in health promoting behaviours if they feel the behaviours fit their purpose or help them achieve their future goals (Steger *et al.,* 2008). In the same way as physical activity not seen as an important part of purpose and future goals, BMI was positively associated with the presence of meaning in men. This could

mean that unhealthy weight status is not seen as a negative factor that disturbs or affect sense of meaning and future goals, but instead the men in this study are content and happy with their unhealthy weight.

This study found no association between search for meaning in life and healthy eating, weight status and physical activity and only a marginal positive significant association with frequency intake of salty snacks in women. These results contradict the results of other studies that investigated search for meaning and found a positive association between search of meaning and physical activity and healthy eating (Brassai *et al*., 2011; Brassai *et al*., 2015). Unlike this study, both studies that found associations between search for meaning and healthy eating and physical activity were conducted among adolescents, whereas this study was among working adults. Search for meaning was found to be positively associated with well-being in adolescence, however; it seems to be negatively associated with well-being in later stages of life (Steger *et al*., 2009). This means that the difference in age groups between this study and the studies mentioned above could be responsible for the difference in the results. Search for meaning could be part of how adolescents develop their views and identities, whereas it could reflect failure and difficulty in older adults (Steger *et al*., 2008). After all, search for meaning could either have healthy or unhealthy effects depending on who is searching; thus the positively orientated individuals could have positive effects if they are searchers, while the avoidance orientated individuals could have negative effects if they are searchers (Steger *et al*., 2008). The sample size in this study was also small (n=80) in comparison to the abovementioned studies (n=1977 and n=456 respectively) (Brassai *et al*., 2011; Brassai *et al*., 2015). The small sample size in this study could be the reason why an association between search for meaning and healthy eating, weight status and physical activity was not detected. Although meaning in life is important across cultures, Steger *et al*. 2008b reported that levels of presence and search for meaning differs between cultures. The cultural difference between participants in this study and the studies above that found association between presence and search of meaning and health promoting behaviours is a possible contributing factor to contradicting results.

Individuals who feel a reduction in the presence of meaning, search and achieve greater meaning (Steger *et al*., 2008a). Most participants in this study had both presence and search for meaning (88% of men and 60.5% of women), perhaps in search for meaning individuals who already have presence of meaning could be more likely to engage in health promoting behaviours if they experience greater sense of meaning and are no longer searchers

This study found that 75% of participants were non-smokers; this is close to the 79.2% rate of people who never smoked tobacco reported in South Africa by the SANHANES-1 2012 (Shisana *et al*., 2014). Like with the SANHANES-1 2012, this study also found that more men smoked as

compared to women. Smoking was negatively associated with BMI and waist circumference among the men. An earlier South African study also found a negative association between BMI and smoking (Kruger *et al.,* 2002).

This study found a prevalence of combined overweight and obesity of 68.4% in women which is similar to the prevalence of combined overweight and obesity of 68% in South African women. However, the prevalence of combined overweight and obesity in men in this study (67%) was more than double the reported prevalence of 31% in South African men (SADHS 2016 2017). Senekal *et al*. (2003) found that individuals with less than grade 7 education were more likely to be overweight than those with a higher education level. Malhotra *et al*. (2008), however, found no association between education level and risk of overweight and obesity but found that unemployed individuals had a lower risk of being overweight or obese. Most participants in this study (56.3%) had at least secondary school education, and therefore employment status is a possible explanation for a higher overweight and obese prevalence in men seen in this study. Kruger *et al.* (2002) found that women with a higher income had a greater risk of being overweight or obese; this could also contribute to a higher obesity prevalence seen in men in this study. The difference in the prevalence of overweight and obesity between men in this study and South African men and no difference in the prevalence of overweight and obesity in women in this study and South African women, is probably due to the higher education and income level of the study participants, compared to the general South African population.

In men the high prevalence of overweight and obesity found in this study co-existed with high levels of physical activity (71.4% men met the recommended weekly physical activity). However, a trend of a negative association between GPAQ scores and BMI found in men suggests that more active men had a lower BMI. This result in men was in line with a finding that women with higher levels of physical activity were less likely to be obese in the North West Province of South Africa (Kruger *et al*., 2002). In this study no association between GPAQ score and BMI in women was found. This finding may be due to the general low level of physical activity of the women in this study.

The physical activity level of men in this study differs from physical activity found in 2000 in South African men; where 49% of men did not meet the recommended weekly physical activity (Joubert *et al*., 2007). The physical inactivity of women in this study (55.3% of women did not meet the recommended weekly activity) is higher than the 43% found in South African women (Joubert *et al*., 2007). The SANHANES-1 2012 reported 62.4% of men to be physically fit whereas 42% of women were reported to be physically fit (Shisana *et al.,* 2014). Participants of this study are soldiers who sometimes participate in compulsory physical activities which could be a probable contributor to a higher reported physical activity especially in men, but this does not explain the

similar activity levels found in South African women and this study's participants. The big difference between the activity levels of men and women in this study could be because fewer women participated in physical activities at work.

This study found a negative correlation between the amount of sugar added to tea or coffee and frequency of fruit intake and salty snacks in women, whereas in men, a positive correlation between frequency intake of fast foods and frequency intake of sugary drinks, salty snacks, cookies and sweets. These results may be an indication of particular dietary habits among the study participants of lower sugar intakes among those with higher fruit intakes, as well as a group with higher intakes of fast foods, cold drinks and snacks. These results are similar to other studies that found a positive association between the frequency of fast food and soft drinks and a positive association between sugary drinks intake and poor dietary habits (Bowman *et al*., 2004; Collison *et al*., 2010 & Paeratakul *et al.,* 2003).

Another study found that people who reported a higher frequency intake of fast foods also reported a higher intake of sugary drinks and a low intake of fruit and vegetables (Paeratakul *et al.,* 2003). This is probably because the most frequently consumed drink with fast foods is soft drinks and fruit juice (Van Zyl *et al*., 2010). Not only does frequency of intake of fast foods and sugar in drinks correlate positively with frequency of intake of unhealthy foods, but sugar in drinks was also negatively associated with frequency of fruit intake in this study. This is similar to other studies that found that high intake of sugary drinks was associated with decreased fruit intake and that individuals who increased their fruit and vegetable intake also decreased their high sugar foods intake (Epstein *et al*., 2001; Vartanian *et al*., 2007). The results of this study of a positive correlation between frequency of intake of fast foods with savoury snacks and sugary drinks intake are similar to a study in school children (Collison *et al*., 2010). This was also supported by Vorster *et al*. (2014) who found that individuals who consumed less than 10% of total energy as added sugar had healthier diets than those who consumed more than 10% total energy as sugar.

A positive association between BMI and age found in this study in women is similar to that found by Kruger *et al.* (2002). This study found a positive association between fruit intake and education level in men. This result was supported by Peltzer & Phaswana-Mafuya (2012) who found an association between low education level and inadequate fruit and vegetable intake.

4.5 Conclusion

Presence of meaning showed a positive association with BMI and waist circumference in men and a weak negative association with waist circumference in women and physical activity in men. Presence of meaning was also associated with frequency of fruit and milk intake in women and

showed a marginal association with frequency of fruit intake in men. Search for meaning was found to only have a weak positive association with frequency intake of salty snacks in women and was not associated with weight status, healthy eating and physical activity in both men and women. The presence of meaning may play an important role in facilitating or hindering health promoting behaviours. Further research is required to understand the difference in the relationship between presence of meaning and search for meaning and health promoting behaviours in men and women and if such relationship will translate into positive health outcomes.

4.6 Acknowledgements

The authors would like to thank all the participants and supporting staff in this study and the Officer Commanding Lenz Military Base for allowing the study to take place.

- **Financial support**

No financial support was received for this study.

- **Competing interests**

M.M. Ngoepe is employed by the South African National Defence Force based at Lenz Military Base. Prof Kruger and Dr Deacon declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

- **Authorship**

M.M. Ngoepe drafted the manuscript and collected data with input from H.S. Kruger and E Deacon. H.S. Kruger performed statistical analysis. All authors conceptualised the study and were involved in interpreting the results and have reviewed and approved the final version for publication.

- **Disclaimer**

The views expressed in this article are of the authors and not an official position of any institution.

REFERENCE LIST

Bowman, S.A., Gortmaker, S.L., Ebbeling, C.B., Pereira, M.A. & Ludwig, D.S. 2004. Effects of fast-food consumption on energy intake and diet quality among children in a national household survey. *Pediatrics*, 113(1):112-118.

Brassai, L., Piko, B.F. & Steger, M.F. 2011. Meaning in life: Is it a protective factor for adolescents' psychological health? *International journal of behavioural medicine*, 18(1):44-51.

Brassai, L., Piko, B.F. & Steger, M.F. 2015. A reason to stay healthy: The role of meaning in life in relation to physical activity and healthy eating among adolescents. *Journal of health psychology*, 20(5):473-482.

Collison, K.S., Zaidi, M.Z., Subhani, S.N., Al-Rubeaan, K., Shoukri, M. & Al-Mohanna, F.A. 2010. Sugar-sweetened carbonated beverage consumption correlates with BMI, waist circumference, and poor dietary choices in school children. *BMC public health*, 10(1): 234.

Conner, M. & Norman, P. 2005. Predicting health behaviour. United Kingdom: McGraw-Hill Education.

Dabone, C., Delisle, H. & Recceveur, O. 2013. Predisposing, facilitating and reinforcing factors of healthy and unhealthy food consumption in schoolchildren: a study in Ouagadougou, Burkina Faso. *Global health promotion*, 20(1):68-77.

Dalal, S., Beunza, J.J., Volmink, J., Adebamowo, C., Bajunirwe, F., Njelekela, M., Mozaffarian, D., Fawzi, W., Willett, W., Adami, H.O. & Holmes, M.D. 2011. Non-communicable diseases in sub-Saharan Africa: what we know now. *International journal of epidemiology*, 40(4):885-901.

Day, C., Groenewald, P., Laubscher, R., Chaudhry, S., Van Schaik, N. & Bradshaw, D. 2014. Monitoring of non-communicable diseases such as hypertension in South Africa: Challenges for the post-2015 global development agenda. *South African medical journal*, 104(10):680-687.

Epstein, L.H., Gordy, C.C., Raynor, H.A., Beddome, M., Kilanowski, C.K. & Paluch, R. 2001. Increasing fruit and vegetable intake and decreasing fat and sugar intake in families at risk for childhood obesity. *Obesity research*, 9(3):171-178.

Faber, M. & Kruger, H.S. 2005. Dietary intake, perceptions regarding body weight and attitudes toward weight control of normal weight, overweight and obese black females in a rural village in South Africa. *Ethnicity and disease*, 15:238-245.

Holahan, C.K. & Suzuki, R. 2006. Motivational factors in health promoting behavior in later aging. *Activities, adaptation, & aging*, 30(1):47-60.

Holahan, C.K., Holahan, C.J. & Suzuki, R. 2008. Purposiveness, physical activity, and perceived health in cardiac patients. *Disability and Rehabilitation: an international, multidisciplinary journal*, 30(23):1772-1778.

Holahan, C.K., Holahan, C.J., Velasquez, K.E., Jung, S., North, R.J. & Pahl, S.A. 2011. Purposiveness and leisure-time physical activity in women in early midlife. *Women & health*, 51(7):661-675.

Homan, K.J. & Boyatzis, C.J. 2010. Religiosity, sense of meaning, and health behavior in older adults. *The International journal for the psychology of religion*, 20(3):173-186.

Hunter, D.J. & Reddy, K.S. 2013. Non-communicable diseases. *New England journal of medicine*, 369(14):1336-1343.

Jackson, E.S., Tucker, C.M. & Herman, K.C. 2007. Health value, perceived social support, and health self-efficacy as factors in a health-promoting lifestyle. *Journal of American college of health*, 56(1):69-74.

Joubert, J., Norman, R., Lambert, E.V., Groenewald, P., Schneider, M., Bull, F., Bradshaw, D. & Collaboration, S.A.C.R.A. 2007. Estimating the burden of disease attributable to physical inactivity in South Africa in 2000. *South African medical journal*, 97(8):725-731.

Kahn, S.E., Hull, R.L. & Utzschneider, K.M. 2006. Mechanisms linking obesity to insulin resistance and type 2 diabetes. *Nature*, 444(7121):840-846.

Khumalo, I.P., Wissing, M.P. & Schutte, L. 2014. Presence of meaning and search for meaning as mediators between spirituality and psychological well-being in a South African sample. *Journal of psychology in Africa*, 24(1):61-72.

Kruger, H.S., Venter, C.S. & Vorster, H.H. 2001. Obesity in African women in the North West Province, South Africa is associated with an increased risk of non-communicable diseases: the THUSA study. *British journal of nutrition*, 86(6):733-740.

Kruger, H.S., Venter, C.S., Vorster, H.H. & Margetts, B.M. 2002. Physical inactivity is the major determinant of obesity in black women in the North West Province, South Africa: the THUSA study. *Nutrition*, 18(5):422-427.

Larsen, A.L., McArdle, J., Robertson, T. & Dunton, G. 2015. Four dietary items of the School Physical Activity and Nutrition (SPAN) questionnaire form a robust latent variable measuring healthy eating patterns. *Journal of nutrition education and behaviour*, 47:253-258.

MacIntyre, U.E., Kruger, H.S., Venter, C.S. & Vorster, H.H. 2002. Dietary intakes of an African population in different stages of transition in the North West Province, South Africa: the THUSA study. *Nutrition research*, 22(3):239-256.

Malhotra, R., Hoyo, C., Østbye, T., Hughes, G., Schwartz, D., Tsolekile, L., Zulu, J. and Puoane, T. 2008. Determinants of obesity in an urban township of South Africa. *South African Journal of clinical nutrition*, *21*(4):315-320.

Naghavi, M. & Forouzanfar, M.H. 2013. Burden of non-communicable diseases in sub-Saharan Africa in 1990 and 2010: Global burden of diseases, injuries, and risk factors study 2010. *The Lancet*, 381:S95.

Paeratakul, S., Ferdinand, D.P., Champagne, C.M., Ryan, D.H. & Bray, G.A. 2003. Fast-food consumption among US adults and children: dietary and nutrient intake profile. *Journal of the American Dietetic Association*, 103(10):1332-1338.

Panter-Brick, C., Clarke, S.E., Lomas, H., Pinder, M. & Lindsay, S.W. 2006. Culturally compelling strategies for behaviour change: a social ecology model and case study in malaria prevention. *Social science & medicine*, 62(11):2810-2825.

Peltzer, K. & Phaswana-Mafuya, N. 2012. Fruit and vegetable intake and associated factors in older adults in South Africa. *Global health action*, *5*(1):18668.

Piko, B.F. & Brassai, L. 2016. A reason to eat healthy: The role of meaning in life in maintaining homeostasis in modern society. *Health psychology open*, 3(1):2055102916634360.

Roepke, A.M., Jayawickreme, E. & Riffle, O.M. 2014. Meaning and health: a systematic review. *Applied research in quality of life*, 9(4):1055-1079.

Senekal, M., Steyn, N.P. and Nel, J.H. 2003. Factors associated with overweight/obesity in economically active South African populations. *Ethnicity & disease*, *13*(1):109-116.

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., Reddy, P., Parker, W., Hoosain, E., Naidoo, P., Hongoro, C., Mchiza, Z., Steyn, N.P., Dwane, N., Makoae, M., Maluleke, T., Ramlagan, S., Zungu, N., Evans, M.G., Jacobs, L., Faber, M. & the SANHANES-1 Team. 2014. South African National Health and Nutrition Examination Survey (SANHANES-1): 2014 edition. Cape Town: HSRC Press.

Silliman, K., Rodas-Fortier, K. & Neyman, M. 2004. A survey of dietary and exercise habits and perceived barriers to following a healthy lifestyle in a college population. *Californian journal of health promotion*, 18:281.

Stats SA (Statistics South Africa). 2015. Mortality and cause of death in South Africa: Findings from death notifications. Pretoria: Statistics South Africa. http://www.statssa.gov.za/publications/P03093/P030932015.pdf Date of access: 3 June 2016.

Stats SA (Statistics South Africa). 2017. National Department of Health (NDoH). South African Medical Research Council (SAMRC) and ICF. South Africa Demographic and Health Survey 2016: key indicators.

Steger, M.F. & Frazier, P. 2005. Meaning in life: one link in the chain from religiousness to well-being. *Journal of counseling psychology*, 52(4):574.

Steger, M.F., Kashdan, T.B., Sullivan, B.A. & Lorentz, D. 2008. Understanding the search for meaning in life: personality, cognitive style, and the dynamic between seeking and experiencing meaning. *Journal of personality*, 76(2):199-228.

Steger, M.F., Oishi, S. & Kashdan, T.B. 2009. Meaning in life across the life span: levels and correlates of meaning in life from emerging adulthood to older adulthood. *The Journal of positive psychology*, 4(1):43-52.

Steger, M.F., Fitch-Martin, A.R., Donnelly, J. & Rickard, K.M. 2015. Meaning in life and health: proactive health orientation links meaning in life to health variables among American undergraduates. *Journal of happiness studies*, 16(3):583-597.

Temane, L. 2012. Validation of the Meaning in Life Questionnaire in an African context. (Doctoral dissertation, North-West University).

Temple, N.J. & Steyn, N. 2016. Community nutrition for developing countries. Athabasca University Press and UNISA Press: 55-62.

Van Zyl, M.K., Steyn, N.P. & Marais, M.L. 2010. Characteristics and factors influencing fast food intake of young adult consumers in Johannesburg, South Africa. *South African journal of clinical nutrition*, 23(3):124-130.

Vartanian, L.R., Schwartz, M.B. & Brownell, K.D. 2007. Effects of soft drink consumption on nutrition and health: a systematic review and meta-analysis. *American journal of public health*, 97(4): 667-675.

Vorster, H.H., Kruger, A., Wentzel-Viljoen, E., Kruger, H.S. & Margetts, B.M. 2014. Added sugar intake in South Africa: findings from the Adult Prospective Urban and Rural Epidemiology cohort study. *The American journal of clinical nutrition*, 99(6):1479-1486.

Wentzel-Viljoen, E., Laubscher, R. & Kruger, A. 2011. Using different approaches to assess the reproducibility of a culturally sensitive quantified food frequency questionnaire. *South African journal of clinical nutrition*, 24(3):143-148.

Wentzel-Viljoen, E., Steyn, K., Ketterer, E. & Charlton, K.E. 2013. "Use salt and foods high in salt sparingly": a food-based dietary guideline for South Africa. *South African journal of clinical nutrition*, 26(3):S105-S113.

World Health Organization (WHO). 2000. Obesity: preventing and managing the global epidemic (No. 894). Switzerland.

World Health Organization (WHO). 2008. Chronic diseases and health promotion: Global school-based student health survey (GSHS) purpose and methodology. Switzerland: http://www.who.int/chp/gshs/methodology/en/index.html Date of access: 3 June 2016.

World Health Organization (WHO). 2010. Global recommendations on physical activity for health. Switzerland: WHO press. http://www.who.int/dietphysicalactivity/publications/9789241599979/en/ Date of access: 3 June 2016.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The aim of this study was to determine the association between meaning in life and healthy eating, weight status and physical activity among members of the SANDF at Lenz Military Base. The objectives of the study were to determine the association between MIL-P and MIL-S and weight status (BMI and waist circumference), MIL-P and MIL-S and frequency intake of healthy foods versus unhealthy foods, and MIL-P and MIL-S and physical activity. The study also determined the prevalence of overweight and obesity and physical activity levels among members at Lenz Military Base. This chapter summarises the results and provide recommendations for future studies.

NCDs can be prevented if risk factors such as physical inactivity, unhealthy eating habits and excess alcohol intake are addressed (WHO, 2013). Regardless of modifiable risk factors, NCDs contribute to 55.5% of deaths in South Africa (Stats SA, 2017). A high prevalence of overweight and obesity is also an important risk factor for the development of NCDs (Ekoru *et al*., 2017; Kruger *et al.*, 2001; Shisana *et al*., 2014). Dietary habits, physical inactivity and socio-economic factors are contributors to obesity (Faber & Kruger, 2005; Kruger *et al*., 2002; Kruger *et al*., 2005; Senekal *et al*., 2003). Self-efficacy, motivation, optimism and positive affect that is present in individuals with a higher sense of meaning are thought to facilitate health promoting behaviours (Roepke *et al.,* 2014). Many studies have found an association between MIL and health promoting behaviours such as physical activity and healthy eating (Brassai *et al*., 2015; Holahan *et al.*, 2011; Steger, 2015).

5.2 Main findings

It was hypothesised that MIL-S and MIL-P will be associated with lower BMI and waist circumference, higher frequency intake of healthy foods, lower frequency intake of unhealthy foods and regular physical activity levels. MIL-P was positively associated with frequency intake of fruit and milk in women and with BMI and frequency intake of fruit in men. MIL-P showed a weak negative association with physical activity in men. MIL-S was not associated with BMI or waist circumference, frequency intake of healthy and unhealthy foods and physical activity. The prevalence of overweight and obesity was 26.3% and 42.1% in women and 31% and 35.7% in men respectively. Most men (71.4%) met the recommended weekly physical activity while more than half of the women (55.3%) did not meet the recommended weekly physical activity. Waist circumference was positively associated with age in both men and women, whereas BMI was positively associated with age in women and negatively associated with smoking in men.

Education level was positively associated with frequency intake of fruit and negatively associated with frequency intake of salty snacks in men. The frequency intake of salty snacks was also negatively associated with age in women, however; not in men. The results of this study implies that although MIL-P was associated with frequency intake of some healthy foods like fruit and milk, the association may not translate into healthier BMI or physical activity levels. Instead MIL-P was positively associated with BMI and negatively with physical activity. MIL-S may not have any association on eating habits, weight status and physical activity.

Correlations between frequency intake of salty snacks and frequency intake of cold drinks and sweets in women, and a positive correlation between frequency intake of fast foods and frequency intake of cold drinks and salty snacks in men, indicate patterns of unhealthy snacking. The combination of intake of unhealthy foods like cold drinks with sweets, fast foods and salty snacks may contribute to the increasing burden of overweight and obesity and associated NCDs. Some negative correlations may imply that a higher intake of healthy foods, like fruits could translate into lower intake of unhealthy foods, like sugar.

Based on the results of this study, only the hypothesis that MIL-P was associated with frequency intake of healthy foods (fruit and milk) can be accepted, however; this did not apply to all the healthy foods included (vegetables and protein rich foods). The hypothesis that MIL-P was associated with lower BMI and regular physical activity was rejected. The hypothesis that MIL-S was associated with lower BMI & waist circumference, higher frequency intake of healthy foods and unhealthy foods and regular physical activity levels was therefore rejected.

The results of this study did not support studies that found an association between MIL-S and healthy eating and physical activity. The results only supported in part a positive association between MIL-P and frequency intake of healthy foods. This is the only study to the knowledge of the researcher that investigated an association between MIL and weight status. This study yielded the unexpected results of a positive association between MIL-P and BMI in men, but not in women. Health promoting behaviours such as healthy eating and physical activity are important in the management and prevention of NCDs and in promoting health and well-being. When promoting health behaviours, the potential role and association of MIL on these behaviours requires further investigation and understanding.

5.3 Conclusion

MIL-P was positively associated with frequency intake of fruit and milk in women and with frequency of intake of fruit in men. MIL-P was also positively associated with BMI and had a negative association with physical activity in men, however; not in women. No association between MIL-S and frequency intake of healthy and unhealthy foods, BMI and waist circumference and physical activity levels was found. The high overweight and obesity rate found in this study, coupled with low physical activity levels found in women, is of great concern. The positive association found between MIL-P and BMI and a negative association found between MIL-P and physical activity in men, renders MIL-P as not only a factor in promoting health promoting behaviours, but could also be a factor that was associated with unhealthy weight status and physical inactivity. It can be concluded that MIL-P, but not MIL-S seems to be associated with some health promoting behaviour such as frequency intake of fruit and milk and therefore should be considered as a possible contributing factor to healthy food choices.

5.4 Limitations

The healthy and unhealthy food intake survey is a short questionnaire and can be completed in a short time for convenience of the participants but the questionnaire does not take into consideration the amount of each food categories consumed daily but only how frequently the food was consumed. The perceptions on food choices and health, food accessibility and the difference in food intake between members getting their meals at the mess and those that does not get meals at the mess was not evaluated. The sample size of this study was small which might affect the results of the study

5.5 Recommendations

Since the presence of meaning in life was associated with certain aspects of healthy eating, but not with frequency intake of unhealthy foods, more studies are necessary to investigate if MIL-P will also be associated with intake of unhealthy foods or support the results of this study. Intervention studies to investigate if assisting individuals to move from being searchers of meaning to having the presence of meaning or facilitating deeper search for meaning for individuals with the presence of meaning will have positive or negative impact on health promoting behaviours, is necessary.

Further studies are required to understand the difference in the association between MIL-P and BMI and physical activity seen in men but not in women. Studies should focus not only on the presence of meaning but also on the search for meaning. Meaning in life, and its possible relationship with health promoting behaviours, is complex and therefore understanding the

mechanisms at which MIL may facilitate or hinder health promoting behaviours could bring the much needed clarity.

The high overweight and obesity prevalence found in this study is a clear indication of the crisis faced with the increasing burden of obesity and associated NCDs. Unhealthy weight status was not regarded as a negative factor that disturbs or affect sense of meaning and future goals, but instead the men in this study appeared to be content and happy with their unhealthy weight. Urgent effective nutritional and lifestyle modification programmes and interventions are of absolute necessity if the fight against NCDs is to be won. Interventions should not only focus on increasing the intake of healthy foods, decreasing and avoiding the intake of unhealthy foods and physical activity, but should also include possible psychological factors that could hinder or facilitate adherence to healthy lifestyles.

REFERENCE LIST

Ekoru, K., Murphy, G.A.V., Young, E.H., Delisle, H., Jerome, C.S., Assah, F., Longo-Mbenza, B., Nzambi, J.P.D., On'Kin, J.B.K., Buntix, F. & Muyer, M.C. 2018. Deriving an optimal threshold of waist circumference for detecting cardiometabolic risk in sub-Saharan Africa. *International journal of obesity*, 42(3):487.

Faber, M. & Kruger, H.S. 2005. Dietary intake, perceptions regarding body weight, and attitudes toward weight control of normal weight, overweight, and obese black females in a rural village in South Africa. *Ethnicity & disease*, 15(2):238-245.

Brassai, L., Piko, B.F. & Steger, M.F. 2015. A reason to stay healthy: The role of meaning in life in relation to physical activity and healthy eating among adolescents. *Journal of health psychology*, 20(5):473-482.

Holahan, C.K., Holahan, C.J., Velasquez, K.E., Jung, S., North, R.J. & Pahl, S.A. 2011. Purposiveness and leisure-time physical activity in women in early midlife. *Women & health*, 51(7):661-675.

Kruger, H.S., Venter, C.S. & Vorster, H.H. 2001. Obesity in African women in the North West Province, South Africa is associated with an increased risk of non-communicable diseases: the THUSA study. *British journal of nutrition*, 86(6):733-740.

Kruger, H.S., Venter, C.S., Vorster, H.H. & Margetts, B.M. 2002. Physical inactivity is the major determinant of obesity in black women in the North West Province, South Africa: the THUSA study. *Nutrition*, 18(5):422-427.

Kruger, H.S., Puoane, T., Senekal, M. & Van der Merwe, M.T. 2005. Obesity in South Africa: challenges for government and health professionals. *Public health nutrition*, 8(5):491-500.

Roepke, A.M., Jayawickreme, E. & Riffle, O.M. 2014. Meaning and health: a systematic review. *Applied research in quality of life*, 9(4):1055-1079.

Senekal, M., Steyn, N.P. & Nel, J.H. 2003. Factors associated with overweight/obesity in economically active South African populations. *Ethnicity & disease*, 13(1):109-116.

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., Reddy, P., Parker, W., Hoosain, E., Naidoo, P., Hongoro, C., Mchiza, Z., Steyn, N.P., Dwane, N., Makoae, M., Maluleke, T., Ramlagan, S., Zungu, N., Evans, M.G., Jacobs, L., Faber, M. & the SANHANES-1 Team. 2014. South African National Health and Nutrition Examination Survey (SANHANES-1): 2014 edition. Cape Town: HSRC Press.

Stats SA (Statistics South Africa). 2017. National Department of Health (NDoH). South African Medical Research Council (SAMRC) and ICF. South Africa Demographic and Health Survey 2016: key indicators.

Steger, M.F., Fitch-Martin, A.R., Donnelly, J. & Rickard, K.M. 2015. Meaning in life and health: proactive health orientation links meaning in life to health variables among American undergraduates. *Journal of happiness studies*, 16(3):583-597.

World Health Organization (WHO). 2013. 10 Facts on Non-Communicable Diseases. http://www.who.int/features/factfiles/noncommunicable_diseases/facts/en/ Date of access: 3 June 2016.

APPENDICES

APPENDIX 1: MIL QUESTIONNAIRE

"Meaning in life in relation to weight status, healthy eating and physical activity among SANDF members at Lenz Military Base"

The Meaning in Life Questionnaire

MILQ: Please take a moment to think about what makes your life feel important to you. Please respond to the following statements as truthfully and accurately as you can, and also please remember that these are very subjective questions and that there are no right or wrong answers. Please answer according to the scale below:

Absolutely Untrue 1	**Mostly Untrue 2**	**Somewhat Untrue 3**	**Can't Say True or False 4**	**Somewhat True 5**	**Mostly True 6**	**Absolutely True 7**

1._____ I understand my life's meaning.

2._____ I am looking for something that makes my life feel meaningful.

3._____ I am always looking to find my life's purpose.

4._____ My life has a clear sense of purpose.

5._____ I have a good sense of what makes my life meaningful.

6._____ I have discovered a satisfying life purpose.

7._____ I am always searching for something that makes my life feel significant.

8._____ I am seeking a purpose or mission for my life.

9._____ My life has no clear purpose.

10._____ I am searching for meaning in my life.

APPENDIX 2: HEALTHY AND UNHEALTHY FOOD SURVEY

Healthy and unhealthy food intake survey

How many times per week do you take the following foods or drinks?

Food group	**Frequency of intake per week**				
	0 days	1-2 days	3-4 days	5-6 days	7 days
1. Fruits (excluding canned fruit)					
2. Vegetables					
3. Meat, chicken, eggs or fish					
4. Milk or maas (inkhomazi, mothembi)					
5. Cold drinks (fizzy drinks or cordials,, sugary drinks)					
6. Sugar in tea/coffee (….teaspoons sugar/cup)					
7. Cookies or cake					
8. Chips or cheese puffs or NikNaks					
9. Sweets or chocolates					
10. Fast foods (Fried chicken, hamburger, chips, pie, pizza, processed meats)					

APPENDIX 3: SOCIODEMOGRAPHIC AND HEALTH QUESTIONNAIRE

SOCIODEMOGRAPHIC AND HEALTH DATA COLLECTION FORM

(All information in this questionnaire is confidential)

1. Date: ___/__/201_

2. Participant's Details:

Participant number: _____ Age: _____ years

Rank: _____ Arms of Service: _____

Section: _____

Uniform member/PSAP member: _____

Do you eat at the mess? Yes _____ No_____

Gender: _____ Language: _____

Race:

Tick the appropriate race below

1	Black	
2	White	
3	Coloured	
4	Indian	
5	Other, specify	

3. Information with regards to own completed education

Tick appropriate education level

	Education level	
1	No school education	
2	Primary School	
3	Secondary school (grade 7)	
4	Senior secondary school	
5	Tertiary education	
6	Other: specify	

4. Anthropometric measurements

Variable	**Measure 1**	**Measure 2**	**Measure 3**
Weight (kg)			
Height (cm)			
BMI (kg/m^2)			
Waist circumference (cm)			

5. Do you smoke?

0	No	
1	Yes, smoked previously but stopped	
2	Yes, current smoker	
How many cigarettes do you smoke per day?		

6. Do you use multivitamin supplements?

0	No	
1	Yes	
2	If yes, state type	
3	How often do you take multivitamin supplements?	

APPENDIX 4: GPAQ

GPAQ Participant number: .....

Physical Activity

Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person.

Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. *[Insert other examples if needed].* In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.

	Questions	Response	Code
Activity at work			
1	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like *[carrying or lifting heavy loads, digging or construction work]* for at least 10 minutes continuously? *[INSERT EXAMPLES] (USE SHOWCARD)*	Yes 1 No 2 *If No, go to P 4*	P1
2	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	Number of days ⌊_⌋	P2
3	How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours : minutes ⌊_⌋⌊_⌋ : ⌊_⌋⌊_⌋ (hrs : mins)	P3 (a-b)
4	Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking *[or carrying light loads]* for at least 10 minutes continuously? *[INSERT EXAMPLES] (USE SHOWCARD)*	Yes 1 No 2 *If No, go to P 7*	P4
5	In a typical week, on how many days do you do moderate-intensity activities as part of your work?	Number of days ⌊_⌋	P5
6	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours : minutes ⌊_⌋⌊_⌋ : ⌊_⌋⌊_⌋ (hrs : mins)	P6 (a-b)
Travel to and from places			
The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship, [insert other examples if needed]			
7	Do you walk or use a bicycle (*pedal cycle*) for at least 10 minutes continuously to get to and from places?	Yes 1 No 2 *If No, go to P 10*	P7
8	In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	Number of days ⌊_⌋	P8
9	How much time do you spend walking or bicycling for travel on a typical day?	Hours : minutes ⌊_⌋⌊_⌋ : ⌊_⌋⌊_⌋ (hrs : mins)	P9 (a-b)
Recreational activities			
The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure), [insert relevant terms].			
10	Do you do any vigorous-intensity sports, fitness or recreational (*leisure*) activities that cause large increases in breathing or heart rate like *[running or football,]* for at least 10 minutes continuously? *[INSERT EXAMPLES] (USE SHOWCARD)*	Yes 1 No 2 *If No, go to P 13*	P10
11	In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (*leisure*) activities?	Number of days ⌊_⌋	P11
12	How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	Hours : minutes ⌊_⌋⌊_⌋ : ⌊_⌋⌊_⌋ (hrs : mins)	P12 (a-b)

Continued on next page

GPAQ, Continued

Physical Activity (recreational activities) contd.			
Questions		**Response**	**Code**
13	Do you do any moderate-intensity sports, fitness or recreational (*leisure*) activities that causes a small increase in breathing or heart rate such as brisk walking,(*cycling, swimming, volleyball*)for at least 10 minutes continuously? *[INSERT EXAMPLES] (USE SHOWCARD)*	Yes 1 No 2 *If No, go to P16*	P13
14	In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (*leisure*) activities?	Number of days ⌊_⌋	P14
15	How much time do you spend doing moderate-intensity sports, fitness or recreational (*leisure*) activities on a typical day?	Hours : minutes ⌊_⌋⌊_⌋ : ⌊_⌋⌊_⌋ hrs mins	P15 (a-b)
Sedentary behaviour			
The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent (sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television), but do not include time spent sleeping. *[INSERT EXAMPLES] (USE SHOWCARD)*			
16	How much time do you usually spend sitting or reclining on a typical day?	Hours : minutes ⌊_⌋⌊_⌋ : ⌊_⌋⌊_⌋ hrs min s	P16 (a-b)

APPENDIX 5: PERMISSION LETTER

RESTRICTED

AMHF/R/104/32

Telephone: (012) 671-5393
Facsimile: (012) 671-5352
Enquiries: Lt Col E.M. van der Westhuizen

Area Military Health Formation
Private Bag X1016
Lyttelton
0140

4 July 2016

APPROVAL TO CONDUCT RESEARCH FOR MASTERS DEGREE BY LT M.M. NGOEPE

1. Attached please find letter with no file reference, dd 22 June 2016.

2. Lt Ngoepe is appointed as a dietitian at Lenz Sickbay since Jan 2014.

3. Telephonically she discussed with SO1 Diet, Area MH Fmn, her intention to do her Master's degree research amongst military members at Lenz Army Support Base and patients who attend Lenz MMC.

4. The Military Ethics Committee however demands approval by the relevant Directorate before they will consider approving the research.

5. Your favorable consideration will be highly appreciated.

Col

(D. TEMPELHOFF)
GENERAL OFFICER COMMANDING AREA MILITARY HEALTH FORMATION: BRIG GEN

REMARKS: Recommended

05/7/2016

(E.X. CURRIE)
DIRECTOR ANCILLARY HEALTH: BRIG GEN

Lefapha la Boipheselo Umnyango wezoku/Vikela Kgoro ya Tshireletso iSebe lezoKhuselo Department of Defence Mishasho wa Tshitedzo UmNyango WezokuVikela Ndrawulo ya swa Vlisirheteri Lefapha la Tshireletso Departement van Verdediging LiTiko leTekuvikela

"Health Warriors Serving The Brave"
RESTRICTED

APPENDIX 6: NORTH-WEST UNIVERSITY HREC APPROVAL

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

Private Bag X6001, Potchefstroom,
South Africa, 2520

Tel: (018) 299-4900
Faks: (018) 299-4910
Web: http://www.nwu.ac.za

Research Ethics Regulatory Committee
Tel: +27 18 299 4849
Email : Ethics@nwu.ac.za

ETHICS APPROVAL CERTIFICATE OF STUDY

Based on approval by **Health Research Ethics Committee (HREC)** on **30/10/2017** after being reviewed at the meeting held on **14/06/2017**, the North-West University Research Ethics Regulatory Committee (NWU-RERC) hereby **approves** your study as indicated below. This implies that the NWU-RERC grants its permission that provided the special conditions specified below are met and pending any other authorisation that may be necessary, the study may be initiated, using the ethics number below.

Study title: Meaning in life in relation to healthy eating, weight status and physical activity among South African National Defence Force members at Lentz Military Base

Study Leader/Supervisor: Prof. HS Kruger

Student: MM Ngoepe-27456382

Ethics number:

N	W	U	-	0	0	0	7	3	-	1	7	-	A	1
Institution				Study Number						Year			Status	

Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation

Application Type: Single study

Commencement date: 14/06/2017 **Risk:** **Medium**

Approval of the study is initially provided for a year, after which continuation of the study is dependent on receipt of the annual (or as otherwise stipulated) monitoring report and the concomitant issuing of a letter of continuation.

Special conditions of the approval (if applicable):

- Monitoring report required six-monthly.

General conditions:

While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, please note the following:

- *The study leader (principle investigator) must report in the prescribed format to the NWU-RERC via HREC:*
  - *annually (or as otherwise requested) on the monitoring of the study, and upon completion of the study*
  - *without any delay in case of any adverse event or incident (or any matter that interrupts sound ethical principles) during the course of the study.*
- *Annually a number of studies may be randomly selected for an external audit.*
- *The approval applies strictly to the proposal as stipulated in the application form. Should any changes to the proposal be deemed necessary during the course of the study, the study leader must apply for approval of these amendments at the HREC, prior to implementation. Should there be any deviations from the study proposal without the necessary approval of such amendments, the ethics approval is immediately and automatically forfeited.*
- *The date of approval indicates the first date that the study may be started.*
- *In the interest of ethical responsibility the NWU-RERC and HREC retains the right to:*
  - *request access to any information or data at any time during the course or after completion of the study;*
  - *to ask further questions, seek additional information, require further modification or monitor the conduct of your research or the informed consent process.*
  - *withdraw or postpone approval if:*
    - *any unethical principles or practices of the study are revealed or suspected,*
    - *it becomes apparent that any relevant information was withheld from the HREC or that information has been false or misrepresented,*
    - *the required amendments, annual (or otherwise stipulated) report and reporting of adverse events or incidents was not done in a timely manner and accurately,*
    - *new institutional rules, national legislation or international conventions deem it necessary.*
- *HREC can be contacted for further information or any report templates via Ethics-HRECApply@nwu.ac.za or 018 299 1206.*

The RERC would like to remain at your service as scientist and researcher, and wishes you well with your study. Please do not hesitate to contact the RERC or HREC for any further enquiries or requests for assistance.

Yours sincerely,

Prof. Refilwe Phaswana-Mafuya
Chair NWU Research Ethics Regulatory Committee (RERC)

APPENDIX 7: 1 MILITARY HREC APPROVAL

RESTRICTED

1MH/302/6/01.09.2017

sa military health service
Department:
Defence
REPUBLIC OF SOUTH AFRICA

Telephone: 012 314 0013
Facsimile: 012 314 0013
Enquiries: Prof / Lt Col M.K. Baker

1 Military Hospital
Private Bag x 1023
Thaba Tshwane
0143

03 November 2017

CLINICAL TRIAL APPROVAL: 01.09.2017: "MEANING IN LIFE IN RELATION TO HEALTHY EATING, WEIGHT STATUS AND PHYSICAL ACTIVITY AMONG SOUTH AFRICAN NATIONAL DEFENCE FORCE MEMBERS AT LENZ MILITARY BASE"

1. The 1 Military Hospital Research Ethics Committee (1MHREC) registered in South Africa with the National Health Research Ethics Council (NHREC) (REC-111208-019-RA) adhering to GCP/ICH and SA Clinical Trial guidelines, evaluated the above-mentioned protocol and additional documents.

2. The following members approved the study:

   a. Lt Col M.K. Baker: Neurologist, male, chairman 1 MHREC.
   b. Lt Col C.S.J. Duvenage: Specialist physician, female, member 1 MHREC.
   c. Lt Col D. Mahapa: Dermatologist, female, member 1 MHREC.
   d. Lt Col A.D. Moselane: Urologist, male, member 1 MHREC.
   e. Lt Col E.J. Venter: Periodontist, male, member 1 MHREC.
   f. Maj M.L. Kekana: Specialist physician, female, member 1 MHREC.
   g. DR T.J. Marè: Advocate, independent of the organization, male, member 1 MHREC.
   h. Mrs. C. Jackson: Layperson, independent of the organization, female, member 1 MHREC.
   i. Maj. M.M.M. Ledwaba: Specialist physician, female, member 1 MHREC

3. The following documents were evaluated:

   a. Personalised covering letter from investigator
   b. Research proposal
   c. Informed Consent Document
   d. Socio-demographic and health data collection form
   e. Advertisement or recruitment
   f. Questionnaires
   g. Healthy and unhealthy food intake survey
   h. Memorandum of understanding between Lenz Military Base and Lt. M.M. Ngoepe
   i. Request for permission from Officer Commanding ASB JHB to conduct study
   j. Conditional approval letter from Health Research Ethics Committee of the Faculty of Health Sciences

Health Warriors Serving the Brave
RESTRICTED

k. Updated Curricula Vitae:

i. M.M. Ngoepe
ii. H.S. Kruger
iii. R. Bielfeld
iv. E. Deacon
v. N.S. Kama
vi. R. Dikotla

4. The recommendations are: The study was ethically approved on 3 November 2017. The principal investigator, Lt. M.M. Ngoepe, will be supervised by Prof. H.S. Kruger. Report backs are to be made to the 1MHREC six monthly, in the event of any serious adverse events and on completion or termination of the study. Should publications result from the study the relevant manuscripts will also need to be approved by Military Counter Intelligence. All funds generated through this research study should be paid into an approved Regimental fund account.

The 1 MHREC wishes you success with the study.

(M.K BAKER)
CHAIRMAN 1 MILITARY HOSPITAL RESEARCH ETHICS COMMITTEE:
LT COL / PROF

DIST

For Action

Lt. M.M. Ngoepe

APPENDIX 8: INFORMED CONSENT FORM

sa military health service
Department
Defence
REPUBLIC OF SOUTH AFRICA

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOM CAMPUS

Health Research Ethics Committee
Faculty of Health Sciences
NORTH-WEST University
(Potchefstroom Campus)
2017 -10- 30
HREC Stamp

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM FOR PARTICIPANTS AT LENZ MILITARY BASE

TITLE OF THE RESEARCH PROJECT: Meaning in life in relation to healthy eating, weight status and physical activity among South African National Defence Force members at Lenz Military Base

REFERENCE NUMBERS: NWU-00073-17-S1

IINVESTIGATOR: M.M. Ngoepe

ADDRESS: E-mail address: mphomathiba@gmail.com, Fax: 0182992464

CONTACT NUMBER: Phone: 011 212 5768, Mobile: 071 190 2123

You are being invited to take part in a research project that forms part of my M Sc research project. Please take some time to read the information presented here, which will explain how this project will be done. Please ask the researcher any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Health Research Ethics Committee of the Faculty of Health Sciences of the North-West University NWU (NWU-00073-17-S1)** and will be

conducted according to the ethical guidelines and principles of the international Declaration of Helsinki and the ethical guidelines of the National Health Research Ethics Council. It might be necessary for the research ethics committee members or relevant authorities to inspect the research records.

What is this research study all about?

- This study will be conducted in the community centre at Lenz Military Base at Lenasia Johannesburg. An experienced and trained health researcher will ask questions and complete questionnaires and measure your weight, height and waist circumference. All members of the Lenz Military Base will be invited to participate and a total number of at least 360 participants will be included in the study.
- The objectives of this research are:
  - To assess if the presence and search of meaning in life will be related to healthy eating habits
  - To assess if the presence and search of meaning in life will be related to weight status.
  - To assess if the presence and search of meaning in life will be related to physical activity
  - You will not participate if you are unable to stand on your own and have hearing difficulties. You shall not be excluded because of your sexual orientation, gender or race.

What will your responsibilities be?

- You will be expected to come to the community centre in the sickbay on a date and time the researcher will communicate with you.
- Your height, weight and waist circumference measurements will be done in a close room at the Dieticians office.
- You will be requested to take off your shoes and hat and all heavy clothes like a jacket when weighing and measuring.
- We will weigh you on a scale, measure your height with a height meter and measure your waist circumference with a tape measure.
- You will be asked to answer questions honestly from a questionnaire which the researcher will ask you, about your age, language, your arm of service, education level, rank and section. You do not have to write anything yourself.

- You will be asked to complete three questionnaires, the meaning in life questionnaire, the questionnaire about your physical activity and a questionnaire about your eating habits.
- The researcher will administer the questionnaires, you do not have to write anything yourself.
- The measurements and the questionnaires will take about 2 hours to complete

Will you benefit from taking part in this research?

- The indirect benefit will be helping the researchers to see if there is any relations between meaning in life and peoples weight status, eating habits and physical activity.
- You will know your weight, height, BMI and waist circumference measurements and your meaning in life score.

Are there risks involved in your taking part in this research?

- There will not be any physical risks in this study.
- The researcher will ask the questions from the questionnaires in a private room.
- The height and weight will be done by a researcher in a private, closed room. You must take your shoes and hat and heavy jersey off for the measurements.
- No names or force number will be written on your questionnaires and forms, only a study number. You will be allocated a study number when you sign for the study.
- All the measurements data will be typed in a password protected computer, but no names.
- Your information will be kept locked in an office and protected in a computer with only the researchers who can see it.
- None of your information will be given to any other person. When your information is reported in research papers or at a congress, only the information of the group will be shown, but no names.
- When the results of the study are available, a general feedback will be given to members of Lenz Military Base at the communication period. No participants will be able to be identified when feedback is given.

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

- Should you have the need for further discussions after your measurement day, an opportunity will be arranged for you to ask any questions to any member of the research team. You are also welcome to call the team leader, Professor Salome Kruger, at telephone number 018 299 2482. If you have any further questions

concerning your consent, you can contact Mrs Carolien van Zyl at the Ethics office of the university at telephone number 018 299 2094.

Who will have access to the data?

- All hard copies of questionnaires will be stored in the office of the principal supervisor, Prof. H.S. Kruger and electronic data will be archived on a password protected computer and backed up on an external hard drive. Data will be recorded and saved by research number only to ensure confidentiality. All hard copies of questionnaires will be stored for 10 years at least and then destroyed by shredding.

What will happen with the data/samples?

- This is a once off collection and data will be entered in an Excel file and the computer programme Statistical Package of Social Sciences (SPSS version 22 program). All the analysis will be done by the researcher at North West University – Potchefstroom.

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

No, you will not be paid to take part in the study. You will however be required to come to the community centre in the sickbay, if you do take part.

Is there anything else that you should know or do?

- You can contact Prof HS Kruger at 018 229 2482 or Mmatlala Ngoepe at 011 212 5768/ 0711902123 if you have any further queries or encounter any problems.
- You can contact the Health Research Ethics Committee via Mrs Carolien van Zyl at 018 299 1206; carolien.vanzyl@nwu.ac.za if you have any concerns or complaints that have not been adequately addressed by the researcher.
- You will receive a copy of this information and consent form for your own records.

How will you know about the findings?

- We will tell you the findings of your height, weight and waist circumference and MIL score after measurements. Your name will never be mentioned in any of the reports.
- We will tell you about the findings by giving general feedback in a presentation at the communication period after the study is completed.

Declaration by participant

By signing below, I ..... agree to take part in a research study, **Meaning in life in relation to healthy eating, the weight status and physical activity among members of SANDF at Lenz Military Base**

I declare that:

- I have read or listened to this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions to both the person obtaining consent, as well as the researcher and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.
- I am aware that I shall receive a signed and dated copy of this informed consent document.

Signed at (*place*) ..... on (*date*) ..... 20....

.....
Signature of participant

.....
Signature of witness

Declaration by person obtaining consent

I ....., declare that:

- I explained the information in this document to the participant.
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did not use an interpreter.

Signed at (*place*) ..... On (*date*) ..... 20....

.....
Signature of person obtaining consent

.....
Signature of witness

Declaration by researcher

I Mmatlala Ngoepe declare that:

- I trained ... . to explain the information in this document to the participant.
- The person obtaining consent encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did not use an interpreter.

Signed at (*place*) ..... on (*date*) .....20....

.....
Signature of researcher

.....
Signature of witness