# The Impact of a Nutrition and Physical Activity Intervention Programme on Frailty Syndrome in Elderly Citizens in Lesotho

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Thesis Submitted in fulfilment of the requirement for the

PhD in Nutrition

in the Faculty of Health Sciences

Department of Nutrition and Dietetics

University of the Free States

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Bloemfontein

2018

**DECLARATION WITH REGARD TO INDEPENDENT WORK**

I, **Rose Kokui Dufe Turkson**, identity number G1024087 and student number 2012001984, do hereby declare that this thesis submitted to the University of the Free State for the degree **PhD Nutrition**: **The Impact of a Nutrition and Physical Activity Intervention Programme on Frailty Syndrome in Elderly Citizens in Lesotho**, is my own independent work, and has not been submitted before to any institution by myself or any other person in fulfilment of the requirements for the attainment of any qualification. I further cede copyright of this research in favour of the University of the Free State.

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## DEDICATION

To the *LORD GOD ALMIGHTY, THE ALPHA AND OMEGA, THE BEGINNING AND THE END, WHO WAS, WHO IS AND WHO IS TO COME.* And to the Sweet Holy Spirit who has been my guide, my teacher and my comforter and to HIS Son Jesus Christ my Lord and Saviour through Him all things were made. Thank you, God for how far you have brought me. Thank you for your unfailing love and shield through it all.

- To my dearest daughter and friend **Miss Favour of God Maame Esi Boatemaa Turkson** you are a precious gift, a treasure, a thing of beauty and joy forever. Thank you, Princess for all you had to endure for mummy to study. I still love you. You Rock my world with your intelligence.
- To my dear father and friend ***Mr. Francis Atter Dufe.*** Daddy you inspired me that the sky is not my limit that I can go even further above the sky. Thank you for your love and support. Thank you for being the best dad I could ever have. ***I Love you dad, may you live long.***
- To my siblings ***Reverend Samuel Gasu, Mr. Isaac Ofue Dufe***, ***Reverend Godwin Tetteh Dufe, Reverend Gideon Teye Mensah Dufe*** , ***Ms Mabel Korkor Kpalam*** and to all ***my cousins.*** Thank you for your love and support.
- *TO ALL PARTICIPANTS AND TO EVERY ONE 65 YEARS AND ABOVE. Kea leboha*
- ***In Loving Memory of Mama***

  To my sweet mum the *Late Mrs Comfort Ajoyo Dufe (nee Lawerteh)* who engineered this move for me to pursue my PhD. Five months down the lane the Lord called you to Eternal Glory. Mama, I still miss you a lot, in every step I take and every move I make***. I love you.***

- ***In loving and fond memory of the love of my life***

To my love, the man who changed my world, the *Late Mr George Ebow Turkson* who kept tracing the progress of this work in his sick bed. George had to drive me all the way to Bloemfontein on the 4th of July just 2 weeks after an operation to face the evaluation committee at UFS you sacrificed a lot to get this work done. ***Kwabena*** your love was amazing. In fact, you dedicated your time to ensure that the data collection and intervention went very well. **Bra. George** the work is now complete, you did not wait to see that your efforts were not in vain, but only God can explain your early exit. ***I STILL LOVE YOU.***

## ACKNOWLEDGEMENTS

It has been a very long journey and the Lord has been very faithful through it all. My spiritual mentor, Senior Prophet Tb Joshua said, '**the challenging situations you are going through today, will not be there tomorrow. They are just to prepare you for your destination**'. Yes, indeed it was all worth it. Many came along this journey of life - some were visible, some were virtual friends thanks to today's technologically advanced world.

- I am highly indebted to this special God-fearing lady and mother the Lord Jesus gave me as a Promoter, **Professor Corinna May Walsh**. Words are not enough for me to describe all that happened during this six year journey under her able leadership. She was indeed an answer to 2 weeks fervent prayer after I was notified that I have been admitted to the PhD program in 2013. I knew my God has never been wrong. He is still a miracle worker. Prof, your academic mentorship has been excellent, I have learnt a lot and I am a better person than I came 6 years ago. I give God all the glory for a generation changer like you. I am so glad our paths crossed - your kindness will forever be remembered.
- **Dr Jennifer Osei Ngounda,** I am so grateful for the immense contribution you made to the completion of this thesis. God bless you.
- **Madam Riette Nel,** a very meticulous and disciplined woman who worked with figures. It was good working with you. I learnt to be conscientious with figures and words alike because they make different meaning when they go out to someone else.
- **Karabelo Mpheko,** my 'co-researcher', I am proud to be associated with your great achievement. Thank you, **Dr Opperman,** for your expertise in the field of Biokinetics and for bringing Karabelo along, she made a valuable impact. Thank you for your immense contribution in this study. I am forever grateful to the team that made this a reality.
- To the **Dean** of the Faculty of Health Sciences, UFS, the entire Department of Nutrition and Dietetics, **Madam Christa Mitchell**, the current HoD, **Prof Van Den Berg,** and all other members, your warmth and love made a great impact on my life. Thank you.
- Special thanks to **Milk South Africa** and the **Bloemfontein Dairy Corporation branch** for the **'amasi'** we used for the intervention.

- To the field team: **Moteiloa Lineo, Mats'episo Judith Mothobi, Mpho John Sofeng, Caza Mateko, Benjamin Adu Poku, Mabatho Mapetla, Mabataung Mphakela, Gugushe Ntebele, Nvulane Nhlapo, Lineo Tamako, Tebello Maphepha** . Thank you for everything. You made it happen.
- To the Dean of Health Sciences, Prof Sunny Ayuik, Mrs Mathuso Ntsapi, the special assistant to the Department, to the current HoD Department of Nutrition Mr Kebitsamang Mothibe and my colleagues and students at National University of Lesotho, for all your love, support and encouragement.
- To a few special people, my Former HoD Mrs Mamra M Ntsike and her family, Dr Kelvin Hoedofia and his lovely wife Dr Mrs Isdorina Tsolo Hoedofia, Mr Nicholas Ahadjze and his family, Mr. David Croome (thank you for the book on the elderly in Lesotho), Mrs Evelyn Rose Debrah Afaneyedey (my confidant), Dr Brenda Abu, Mr Biikook Konlan, Mrs Gloria Kobati Atiga and Dr. Emmanuel Aleser, Ms Caress Ethel Adongo, Pastor David Safoa, Mrs Juliana Lamptey, DSP Mrs Naomi Gberbie Acquah, Mr Kwamina Akorful - thank you for being part of this success.
- The Roma Family, cannot be forgotten in achieving this very important milestone, Mr and Mrs Appiah, Ms Brenda Kabulleta and family (thank you for been there for us we are grateful), Mrs Sithembile Manyawu (thank you for standing in for mum to come and finish her work), Mr Henry Amo Mensah and his family, Mr Alex Ofori Marfo, Dr and Mrs Fru and family, Mr and Mrs Kakoma, Mrs Kasweka Kakoma Kumwenda, Jennifer and all the Twums, Tebello Maphepha, Richard Henaku, Madam Puseletso (Favour and I are grateful), my big daughter Benedicta Boateng and Joseph Patrick Mensah ( Favour, and I are grateful for everything) and Ogwal 'Mamokete.
- The Ghanaian Community in Lesotho, White As Snow Fire Ministry family, and many wonderful friends out there who were with me and supported me physically, emotionally, financially and spiritually through those trying times; I am so grateful.
- To my lovely prayer family in Ghana and in Lesotho; Pastor Finney, Apostle Snow, Prophetess Masingoaneng Berlina Motsamai, Evangelist Doris Esuman, Pastor Mohau Ntae, Mpho Sofeng, Eric Ofori Mensah and 'Mamoroosi Khunonyane and a host of others, your efforts have not been in vain. Ebenezer this is how far the Lord has brought me.

## ABBREVIATIONS

| | |
|---|---|
| ACSM | American College of Sports Medicine |
| AOA | American Optometric Association |
| BoS | Bureau of Statistics |
| CC | Calf Circumference |
| CDC | Center for Disease Control |
| CSHA-CSF | Canadian Study for Health and Aging Clinical Frailty Scale |
| FAO | Food and Agriculture Organization |
| GoL | Government of Lesotho |
| HIV/AIDS | Human Immunodeficiency Virus / Acquired Immune Deficiency Syndrome |
| IADL | Instrumental Activities of Daily Living |
| IDDS | Individual Dietary Diversity Score |
| LHDS | Lesotho Demographic and Health Survey |
| LVAC | Lesotho Annual Vulnerability Assessment and Analysis |
| MUAC | Mid Upper Arm Circumference |
| MDG | Millennium Development Goal |
| MNA | Mini Nutritional Assessment |
| MoFA | Ministry of Agriculture |
| MoSD | Ministry of Social Development |
| NERI | New England Research Institutes |
| NFAG | National Physical Activity Guidelines |
| NIA | National institute of aging |
| NSDP | National Strategic Development Plan |
| SOF | Study of Osteoporotic Fractures |
| UNDP | United Nations Development Program |
| UNMDG | United Nations Millennium Development Goals |
| UNSDG | United Nations Sustainable Development Goals |
| USAID | United States Agency for International Development |
| WHO | World Health Organization |

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## SUMMARY

The number of elderly in the world is steadily increasing. Although a large number of studies have reported on the impact of nutrition and physical activity interventions in preventing, postponing or even reversing frailty in the elderly from developed countries, the evidence from developed countries is lacking.

The main aim of the study was to determine the impact of a nutrition and physical activity intervention on indicators of frailty and malnutrition in the elderly in Lesotho. The baseline phase of the study investigated levels of frailty, malnutrition and associated factors (socio-demography, reported health, dietary diversity and levels of physical activity) amongst a baseline of elderly in Maseru, Lesotho. The baseline was followed by the intervention phase to assess the impact of a fermented milk and physical activity intervention on indicators of frailty and malnutrition in the elderly in Lesotho.

This baseline study had a cross-sectional design. The elderly (N=300) aged 65 years and older were recruited from 16 communities in urban Maseru. A questionnaire was administered to acquire information on socio-demography, reported health and individual dietary diversity. The Physical Activity Scale for the Elderly (PASE) was used to measure levels of physical activity, while the Rockwood frailty scale was applied to assess the degree of frailty and the Mini Nutritional Assessment (MNA) was used to determine nutritional status.

In terms of frailty, 26.2% of participants were classified as fit; 52.4% as fit but bladder incontinent, 9.7% as pre-frail and 11.7% as frail. There was no significant difference between the prevalence of frailty in men and women (p=0.68). In terms of nutritional status, more than half (66.0%) of participants were at risk of malnutrition, while 19.4% were malnourished.

More than forty percent (43.1%) of participants were unemployed and almost half (46.3%) reported a household income of R500 or less. Most (81.3%) resided in brick/concrete dwellings, 61% used pit toilets and 51.3% had access to electricity at their homes. Gas was the most common fuel used for cooking (44.1%).

The most prevalent reported symptom was joint pain (59.7%). Loss of appetite (54%), involuntary weight loss (46.6%) and swelling of the feet (44.5%) were also common. More

than half (63.2%), of participants were diagnosed with high blood pressure, and 36% suffered from heart disease/ heart related diseases. Almost all (90.7%) of the participants were members of a local church. Feelings of sadness and depression were reported by 47%. Almost 60% (57.1%) reported using medication regularly, and 7.2% had been hospitalised during the previous 12 months.

Individual Dietary Diversity Score (IDDS) showed that more than half of participants (53.5%) had low levels of dietary diversity, consuming mostly starchy staples (97.3%). Frequency of consumption of meat and dairy was low (38% and less than 1% respectively). The median PASE score of 106.1, (range 87.2-122.8) fell below the recommendation of $\geq$120.

Compared to the fit group, participants that were pre-frail or frail were more likely to use paraffin as fuel for cooking (p=0.02), less likely to go out (p=0.01), more likely to experience breathlessness with usual exercise (p<0.01) and wheezing or coughing (p=0.03). A significantly higher percentage of elderly in the frail group (13%) had been diagnosed with stroke as compared to the fit group (5.0%) (p=0.04). Diagnoses of lung disease such as asthma was significantly higher in the frail group (22.0%) than in the fit group (10.3%) (p=0.02).

A significantly higher percentage that were well-nourished according to the MNA used electricity for cooking (39.6%) compared to participants (23%) that were malnourished and at risk of malnutrition combined [95% CI -30.2%; -3.5%]. A significantly higher percentage of well-nourished respondents used flush toilets compared to those that were malnourished and at risk of malnutrition [95% CI -30.8%; -7.7%]. Perceived poor health status and nutritional problems were significantly (positively) associated with malnutrition [95% CI 19.3%; 36.0%] and [95% CI 22.2%; 37.8%] respectively. A significantly higher percentage (9.5%) of respondents that were malnourished had cognitive impairment/depression compared to those that were well-nourished (0%) [95% CI 2.6%; 13.9%].

For the intervention phase of the study a pre-test–post-test study design was applied in four urban constituencies (16 communities) in the Maseru District. After completion of the baseline study 120 of the 300 participants that were classified as pre-frail, frail and/or malnourished were selected to participate in the intervention phase of the study. Information

about socio-demography, reported health, IDDS, MNA PASE and frailty (Rockwood scale) was collected in these participants before and after the three month interventions.

The 120 participants were divided into three groups of 40 each. Group 1 received the fermented milk and exercise intervention; Group 2 received only the fermented milk intervention and Group 3 comprised the control group. The interventions were delivered over a 12 week period. In Groups 1 the physical activity intervention consisted of sessions lasting for 1 hour a day on three days a week. After the exercise session the fermented milk was given to participants. In Groups 2 the fermented milk was delivered to participants every second day.

As far as the intervention sample was concerned, about two thirds were female, with a median age of between 74.4-76.1 years (range 64.3-94 years). More than 60% were widowed and had a low literacy level (primary school). More than 80% lived in brick or concrete houses and used pit latrines. As found I the baseline phase of the study, chest pain, loss of appetite and joint pain were the most commonly experienced symptoms, while hypertension and heart disease were the most commonly diagnosed conditions. More than 85% of participants regularly attended church. Major sources of stress included crop or business failure and major intra family conflict. More than 70% of participants in the intervention groups had cared for people infected with HIV/AIDS at some time.

Before intervention, more than 70% of all participants fell in the low dietary diversity score category (70.7% in the both group, 82.2% in the milk group and 70.2% in the control group). Only 4.9% of participants in the both group, 17.8% of those in the milk group and 12.8% in the control group were classified as well-nourished according to the NMA score. Before intervention the median PASE score of all was 113.3 in the both group, 102.9 in the milk group and 103.7 in the control group, indicating a low level of physical activity. In terms of the frailty score, 12.5% of the participants in the both group, 28.9% of those in the milk group and 28.9% in the control group were categorised as pre-frail and frail. After three weeks of intervention, no significant improvements in any of the indicators of frailty or malnutrition were observed in any of the groups.

In conclusion, a large percentage of elderly participants included in this study were characterised by poverty, ill health, low dietary diversity, malnutrition and risk of frailty. Frailty and malnutrition were associated with a lower socio-economic situation, lower mobility and higher risk of symptoms and disease.

It is probable that the amount of fermented milk that was provided was not enough to impact on measures of frailty and malnutrition in participants. The socio-economic and food security situation of the elderly in Lesotho resulted in sharing of the food supplement. These findings further confirm the role of socio economic status and perceived health on nutritional status, and the need for routine screening thereof in the elderly to ensure timely diagnoses and management of malnutrition. Important differences between developed and developing countries, such as those related to socio-economic status, caregiving responsibilities of the elderly and food insecurity, complicate the situation of the elderly in developing countries. Research related to the unique nutrition situation and development, implementation and evaluation of relevant nutrition interventions in African countries are urgently required.

# CHAPTER 1

# BACKGROUND AND MOTIVATION FOR THE STUDY

## 1.1 Introduction

In both the developed and developing world, the number of elderly people (aged 60 years and older) is steadily increasing (Lorenzo-Lopez et al., 2017; Suzaman and Beard, 2011), due to improved survival and longer life expectancy (He et al., 2016). According to the United Nations (UN, 2015), the global number of elderly is projected to increase from 901 million in 2015 to 1.4 billion in 2030. By the year 2025, the number is expected to reach 1.2 billion with 840 million living in low-income countries (WHO, 2015).

In Africa, the population of elderly is expected to increase from 42.5 million in 2000 to nearly 220.3 million by the year 2050 (UNDESA, 2015). The average life expectancy for low and middle-income countries has increased from 42 years in 1950 to 68 years in 2015 and it is estimated to rise to 75 years by 2050 (UNDESA, 2015). Higher life expectancy translates to a larger number of elderly people who are more vulnerable to malnutrition, frailty and chronic diseases.

In contrast to the global projections, the number of people aged 60 years and above in Lesotho is predicted to decrease from approximately 8% of the population in 2013 to approximately 6% of the population in 2026 (BoS, 2013). The reason for this projected decrease is ascribed to the impact of Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome (HIV/AIDS) mortality that is currently affecting the younger population (BoS, 2013). Lesotho has the second highest HIV prevalence in the world, with more than 25% of the adult population having been diagnosed with HIV and 80% of those with HIV also suffering from tuberculosis (UNAIDS, 2017). Although testing and treatment have improved dramatically over the past years, poverty, stigma and gender inequality have hindered progress. Of the total population of 2.1 million people in Lesotho, an estimated 73 000 children are orphans (UNAIDS, 2017), with the HIV/AIDS pandemic being cited as the major reason for this (Lesotho Ministry of Health, 2012).

According to Himmelgreen et al., (2009), the impact of the HIV/AIDS pandemic is intensified by poverty, poor food security and gender inequality. In Lesotho, 57.1% of the population live below the poverty line and more than a third require food assistance (LVAC, 2017; WFP, 2016). In the face of the drought caused by El-Niño, a major food crisis is currently being experienced in Lesotho. The problem is exacerbated by the fact that only 9% of the landmass in Lesotho is suitable for growing crops (WFP, 2016).

Sadly, the attitude toward the elderly in Lesotho has changed over time. According to the Ministry of Social Development (MoSD, 2014), the previous respect and care that used to be shown to the elderly (they were believed to be the custodians of customs and traditions) has been replaced with a view by many that they are a liability, increasing the risk of neglect and even abuse of the elderly. There is a belief by many that resources should be prioritised for the many young children that are malnourished (7.13% of the GDP is spent on chronic malnutrition of children) and pregnant and breastfeeding mothers that are faced with other pertinent health problems (UNAIDS, 2017), leaving little over for the elderly who are believed to have already lived their lives (Charlton and Rose, 2001). Other reason for the decline in the care for elderly people by younger ones in Lesotho include the increasing number of younger people who attain higher levels of education, especially women, and often work away from home for career and financial reasons (Ranotsi and Aiyuk, 2012), and the fact that the adult children of the elderly are ill or have died from AIDS, increasing the care-giving responsibilities of the elderly (MoSD, 2014; Lesotho Ministry of Health, 2012; Lesotho Ministry of Health, 2016).

The Government of Lesotho (GoL) has set goals to improve the health of the nation. The Lesotho Vision 2020 document states that, “by the year 2020 Lesotho shall be a stable democracy, a united and prosperous nation at peace with itself and its neighbours. It shall have a healthy and well-developed human resource base. Its economy will be strong, its environment well managed and its technology well established” (GoL, 2012). The National Strategic Development Plan (NSDP) 2012/2013-2016/2017 has emphasised the importance of the Vision 2020 document (GoL, 2012) and the Millennium Development Goals (MDG), now

Sustainable Development Goals (SDG), of which Lesotho is a signatory. SDG Goal 1 states 'End poverty in all its forms everywhere' (UNSDG, 2015). Despite these goals, the latest Human Development Index showed that Lesotho is among the 49 poorest countries in the world and is ranked 161 out of 188 (Human Development Index, 2016).

Dependency ratio is defined as the number of economically active persons that are available to support the non-economically active, the very young and the elderly. In Lesotho, the dependency ratio is 72:100 (i.e. to every 100 working persons aged 15-59 years, there are 72 people aged <15 and 60+ years that are dependent on them) (BoS, 2016). As part of a strategy to address poverty and chronic food insecurity in Lesotho, the GoL introduced a non-contributory pension scheme for the elderly 70 years and older in 2004 (GoL, 2010). Although the elderly in Lesotho are benefiting from this pension fund, they spend most of the money on their grandchildren and have little or nothing left for themselves (Croome, 2015). As a result, many elderly people engage in economic activities to improve their livelihood in addition to receiving the pension. According to the 2014 Lesotho Demographic and Health Survey (LDHS) analytical report (Lesotho Ministry of Health, 2016), 78.9% of the population between 60 and 80 years were still involved in active economic activities. The elderly are compelled to continue working, most probably because they often have to take care of orphans and/or adult children who have AIDS and can no longer work. The elderly are also faced with the financial cost of illness and death of their children.

### 1.2 Aging, frailty and nutrition

Aging is often considered to be characterised by illness and frailty. In reality, however, this opinion is considered to be a stereotype, since the elderly are a very heterogeneous group, including those that are fit and healthy on the one hand and those that are frail and ill on the other (Beaudart et al., 2017; Wolfe, 2015). Some elderly become frail and vulnerable at a much earlier age, while others experience a delayed onset in their 90s, because frailty does not necessarily occur with sequential age (Beaudart et al., 2017; Bergman et al., 2007).

Usually the attributes of aging are difficult to distinguish from frailty because aging is associated with accumulated multiple impairments in the physiological system that are likely

to lead to vulnerability (Wolfe, 2015; Izaks and Westenorp, 2003). Research carried out on 138 centenarians in the Sardinia Study of Extreme Longevity revealed that almost all of them had some functional deficits (Lipsi et al., 2015; Deiana et al., 1999).

There have been varying opinions about frailty and aging. According to Clegg et al., (2013), frailty is a clinical state characterised by an increased risk of becoming dependent on others when exposed to a stressor. On the one hand, researchers such as Fried et al., (2001) have focused on the physical components of frailty such as unintentional weight loss, muscle weakness (sarcopenia), slow walking speed, low physical activity and fatigue, while other researchers such as Rockwood et al., (2005) are of the view that a measure of frailty that incorporates a diverse range of deficits including functional limitations, morbidity, disability, psychosocial status and cognitive ability is a better predictor of autonomy, institutionalisation and mortality (Rockwood et al., 2005). Some or all manifestations of frailty are caused by underlying factors, separate from aging but most likely to develop and progress with aging (Cruz-Jentoft et al., 2017).

Malnutrition is an important component of the frailty syndrome (Lorenzo-Lopez et al., 2017; Cruz-Jentoft et al., 2017; Combs et al., 2013). Inadequate dietary intake and a diet of poor quality are closely related to the incidence of frailty. Nutrient deficiencies (energy, protein and micronutrients) result in declining muscle strength and disability and this in turn increases the risk of poor nutrition (Cruz-Jeloft et al., 2017; Yannakoulia et al., 2017), resulting in a vicious cycle which may 'trigger and or sustain the cascade of other processes that lead to frailty' (Fried et al., 2001).

The important role of nutrition in frailty has been outlined in a number of studies, most of which have been undertaken in developed countries, such as Germany (Bollwein et al., 2013a; Bollwein et al., 2013b; Kaiser et al., 2009; Smoliner et al., 2008); Italy (Rabassa et al., 2015); France (Rahi et al., 2016); Sweden (Johansson, et al., 2009; Saletti et al., 2005); Spain (Jürschik et al., 2014); Switzerland (Gulgoz et al., 2002); Taiwan (Chang, 2017); China (Chan et al., 2015); Japan (Kobayashi et al., 2013) and the United States (Shikany et al., 2014; Matteini et al., 2008; Bales and Buhr, 2009).

In contrast to the developed world, limited research has been undertaken amongst the frail elderly in the developing world (Nguyen et al., 2015; Charlton and Rose, 2001). Important differences between developed and developing countries, such as those related to food security and socio-economic status, make the situation of the elderly in developing countries even more dire. According to Lee et al. (2014), however, appropriate interventions have the potential to prevent, postpone or even reverse frailty.

### 1.3 Problem statement

Adequate nutrition, physical activity, healthy aging and the ability to function independently are essential components of good quality of life (Wolfe, 2015; Ismail and Pieterse, 2003). Most of the elderly in developing countries reach their senior years after a lifetime of poverty and deficiency, poor access to health care services and an inadequate diet (Nguyen et al., 2015; Charlton and Rose, 2001).

There is an urgent need to undertake research in Africa where the elderly have unique circumstances and challenges. In Sub-Saharan Africa, and particularly in Lesotho, the situation is very different from other developing countries and it is not possible to draw conclusions from published studies conducted in other countries. The critical role played by the elderly in family welfare and income necessitates a greater focus on their welfare. In view of this, there is a need to assess the prevalence of frailty, malnutrition and associated factors in this group. Such a baseline is required to provide information to plan, implement and evaluate relevant interventions related to nutrition and physical activity with the aim of improving the health and quality of life of the elderly in Lesotho.

### 1.4 Aim and Objectives

The main aim of the study was to determine the impact of a nutrition and physical activity intervention on indicators of frailty and malnutrition in the elderly in Lesotho.

The study had the following specific objectives:

- To compile a baseline of the level of frailty and associated factors (socio-demographic factors, reported health, dietary diversity and physical activity) in the elderly in Maseru, Lesotho;
- To compile a baseline of nutritional status and associated factors (socio-demographic factors) in the elderly in Maseru, Lesotho; and
- To determine the impact of a nutrition and physical activity intervention on nutritional status and frailty in the elderly in Lesotho.

In order to achieve these specific objectives, the research project was divided into two phases:

***Phase 1 - Baseline***

A baseline study was conducted to determine the following in the elderly:

- Socio-demographic status
- Reported health
- Nutritional status
    - Anthropometric assessment
    - Global evaluation (lifestyle, medication and mobility)
    - Dietetic assessment (food and fluid intake)
    - Subjective assessment (self-perception of health and nutrition)
- Dietary diversity
- Physical activity
- Degree of frailty

***Phase 2 - Intervention***

The intervention phase involved implementing and evaluating a nutrition and physical activity intervention (food supplementation and physical activity) in two experimental and one control area.

## 1.5 Structure of the thesis

This thesis is presented in article format and divided into seven chapters. Chapter 1 provides the background and motivation for the study including aims and objectives. Chapter 2 gives an overview of relevant literature related to nutritional status and frailty in the elderly.

Chapter 3 describes the methodology used in the study, while chapter 4 reviews levels of frailty and related factors in Lesotho. Chapter 5 describes nutritional status and related factors in the elderly in Lesotho. The impact of the nutrition and physical activity intervention on indicators of nutritional status and frailty is included in Chapter 6. Finally, Chapter 7 summarises the main research findings and provides recommendations for future studies and interventions based on the findings of this study.

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# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

This chapter provides a review on ageing, frailty and malnutrition of the elderly and elaborates on factors that may influence these variables (physiological, psychological and socio-demographic). Finally, the impact of nutrition and physical activity interventions on malnutrition and frailty are reviewed.

## 2.2 Theories of aging and frailty

Aging is an endless process of life that begins from conception and progresses throughout the life cycle until death. During this life phenomenon, the functional capacity of the biological systems (e.g. muscular strength, cardiovascular performance, respiratory capacity, etc.) increase during the first years of life, reaches its peak in early adulthood and naturally declines thereafter (Martin et al., 2015). The rate of decline is mainly determined by external factors throughout the life course. For instance, the natural decline in cardiac or respiratory function can be accelerated by factors such as smoking, snuffing and air pollution, leaving an individual with lower functional capacity than would normally be expected at a particular age (Wellman and Kamp, 2017).

As people age, the whole body is affected, with each organ independently losing function. Each person ages at a different rate, and uniquely. The process that controls the rate at which people age, and how this senescence affects development of chronic disease is poorly understood (Martin et al., 2015; Childs et al., 2015). Although the degenerative changes associated with aging are not well understood, a number of theories have been proposed to account for the deterioration, at least in part. According to Wellman and Kamp (2017), these theories can be grouped into two classes namely, programmed redetermination (inherent mechanisms partly influenced by genetics, race and gender) and accumulated damages (occurring as a result of systemic deterioration).

The elderly is a heterogeneous group with diverse living conditions and lifestyles, including healthy and fit older persons to frail and ill persons (Wolfe, 2015). In the midst of comorbidities and disability, some people may go through rapid progressive physiologic decline and dysregulation and develop physical functional limitations that rapidly lead to vulnerability, while others may experience slower progression and dysregulation and remain independent (Lorenzo-Lopez et al., 2017; Gill et al., 2006; Walston et al., 2006).

The frailty trajectory (path) depicted in figure 2.1 outlines the path along which aging occurs. As one ages, the changes in biological functions, hormonal imbalances and physiological function decline, thereby increasing vulnerability along one side of the age continuum, while on the other side physical function and independence decreases (Lekan, 2009). This continuum is not linear and includes transitions between the various levels. In the elderly, the active interactions which occur between the physiologic and physical functions that occur along the age continuum unfold and manifest in different patterns (National Academies of Sciences, 2016: Gill et al., 2006). Frailty is thus a continuous process that occurs along the age continuum which interacts with age associated physiologic changes, chronic and acute illness and physical function (Wellman and Kamp, 2017).

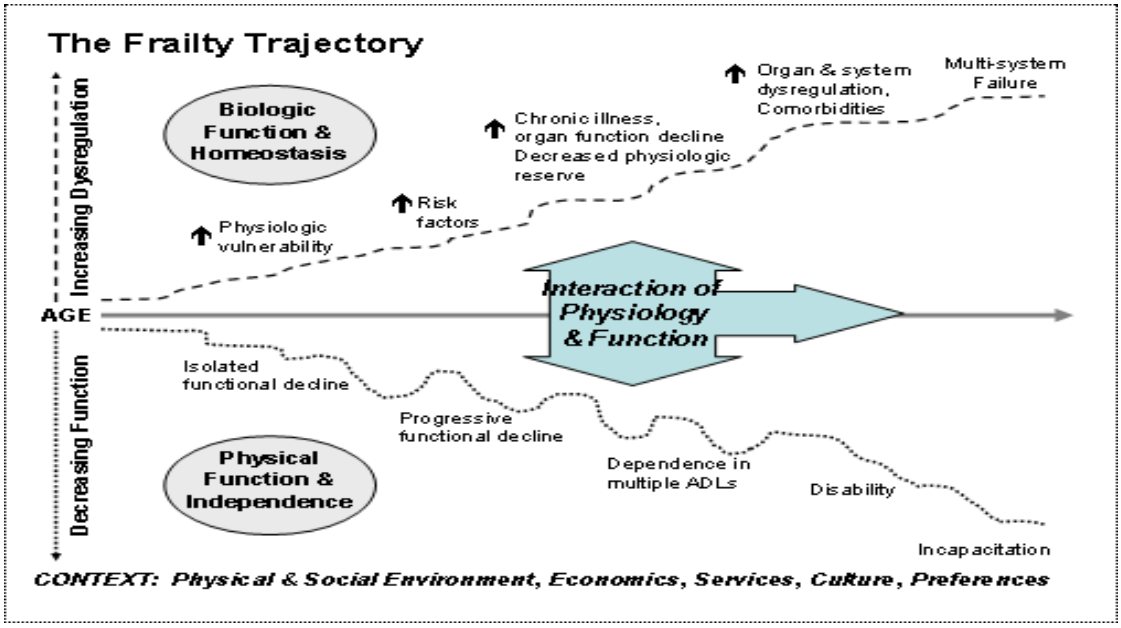


**Figure 2.1: The Frailty Trajectory (Lekan, 2009)**

## 2.3 Defining and measuring frailty and malnutrition

### 2.3.1 Frailty

According to Stedman's Medical Dictionary (2000), a medical syndrome is the "aggregate of symptoms and signs associated with any morbid process and constituting together the picture of disease". However, in the elderly, "syndrome" has been commonly used to indicate the "accumulated effect of impairment in multiple domains" that together, result in particular adverse outcomes such as falls and incontinence (Cruz-Jentoft et al., 2017; Bergman et al., 2007; Rockwood et al*.,* 2006).

The term "frailty" is a common terminology used by people who care for the elderly and it is often referred to as "geriatric syndrome" (Wellman and Kamp, 2017). Interestingly, geriatricians have failed to come to a consensus on the exact definition for frailty. The biological basis of frailty has been difficult to establish owing to the lack of a standard definition, its complexity and its frequent co-existence with illness (Negm et al., 2017; Walston et al., 2006).

The concepts of ageing and frailty are thus evolving. According to Clegg et al., (2013), frailty is a clinical state characterised by an increased risk of becoming dependent on others when exposed to a stressor. On the one hand researchers such as Fried et al., (2001, 2005) have focused on the physical components of frailty such as unintentional weight loss, muscle weakness (sarcopenia), slow walking speed, low physical activity and fatigue, while other researchers such as Rockwood (2005) are of the view that a measure of frailty that incorporates a diverse range of deficits including functional limitations, morbidity, disability, psychosocial status and cognitive ability is a better predictor of autonomy, institutionalisation and mortality (Rockwood et al., 2005). Some or all manifestations of frailty are caused by underlying factors, separate from aging but most likely to develop and progress with aging (Cruz-Jentoft et al., 2017).

According to Inouye et al., (2007), frailty develops as a result of a number of factors that may include psychological factors such as delirium, dementia and depression, and physical factors such as incontinence, falls, osteoporosis, pressure ulcers and functional decline, which

increase the risk of developing disability, immobility, institutionalisation and death (figure 2.2).

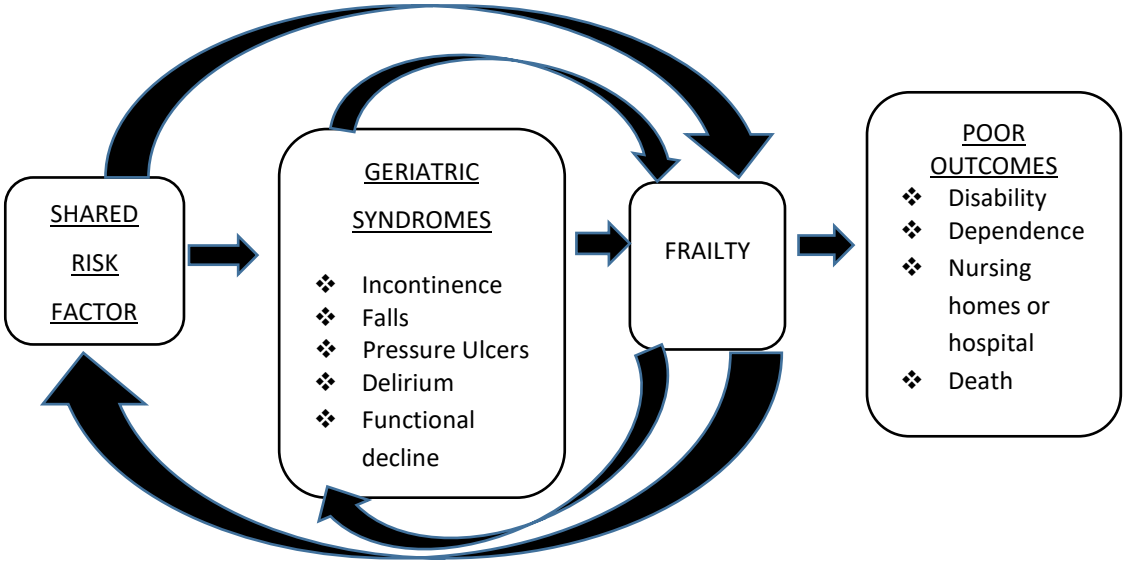


**Figure 2.2 Geriatric Syndrome (Inouye et al., 2007)**

A number of researchers have developed classification and scoring systems to measure frailty in the elderly living in the community and these are discussed in the following section.

Fried et al., (2001), characterised "The Frailty Phenotype" according to data from the Cardiovascular Health Study (CHS) carried out in the United States of America. According to these authors, frailty includes the presence of three or more of the following: self-reported exhaustion (poor energy or endurance), unintentional weight loss, weakness (hand grip strength in the lowest quartile), slow walking speed (in the lowest quintile), and low physical activity (Physical Activity Scale for the Elderly (PASE) in the lowest quintile). Based on the CHS data, Abellan et al., (2008) developed the FRAIL scale that is similar to the Fried CHS scale in that it also consists of five criteria and is scored the same. The criteria included in FRAIL include fatigue, resistance (inability to climb one flight of stairs), ambulation (inability to walk one block), illness (more than 5 illnesses), and loss of more than 5% weight. For both tools, a score of 1 is assigned to each variable and scored as robust (0); pre-frail (1-2); and frail (3 or more) (Woo et al., 2012).

Enstrud et al., (2009) have proposed a definition of frailty based on the Osteoporotic Fractures (SOF) index. They included weight loss, inability to rise from a chair and low levels of energy intake in their classification system. These authors further compared the Fried CHS and SOF indexes and observed that the validity of the easier to perform SOF index was found to be good, with the SOF index predicting falls, disability, fracture and mortality in men as well as the more complicated CHS index. Using this tool, frailty status is categorised as robust, intermediate or frail. Gobben et al., (2012), have defined frailty as "a dynamic state affecting an individual who experiences losses in one or more domains of human functioning i.e. physical, psychological and social," using the Tilburg Frailty Indicator (TFI). According to these authors, frailty is caused by a range of variables which increases the risk of adverse outcome. The variables are grouped into physical frailty which is composed of eight components including unexplained weight loss, poor physical health, difficulty walking, poor balance, vision problems, hearing problems, poor handgrip, and physical tiredness. Psychological frailty includes four components including poor cognition, depressive symptoms, anxiety, and problems coping. Lastly social frailty includes three components, included living alone, poor social relations, and lack of social support.

In an older study by Lambert et al., (1997), frailty was characterised by generalised weakness, impaired mobility and balance and poor endurance. These authors further stated that loss of muscle strength is an important factor in the development of frailty, and the limiting factor for an individual's chances of living an independent life until death.

The WHO have developed a universal definition for frailty using an International Classification of Frailty (ICF) tool. This tool provides information other than the medical diagnosis relevant to health planning (WHO, 2002). This definition has been applied by Fairhill et al., (2011) who has developed figure 2.3 to show the interconnection between frailty and the components of the ICF.

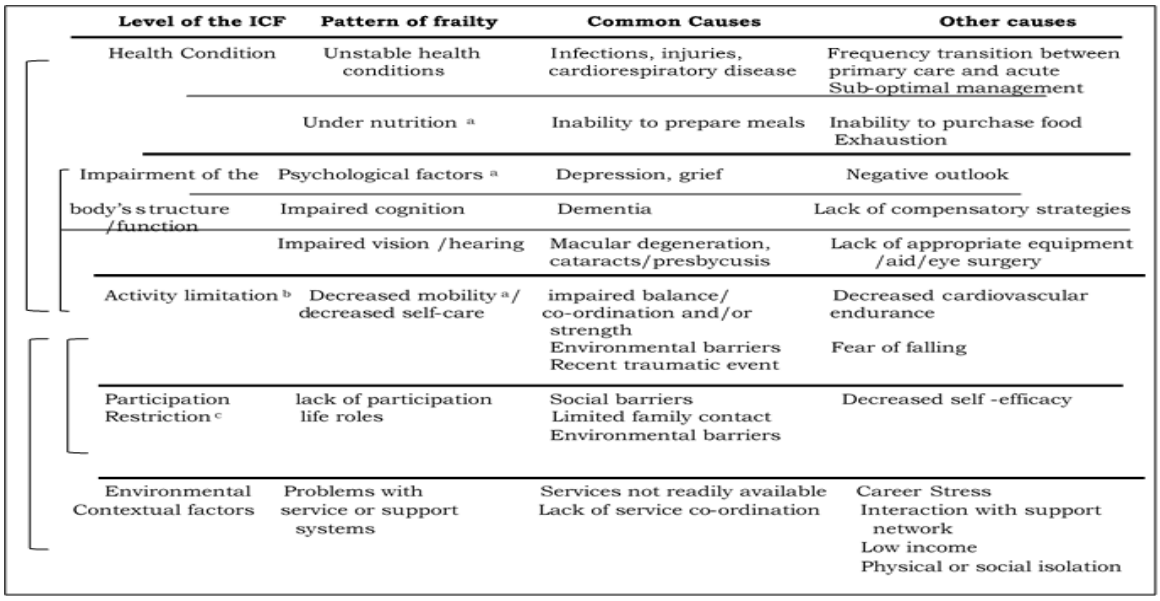


**Figure 2.3 Important factors used to assess frail patients and the interaction between them (Fairhill et al., 2011)**

***a*** *captured in the frailty phenotype*

***b*** *defined as difficulty experienced by the individual when executing activities (international classification of functions, ICF).*

***c*** *defined as problems experienced by an individual in their involvement in life situation (ICF).*

According to the ICF, disability and functioning are outcomes of interactions between health conditions (diseases, disorders and injuries) and contextual factors (WHO, 2002). All positive components of health are termed "functioning" while all negative components are considered "disability". Disability refers to "the inability to fulfil customary and desired roles due to functional impairments in the ability to perform activities of daily living and/or instrumental activities of daily living". Basic activities of daily living include dressing, eating, ambulating, toileting and hygiene, while advanced activities of daily living include shopping, housework, accounting, food preparation, and transportation (WHO, 2002; Sien and Jung, 2008).

The Canadian Study for Health and Aging Clinical Frailty Scale (CSHA-CSF) also proposed a definition of frailty which doesn't need sophisticated clinical measurements (Rockwood et al., 2005). This scale classified persons as very fit (robust, active, energetic and highly motivated); well without active disease (less fit; well with treated comorbid disease; apparently vulnerable, not dependent, but beginning to slow down); mildly frail (dependent on others for Instrumental Activity of Daily Living (IADLs)); moderately frail (help is needed with IADLS); and severely frail (completely dependent or terminally ill). Based on this, Rockwood and colleagues developed an easy to use frailty scale which has the ability to predict morbidity or need for institutional care, and correlated the results with those obtained from other established tools (Rockwood et al., 2005).

Based on the ability to walk without assistance, perform activities of daily living, presence of incontinence and cognitive decline, this scale classifies individuals as fit, pre-frail and frail. The Vulnerable Elders Survey (VES-13) tool was specifically developed to identify community-dwelling vulnerable elderly at risk for functional decline. This tool includes questions about age, self-rated health, physical fitness and the need for assistance with activities. It consists of 13 questions and has a maximum score of 10 points, with a cut-off value of ≥3 indicating frailty (Saliba et al., 2001).

The Groningen Frailty Indicator (GFI) consists of fifteen items and focuses on the loss of function and resources in four domains: physical (nine items); cognitive (one item); social (three items); and psychological (two items). A cut-off value of ≥4 is used to indicate frailty (Peters et al., 2012).

Bouillon et al., (2013) summarised the measures of frailty used in population-based studies, as well as the validity and reliability of each measure. When reporting on the reliability and validity of various frailty measures, the Frailty Scale developed by Rockwood showed acceptable reliability and excellent validity. In terms of frequency of use, the instruments created by Fried (2001) and Rockwood (2005) were the only two that had been assessed against adverse health outcomes, thus increasing their external validity. The key difference between the "Frailty Phenotype" developed by Fried and the "Frailty scale" developed by Rockwood is that the phenotype model of frailty considers frailty as a set of observable traits

related to the effects of ageing on multiple systems in the body, while the frailty scale considers frailty in terms of an accumulation of deficits related to ageing.

### 2.3.2 Malnutrition

Good nutrition is paramount to successful aging and ensuring that the body is adequately nourished is essential to achieving this goal. On the contrary, failure to consume a well-balanced diet over time results in malnutrition, ill health and mortality (Chang, 2017; Chang and Lin, 2016; Manal et al., 2015; Guigoz et al., 2002). As previously mentioned, frailty is significantly associated with malnutrition (Chang et al., 2017; Cruz-Jentoft et al*.,* 2014; Coker et al., 2012; Cereda et al., 2008; Combs et al*.,* 2013; Pepersack, 2009).

Assessment of nutritional status in the elderly considers subjective and objective factors. It includes alterations in functional status which may occur as a result of disease and aging as well as perception of health and well-being (Guigoz et al., 2017; Bollwein et al., 2013). The importance of nutritional assessment in the elderly includes identifying patients with malnutrition in need of nutrition intervention, establishing baseline values for evaluating the efficacy of nutrition interventions and to provide system for early detection of the health risk due to nutritional factors (Ahmed and Haboubi, 2010).

Nutritional status in a broad sense thus relates to a multidimensional approach which includes assessment of the physical, psychological and social aspects of food and eating (Leslie and Hankey, 2015; Ahmed and Haboubi, 2010). Components of a nutritional assessment most often include socio-demographic factors, anthropometry, diet and lifestyle factors (such as levels of physical activity, alcohol consumption and smoking) (Wellman and Kamp, 2017).

The Mini Nutritional Assessment (MNA) is an 18-item questionnaire used as a screening tool to reveal the risk of malnutrition and other life-style characteristics associated with nutritional risk in community-dwelling elderly persons (Guigoz et al*.,* 2002). It was developed by the study group of Vellas and Guigoz in 1989 and has become a well-known nutritional assessment tool for the elderly, with proven validity (Chang, 2017; Chang and Lin, 2016; Woo et al., 2015; Bollwein et al., 2013; Morley, 2011). The MNA comprises of anthropometric measurements

combined with a questionnaire regarding dietary intake, a global assessment, and a self-assessment.

The global evaluation includes questions related to living conditions; prescription drug use; presence of psychological stress/acute disease; mobility; neuropsychological problems; as well as, presence of pressure sores/skin ulcers. The subjective assessment includes questions related to the elderly's self-view of nutritional status and how they would consider their health status in comparison to other people of the same age. Anthropometric assessment relevant to the elderly population includes weight and height to determine body mass index (BMI), mid-upper arm circumference (MUAC) and calf circumference (CC). Dietary assessment includes questions related to how many full meals are consumed daily; daily servings of dairy; weekly servings of beans/eggs; daily number of servings of meat, fish or poultry; daily servings of fruits or vegetables; food intake decline over the past three months due to a loss of appetite, digestive problems, chewing or swallowing difficulties; number of cups of fluid consumed daily; and, the need for feeding assistance (Guigoz et al., 2002).

According to Fried et al*.,* (2001), inadequate dietary intake is likely to be a major component of frailty. Consuming a more diverse diet is thus an important strategy to improve nutritional status and health. Studies have shown that diverse diets are associated with lower rates of both undernutrition on the one hand and overweight and obesity on the other (Cruz-Jentoft et al., 2017). Poor dietary diversity and quality have been shown to result in nutritional deficiencies (Lorenzo-Lopez et al., 2017). Individual Dietary Diversity (IDD) is a qualitative tool designed by Food and Drug Organisation (FAO) which serves as a measure of food consumption that depicts an individual's access to a range of food (Kennedy et al., 2011; Arimond et al*.,* 2010; Foote et al*.,* 2004). It serves as a proxy for nutrient adequacy in the diet of the individual or the household. DDS can also be used to assess changes in diet before and after an intervention or after a disaster such as crop failure. It includes a 24-hour recall of food eaten by the individual based on food groups and it reflects economic capacity to access a variety of foods (Kennedy et al*.,* 2011).

Assessment of lifestyle factors such as physical activity is another important component of nutritional status and malnutrition (Wellman and Kamp, 2017). A number of self-report

questionnaires have been used to quantify the amount of daily physical activity of older adults (Logan et al., 2013). The Physical Activity Scale for the Elderly (PASE) is a validated tool used for assessing the fitness level of the elderly who are 65 years and above. PASE was developed by Washburn et al., (1993) in the early 90s to provide a tool for age specific physical activity. It makes use of a seven day recall of leisure activity, light activity, strenuous activity, house chores, caring for others, and voluntary work. It also incorporates the issue of falls and fracture risk as well as balance and gait characteristics, bone density and cardiovascular disease in the elderly (Washburn, 1993). The PASE is a useful and inexpensive tool to use in determining physical activity of the elderly in the community setting (Logan et al., 2013). Previous research has validated the use of the PASE score by comparing the questionnaire to both indirect and direct measures of physical activity (Chad et al., 2005; Dinger et al., 2004; Washburn et al., 1999; Schuit et al., 1997). The PASE has been identified to correlate with health and physiologic measures. It was also found to correlate positively with hand grip strength, walking steps, energy expenditure, reported health status (Washburn et al., 1993: Hagiwara et al., 2008) and waist circumference (Logan et al., 2013).

## 2.4 Factors that affect aging, frailty and nutritional status in the elderly

As previously mentioned, factors that affect the aging process include physiological, psychological, and socio-demographic, socio-economic and socio-cultural factors.

### 2.4.1 Physiological factors

As previously mentioned, it is difficult to determine which of the changes that occur with aging are inevitable consequences of the aging process and which are the effects of a disease state. Whether caused by disease or irreversible loss of cells and cell function, the changes that occur in organs and organ systems can affect nutritional status by altering the appetite for food, digestion and absorption, nutritional requirements, and the ability to obtain food (Wellman and Kamp, 2017; Rolfes et al., 2012).

#### 2.4.1.1 Body composition and sarcopenia

Aging is associated with significant changes in body composition, a reduction in lean body mass and an increase in body fat. The average body fat percentage in males increases from about 15% when young to 25% at the age of 65 years and above (Hunter et al., 2010; WHO, 2000). In women, it increases from about 18% to 23% when young to 32% at the age of 60 years. Regular exercise can help maintain muscle mass, bone strength and cardio-respiratory function (Cartee et al., 2016).

Sarcopenia is defined as the age-related loss of skeletal muscle mass and strength which results in reduced muscle strength (Cruz-Jentoft et al., 2014; Bautmans et al., 2009). Sarcopenia contributes to changes in gait and balance, loss of physical function and increased risk of chronic diseases. This condition is associated with lower functional independence and disability (Beaudart et al., 2017; Walston, 2012), that significantly impacts on the ability to perform activities of daily living such as dressing, toileting, getting in and out of bed or chair without assistance, maintaining continence, and eating, (Mlinac and Feng, 2016; Candow et al., 2012) and consequently results in reduced quality of life (Candow et al., 2012; Cruz-Jentoft et al., 2010).

The clinical process involved in the development of sarcopenia originates from abnormal muscle mass or quality that progresses to muscle weakness, resulting in reduced physical function and disability (Mijnarends et al., 2015; Sugar et al., 2014; Combs et al., 2013). The condition is accelerated by aging, disease, inactivity and malnutrition (Yoo et al., 2018; Cruz-Jentoft et al., 2014; Coker et al., 2012; Bautmans et al., 2009; Boirie, 2009). The decrease in metabolically active skeletal muscle and increase in fat mass are associated with lower levels of fitness, reductions in metabolic rate and increased risk and prevalence of type 2 diabetes mellitus (Tang and Phillips, 2009) as well as an increased risk of falling and hip fractures (Yoo et al., 2018; Bonjour et al., 2013) and even cognitive decline (Nishiguchi et al., 2015). The mechanisms that are involved include lower production of anabolic hormones, reduction in insulin and growth hormone sensitivity, oxidative stress (Boirie, 2009) and inflammation (Yoo et al., 2018; Boirie, 2009; Bautmans et al., 2009).

According to Cruz-Jentoft et al. (2014), prevalence of sarcopenia ranges between 1–29% in people that live in the community and 14–33% in those that live in long-term care facilities. Although information about the nutritional status of elderly persons in developing countries is largely lacking, estimates indicate that about a third of South African elderly are underweight (Charlton and Rose, 2001), while more than half of older South Africans are overweight or obese (Kimokoti and Hamer, 2008). In the elderly, overweight is often characterised by loss of lean muscle mass and micronutrient malnutrition, a condition termed sarcopenic obesity (Cruz-Jentoft et al., 2017; Coker et al., 2012).

#### 2.4.1.2 Sensory losses

The senses of taste, smell, sight, hearing and touch diminish at individual rates (Schiffman, 2009). Reduced senses of taste (dysgeusia) and smell (hyposmia) are common in the elderly and may result from a variety of factors, including, certain diseases such as Alzheimer's disease; medications, surgical interventions, radiation therapy, and environmental exposure (Jayant et al., 2014). Taste and smell dysfunction tend to begin at around 60 years of age and become more severe in persons older than 70 years of age. A reduced ability to detect odours and identify foods may occur. The decline of these senses can contribute to impaired nutritional status by decreasing the appeal and enjoyment of food (Benelam, 2009; Chernoff, 2006). Some studies suggest that the decline in taste acuity is due to a reduction in the number of taste buds on the tongue; others suggest that it is the result of changes in sensitivity to specific flavours such as salty and sweet. Loss of taste and smell may not only reduce the pleasure and comfort associated with food, but may also pose a risk for food poisoning or for overexposure to environmentally hazardous chemicals that would otherwise be detectable by taste and smell (Sugar et al.,2014). Taste and smell stimulation induces metabolic changes, such as salivary, gastric acid and pancreatic secretions as well as increases in plasma levels of insulin. Decreased sensory stimulation may thus impair these metabolic processes (Wellman and Kamp, 2017).

Hearing loss, impaired vision, and loss of functional status may lead to diminished food intake as a result of decreased appetite, food recognition and self-feeding ability and consequently

reduced quality of life (Seiberling and Conley, 2004). As vision declines, shopping and the preparation of food become more difficult (Whitney and Rolfes, 2008).

As macular degeneration and cataracts increase, visual acuity declines. Since oxidative damage is associated with both macular degeneration and cataracts, a diet high in foods containing antioxidant nutrients might slow or prevent these conditions (Aslam et al., 2014; Whitney and Rolfes, 2008).

#### 2.4.1.3 Oral health

The elderly often experience dry mouth caused by hyposalivation (xerostomia) that is a common problem among the elderly. Elderly persons with xerostomia have been shown to have difficulty in chewing and swallowing, and as a result, they tend to avoid certain foods, particularly crunchy, dry and sticky foods (Lorenzo-Lopez; 2017; Martin et al., 2006). Untreated dental carries and periodontitis are major causes of tooth loss in the elderly, leading to dependence on dentures. Xerostomia may be due to a decrease in secretion of saliva in the mouth. Saliva mixes with food to allow it to be tasted and to provide lubrication for easy swallowing. A decrease in saliva causes dryness that decreases the taste of food and make swallowing difficult (Bollwein et al., 2013; Welman and Kamp, 2017). Saliva is also an important defence against tooth decay because it helps wash materials away from the teeth and contains substances that kill bacteria. Thus a dry mouth increases the likelihood of tooth decay and periodontal disease. Loss of teeth and improperly fitting dentures also limit food choices and can contribute to poor nutrition in the elderly (Martin et al., 2006).

#### 2.4.1.4 Gastrointestinal function

A number of changes affecting nutrient intake, digestion and absorption occur in the gastrointestinal system during the aging process. During aging, the walls of the bowel tend to lose elasticity and this also affects the ability of the GIT to secrete hormones. Lactase decline interferes with digestion and absorption of the lactose in dairy products, and is frequently a characteristic of aging. This can increase the risk for developing osteoporosis (Weaver et al., 2013).

Another gastrointestinal change that may occur with aging is the frequent development of atrophic gastritis and the inability to secrete gastric acid (Wellman and Kamp, 2017). Gastric hypochlorhydria can cause malabsorption due to small bowel bacterial overgrowth and diminished absorption of nutrients, such as vitamin B12, which can result in pernicious anaemia (Allen, 2009). Aging, furthermore, alters the metabolism of calcium and vitamin D in several ways that can contribute to accelerated bone loss and development of senile osteoporosis (Thandrayen and Pettifor, 2018).

Furthermore, reduced stomach acid secretion in the elderly may further allow microbial overgrowth in the stomach and small intestine. The increased populations of microbes in the gut further reduce $B_{12}$ absorption by competing for available vitamin $B_{12}$ (Naylor and Axon, 2003).

Constipation is one of the most common digestive complaints in the elderly (Wellman and Kamp, 2017). It is often as a result of prolonged rectosigmoid transit, which can be caused by deficient fluid intake, inadequate dietary fibre intake and a sedentary life-style. Constipation can be reduced by increasing intake of dietary fibre and fluid as well as by physical activity (WHO, 2000).

#### 2.4.1.5 Metabolic function

Menopause and lower levels of physical activity result in an increase in abdominal fat, which increases the risk of metabolic abnormalities and the resultant non-communicable diseases (Ward, 2018). The decrease in glucose tolerance with the aging process leads to increases in plasma glucose levels. Treatment of glucose intolerance in the elderly usually involves dietary modifications, exercise and oral pharmacology agents. Good glucose control reduces the incidence and severity of complications from diabetes (Perlmuter, et al*.,* 2008; WHO, 2000; Ward, 2018).

Serum cholesterol levels in men tend to peak at 60 years of age but total cholesterol levels as well as the low-density lipoprotein (LDL) fraction, continue to rise in women until the age of 70 years. Waist–to-hip ratio, alcohol intake, smoking and fasting plasma glucose and plasma

insulin levels are significant predictors of serum triglyceride levels in postmenopausal women (WHO, 2000).

#### 2.4.1.6 Cardiovascular function

The risk factors that influence the occurrence of cardiovascular disease in the elderly are similar to those for people who are middle aged. During the aging process, blood vessels become less elastic and total peripheral resistance increases, leading to increased risk and prevalence of hypertension. There is also an increased likelihood of deposition of fatty streaks in the blood vessels that can result in atherosclerosis (Wellman and Kamp, 2017). Blood pressure continues to increase in women older than 80 years of age, but declines substantially in older men. Correction of hypertension and hyperlipidaemia has been shown to reduce cardiovascular morbidity and mortality in the elderly (WHO, 2000).

#### 2.4.1.7 Renal function

Renal function and glomerular filtration rates can diminish as much as 60% between the ages of 30 years and 80 years, primarily due to chronic conditions, reduction in the number of nephrons, and reduced blood flow (Wellman and Kamp, 2017). This makes the elderly person less able to respond to changes in fluid status and may affect acid base balance. Excessive amounts of protein waste products and electrolytes may become increasingly difficult to metabolise (WHO, 2000; Saxon et al., 2010).

#### 2.4.1.8 Neurological function

Changes in the nervous system and brain are common during aging (Wellman and Kamp, 2017). The elderly are very likely to develop reduced cognitive ability, steadiness, coordination, gait and sensations. The brain loses 5-10% of its weight between ages of 20-90 years (Galvin and Sadowsky, 2012). The decline in function of the brain cells as they grow older may result in reduced ability to speak and be understood, cognitive decline and short-term memory loss. Sometimes this decline also affects the ability to react and perform certain tasks, such as eating, chewing and swallowing, thus increasing the risk for malnutrition (Lopez da Silva et al., 2012).

Because aging is closely related to disease conditions and deterioration, it becomes difficult to distinguish the reduction in brain function from common conditions associated with aging (Galwin and Sadowsky, 2012). Disorders that can affect brain function include depression, stroke, an underactive thyroid gland (hypothyroidism), and degenerative brain disorders such as Alzheimer disease. Uncontrolled high blood pressure, hyperglycemia, hypercholesterolemia and prolonged smoking can also lead to impaired brain function and dementia (WHO, 2000; Wellman and Kamp, 2017).

#### 2.4.1.9 Immuno-competence

The ability of the Immune system to fight disease declines with age. Both humoral and cell–mediated immunity are affected. These changes result in diminished ability to fight infections, leading to increased prevalence of infection in the elderly (WHO, 2000). Some of the decrease in immune function may be due to nutritional deficiencies. On the other hand, the increase in infections and chronic disease that occur can affect nutritional status. The immune response depends on the ability of cells to differentiate, divide rapidly, and secrete immune factors, so nutrients that are involved in cell differentiation, division, and protein synthesis can influence the immune response. Inflammation and buildup of free radicals results in increased risk of infection (Welmman and Kamp, 2008).

#### 2.4.1.10 Polypharmacy and substance use

As mentioned, the elderly are often diagnosed with conditions such as diabetes, hypertension, cardiovascular disease, cancer etc. that necessitate the use of many medications (Woo et al., 2015). As a result, the elderly can experience polypharmacy (a practice where two or more prescription drugs are taking on a daily basis) (Wellman and Kamp, 2017; Guigoz et al., 2002).

Taking multiple drugs may result in drug-nutrient interactions, or drug-drug interactions, non-adherence, adverse drug effects and complications. These types of interactions may have an effect on nutrients absorption that may lead to nutritional deficiencies. Drug nutrient interactions could results in loss of appetite, nausea, diarrhoea, weight changes, digestive

system complications and malnutrition that in turn affects the overall wellbeing of the elderly. Polypharmacy increases morbidity and mortality in the elderly (Wellman and Kamp, 2017).

Substance use such as smoking, alcohol consumption and snuffing can also affect the overall well-being of the elderly. The exposure to these substances poses a risk to the development of several health related issues as well as reduced quality of life and morbidity. Smoking may cause lung cancer, emphysema, and worsen all chronic health conditions. Snuff may be a good alternative to smoking because it does not contain tar or any toxic gases produced by burning cigarettes that are high in nicotine, the major addictive element. Snuff tobacco contains tobacco-specific nitrosamines that are the most potent carcinogens in tobacco. Snuff increases the risk of developing leukoplakia, receding gums, tooth loss and oral cancer. Alcohol consumption can also be detrimental to health. Elderly females who consume 3-7 drinks a week and males who consume 3-14 are considered to be moderate drinkers, while elderly females are considered heavy drinkers when they consume more than 7 drinks and males when they consume more than 14 drinks a week (Schoenborn and Adams, 2010).

### 2.4.2 Psychological factors

Psychological changes are inevitable components of aging. This life stage is often characterised by failing health, loss of independence, loneliness, bereavement, relocation, an inability to perform daily tasks, feelings of powerlessness and financial concerns. As a result, depression is the most common psychological difficulty in the elderly (Jee and Lee, 2013; Ho et al, 2010).

Depression can result in loss of appetite and of motivation to cook or even to eat frequently, skipping meals and poor eating habits (Wellman and Kamp, 2017). This can also affect digestion, energy levels, weight and wellbeing (Leslie and Hankey, 2015; WHO, 2000). The support and company of family and friends, especially at mealtimes, can help overcome depression and enhance appetite (Sobhani et al*.,* 2010).

In addition to depression, psychological issues increase the levels of stress that are experienced by the elderly. Stress hormones plays a critical role in brain aging, suppression of the immune system and sarcopenia (Hasan et al*.,* 2012; Slominski, 2007).

### 2.4.3 Socio-demographic, socio-economic and socio-cultural factors

Socio demography is a broad terminology that encompasses sociologic (cultural and environmental factors) and demographic (age, sex, place of residence, religion, education marital status) characteristics (Banda, 2003). A variety of social and economic changes often accompany aging. These factors are all interrelated and affect nutritional and health status by decreasing the motivation to eat and the ability to acquire and enjoy food (Wellman and Kamp, 2017).

The highest rates of poverty occur among the oldest, minorities, women, persons living alone, and those with disabilities. In Africa, the poverty rate among the elderly is higher than in developed countries. Many older individuals, regardless of income levels, must live on a fixed income when they retire from their jobs, making it difficult to afford a healthy diet. Poverty impacts on the choice of food, since those with less resources tends to eat whatever they can afford, while those with more resources can choose what they eat and in what environment they would like to eat (Mihic and Culina, 2006). Food is often the most flexible expense in a budget, so limiting the types and amounts of foods consumed may be the only option available for older adults who are trying to make ends meet (WHO, 2000; Helpage 2004).

The HIV/AIDS pandemic and death of a large number of the younger generation has resulted in an increase in the number of elderly headed households (Chikokob and Nabalambaa, 2011). In these elderly headed households, extreme poverty and poor food security is often present. According to UNICEF (2003), more than a half of the orphans in Africa currently live with their grandparents. In most sub-Saharan African countries, very few safety nets are available to meet the needs of the elderly, resulting in neglect and exposure to high risk and vulnerability. Health care systems are very often poor, distances to health care centres are often far, and transport is limited and expensive. Even when health facilities are accessed, services are often inadequate and fragmented.

With respect to sociocultural factors, increased technological advancements and industrialization, have led to more nuclear family units that has resulted in the elderly losing the high social status and societal recognition that they once enjoyed. The elderly used to have more contact with their adult children, caring for children and considered experts on

family matters. As a result they are now isolated, have low self-esteem, lack social support and have less social relations, exacerbating poor quality of life and frailty. Constant interactions with family and friends break the barrier of isolation, loneliness and deprived social relationships (Belanger et al., 2017).

Social integration and support to provide people with emotional and practical resources. The elderly who are more socially integrated - for example those who are members of social clubs or religious groups (churches) organizations, or those involved in family activities – were more likely to have improved quality of health (Sugar et al., 2014).

## 2.5 Physical activity and fitness in the elderly

According to the Global Action Plan on Physical Activity 2018-2030 of the WHO (2018), physical activity is "any bodily movement produced by skeletal muscles that requires energy expenditure – including activities undertaken while working, playing, carrying out household chores, travelling, and engaging in recreational pursuits" (WHO 2018). Exercise is a form of physical activity that is specifically planned, structured and repetitive and includes activities such as weight training or aerobic exercise (NIA, 2013).

### 2.5.1 Benefits of being physically active and fit in the elderly

Physical inactivity is a major contributing factor for disability (ACSM, 2014; Singh et al., 2002; van Heuvelen et al., 2000; Wong et al., 2003). The main aim of physical activity in the frail elderly is thus to increase their functional capacity and independence (Bayles et al., 2009).

Being physically active and fit improves muscular strength and endurance, increases aerobic capacity, enhances joint function and muscle flexibility, improves balance and coordination, Improves psychological wellbeing, assists with weight loss (if needed) and the management of chronic diseases/ disabilities (Dorfman, 2017; Bayles et al., 2009). These benefits of physical activity result in improved ability to do physical work, better sleep, resistance to cold and infectious disease, healthy self-image, low incidence of

anxiety and depression, and improved quality of life in later years (ACSM, 2010; Singh, 2002).

In the elderly, even modest amounts of daily physical activity, such as walking at a normal pace, may increase appetite and increase lean body mass (Thomas and Bishop, 2007). The elderly who are physically active and can manage with a higher level of physical activity such as brisk walking, stair climbing or recreational activities may benefit more (Jadczak et al., 2018).

Physical activity is critical for delaying the metabolic and inflammatory disorders related to aging like sarcopenia and osteoarthritis, resulting in improved mobility and decreased risk of falling (Wolfe, 2015). In terms of metabolic benefits, regular physical activity leads to an increase in High Density Lipoprotein (HDL), a decrease in Low Density Lipoprotein (LDL) , improved insulin sensitivity and better blood glucose control (Forbes et al., 2012; de Labra et al., 2015).

### 2.5.2 Guidelines and recommendations for physical activity in the elderly

It is recommended that the frail elderly be as physically active as possible; consult an appropriate health practitioner before starting or increasing physical activity; start off slowly and build up to the recommended physical activity levels (NPAG, 2012; WHO, 2010).

General guidelines for staying physically active include taking the stairs regularly; walking to run errands instead of driving or using public transport; breaking up sedentary periods lasting longer than 90 minutes with 5 to 10 minutes of standing, moving around or doing some physical activity (NPAG, 2012).

According to the WHO (2010) and National Physical Activity Guidelines (NFAG, 2012), types of physical activity for the frail elderly should include aerobic, resistance, balance and flexibility exercises. Aerobic exercise can include aerobic endurance (or cardiovascular) activities that require continuous and rhythmic movement of the body's major muscles for a sustained period. Aerobic endurance activities (such as walking) are needed for heart and lung health and for weight control, to cross the road safely and for the energy to play with

grandchildren. The NPAG (2012), suggest that, for older adults, a moderate-intensity aerobic activity causes a noticeable increase in breathing and heart rate. For instance, older adults should still be able to talk but do not have enough breath to sing while engaging in brisk walking, low-impact aerobics, gardening or doing housework. For older adults, a vigorous intensity aerobic activity causes heavy breathing and increase in heart rate. For instance, older adults should still be able to say a few words but are not out of breath while engaging in brisk walking up hills, jogging, or step aerobics (NPAG, 2012).

Resistance activities (such as climbing stairs) involve creating resistance to help increase muscle strength and mass, as well as power and endurance. Strong muscles and bones are needed to lift and carry groceries. Strength activities provide additional health benefits. These include strengthening of muscle, bone and joints (e.g. using hand-held weights, resistance bands, carrying groceries and climbing the stairs). Strength activities should involve major muscle groups: legs, hips, back, abdomen, chest, shoulders and arms (NPAG, 2012). Balance activities improve a person's ability to prevent falls caused by self-motion, the environment or other objects. Balance is required to climb stairs, hills or get on and off a taxi. Flexibility activities (such as stretching) improve the range of movement possible at a joint by gently stretching the muscles, tendons and ligaments. Flexibility is required on a daily basis to tie shoelaces, wash hair and hang up washing.

An exercise prescription refers to a specific plan of fitness for a specific purpose. Depending on the specific and unique needs and interest of the participant, the goal should be to apply exercising principles and behavioural techniques that motivate participants to be more active (ACSM, 2014).The ACSM (2014) guidelines on exercise prescription include the following components: **frequency** (how often), **intensity** (how hard), **time** (duration or how long), and **type** (mode or what kind) together with the **volume** (amount) and **progression** (advancement) of exercise.

**Frequency** of exercise refers to the regularity (i.e. the number of days in a week dedicated to an exercise regime) of performing exercise**.** On average 3-5 days/week of moderate and vigorous intensity of cardio respiratory endurance is recommended for adults. Little or no benefit is attained over and above this amount. **Intensity** of exercise refers to the amount of

effort that should be exerted in the exercise training programme. A balance needs to be found between finding enough intensity to improve fitness without over training which may result in injury. According to Swain and Franklin (2002), the minimum threshold of intensity for benefit varies depending on the cardiorespiratory function of the individual, age, health status, habitual physical activity and social and physiological factors. **Time** of exercise (duration) refers to the duration an exercise session. It describes the amount of time that physical activity is performed. It is recommended that most adults accumulate 30-60 min/ day of moderate intensity exercise. **Type** of exercise (mode) refers to the kind of exercise that should be chosen to achieve the appropriate training response. For instance in cardio-respiratory training, the best type of exercise that will improve cardio respiratory function should be continuous in nature (rhythmic) and aerobic mainly involving large muscle groups. **Volume** of exercise (quantity) refers to the volume of exercise is the product of frequency, intensity and time (duration) of exercise. Epidemiological studies and randomised control trials have shown that there is a dose response association between the volume of exercise and health outcomes (i.e. with greater amounts of physical activity, the health /fitness also increases (Church et al., 2007: Garber, et al*.,* 2011; USDHHS, 2013). **Progression** of exercise deals with a steady advancement of greater resistance, and /or more repetitions per set and /or increasing frequency. The muscles have to adapt to a resistance exercise training programme as participants or persons in the program continue to subject these muscles to overload or greater stimuli to increase muscular strength and mass (ACSM, 2014).

## 2.6 Interventions to address frailty

The most common interventions to address frailty, sarcopenia and malnutrition in the elderly include physical activity and nutrition supplementation. A large body of evidence has shown that physical activity has the potential to improve muscle mass and reduce disability in the elderly.

Food and nutrition play important roles in supporting health and preventing disease (Combs et al., 2013). The amino acids that are provided by protein are necessary for growth and maintenance of muscle mass (Gryson et al., 2013; Boirie, 2009; Millward 2008). Essential amino acids are especially important in stimulating muscle protein synthesis (Candow et al.,

2012; Gryson et al., 2013) with leucine playing a pivotal role (Casperson et al., 2012; Fujita et al., 2007), due to its ability to increase rate of protein synthesis and stimulate insulin secretion (Bonjour et al., 2013).

The term “anabolic resistance” refers to the age-related decrease in the ability of essential amino acids to enhance skeletal protein synthesis (Burd et al. 2012; Coker et al., 2012). The result of anabolic resistance to dietary proteins may lead to a decrease in muscle mass and physical function, which is worsened by an inadequate diet that is low in energy and protein (Coker et al., 2012; Nieuwenhuizen et al. 2010).

A more cost-effective and practical strategy to improve muscle mass than supplementing essential amino acids is to increase the intake of high-quality proteins from foods (Candow et al., 2012). The intake of various types of proteins, however, impacts on muscle protein synthesis differently. These differences are related to the degree to which muscle protein synthesis is increased, as well as the duration of increased synthesis (Gryson et al., 2013; Phillips et al., 2009; Wilkinson et al., 2007). This is particularly important after resistance training (Phillips et al., 2009), and is thought to be determined by the amino acid composition of the protein as well as the rate of digestion (Gryson et al., 2013; Phillips et al., 2009; Forbes et al 2012; Chale et al., 2013).

### 2.6.1 Benefits of physical activity to address frailty and malnutrition

Sarcopenia is characterised by an imbalance between the rate of muscle protein synthesis and muscle protein breakdown (Phillips et al., 2009; Tang and Phillips, 2009). This balance is determined by the intake of protein and the resultant increase in amino acids in the blood. After protein intake, muscle protein synthesis increases, while muscle protein breakdown is supressed. The opposite is true during fasting, when muscle protein synthesis decreases and muscle protein breakdown is slightly increased (Philips et al., 2009).

Exercise enhances adaptations in skeletal muscles which may aid in the prevention or reversal of sarcopenia in the elderly. Resistance exercise has the ability to increase muscle protein mass and strength (Candow et al., 2012; Forbes et al., 2012; Bautmans et al., 2009; Boirie, 2009; Phillips et al., 2009; Chale et al., 2013), which over time can result in improved muscle

protein synthesis and muscle hypertrophy (Forbes et al., 2012; Tang and Phillips, 2009). More recently the benefits of resistance training on muscle power and functional capacity have also been highlighted (Forbes et al., 2012). On the other hand, aerobic exercise is able to improve insulin sensitivity and decrease oxidative stress (Forbes et al., 2012). Preserving muscle mass has a number of benefits, including maintaining metabolic rate and thus reducing risk of obesity and its comorbidities (Phillips et al., 2009; Tang and Phillips, 2009).

### 2.6.2 Benefits of milk intake to address frailty and malnutrition

Dairy products have a high nutrient density and palatability, making them beneficial in the diet of both healthy and frail elderly persons (Drenowski, 2011; van Staveren and de Groot, 2011). Milk contains both macronutrients and micronutrients essential for growth, development and repair of tissues (Muehlhoff et al., 2013). According to the FAO STAT (2012), milk is a major source of dietary protein and fat. The main proteins found in cow milk are whey and casein and they are of high biological value and quality to support maximal growth due to a good balance of all essential amino acids (Wijesinha-Bettoni and Burlingame, 2013; Gryson et al., 2013; Bonjour et al., 2013). Of these two, whey protein supports the rapid increase in muscle protein synthesis, while casein enhances continual increase in muscle protein synthesis and decreases muscle protein break down (Gryson et al., 2013; Forbes et al., 2012; Chale et al., 2013).

Whey and casein proteins are absorbed at different rates in the digestive system. Whey proteins, also termed “fast proteins,” remain in a liquid state in the stomach, thus increasing amino acid availability and absorption. On the other hand, caseins, or “slow proteins” clot in the low pH of the stomach, resulting in a slower availability of amino acids (Gryson et al., 2013). In addition to the whey and casein proteins that are present in dairy milk, it is also a very good source of leucine (Gryson et al., 2013; Phillips et al., 2005; Tang et al., 2009; West et al., 2011). Gryson et al., (2013), have shown that the leucine in whey milk protein is more available than leucine from other protein sources.

The carbohydrate component of milk is mainly lactose which is involved in the intestinal absorption of calcium, magnesium and phosphorus, and the utilization of vitamin D (Park et

al., 2007). The lactose in milk, however, may cause intolerance in some people, especially those of African and East Asian descent (Vandenplas, 2015; Heaney, 2013).

Fermented milk is said to have been be the first milk product in the world. It can be prepared locally at home by leaving the milk to ferment or prepared industrially by adding living lactic acid bacteria to milk to ferment it (Gadaga et al., 2013). Fermented milk is easily digested and absorbed. The proteins in fermented milk are broken down by the action of bacterial proteolytic system and are thus less likely to cause intolerance (Wijesinha-Bettoni and Burlingame, 2013). The quantity of lactose in fermented milk is lower than in whole milk because some of it is converted to lactic acid. Lactic acid gives rise to the characteristic sour taste associated with fermented products. Fermentation not only makes milk more digestible, but is also a means of increasing the shelf-life and microbiological safety of the products (Wijesinha-Bettoni and Burlingame, 2013).

In Lesotho, traditionally fermented milk is known as mafi. It is made by fermenting milk for 2-3 days until it curdles at a temperature of 25 to 30 degrees (Gadaga et al., 2013). The curds are eaten with porridge called papa or on its own as a drink. In some parts of South Africa, Zimbabwe and Swaziland traditionally fermented milk is called amasi/emasi (Buekes et al., 2001). Fermented milk that is industrially produced is also widely available in South Africa and Lesotho.

### 2.6.3 Evidence from systematic reviews of intervention studies

Comparison of interventions to address frailty and sarcopenia are complicated by differences in sample sizes; degree of sarcopenia in participants; level of frailty and fitness; type, duration and intensity of exercise programmes; as well as the type, quality, digestion rate and level of protein supplementation used. The timing of consumption in relation to physical activity is also not consistent over studies. Despite these limitations, the results from a number of systematic reviews of intervention studies have shown that the elderly that are frail and sarcopenic can benefit from exercise and nutrition interventions, especially when they are combined.

In terms of exercise interventions, the most recent umbrella review of systematic reviews by Jadczak et al., (2018) aimed to determine the impact of various physical activity interventions in improving physical function (muscle strength, gait, balance, mobility and physical performance) of frail or pre-frail elderly participants. They concluded that exercise interventions that included resistance exercise in particular as well as resistance exercise combined with aerobic, balance and flexibility components were able to improve physical function in the elderly. De Labra et al., (2015) also undertook a systematic review of RCTs to determine the effect of multi-component physical activity interventions in frail participants. They reported reduced incidence of falls as well as improved mobility, muscle strength and body composition. A systematic review of RCTs to determine the effect of physical activity interventions on frailty in frail participants by Silva et al., (2017) showed that exercise improved physical functioning, psychological wellbeing and even cognition.

Dedeyne et al., (2017) completed a systematic review to assess the impact of multi-domain interventions (exercise, nutrition, pharmacological, psychological and social) on frailty, functional and cognitive status in frail and pre-frail participants. They concluded that multi-domain interventions (including physical activity) were more likely to be effective in improving frailty scores, muscle mass and physical functioning than single interventions. In terms of cognitive and social outcomes, the results were less positive.

In an umbrella review of systematic reviews, Schultz et al., (2016) showed that nutritional supplements on their own and in combination with resistance training and nutrition counselling were able to improve body composition in underweight and overweight elderly participants. The systematic overview of systematic reviews by Lozano-Montoya et al., (2017), showed that muscle strength and physical performance improved with exercise and amino acid supplementation in frail and sarcopenic elderly.

Manal et al., (2015) reviewed randomised controlled trials (RCTs) of nutrition interventions (micronutrients, macronutrients, nutritional supplements or food regimens) to determine the relationship between frailty and nutrition. They concluded that improvement of the quality of the diet could improve strength, walking speed and nutritional status of frail or pre-frail elderly participants.

In 2014, Cruz-Jentoft et al., (2014) published a systematic review assessing the effect of physical activity and/or dietary supplementation on sarcopenia. Most exercise interventions (mostly resistance training) showed an improvement in muscle strength and physical performance. In terms of nutrition interventions, the small number of studies and heterogeneous study designs made it difficult to confirm the benefits of nutrition intervention. Essential amino acids, including leucine, did seem to improve muscle mass and function. The systematic review by Denison et al*.,* (2015) assessed the effect of combined exercise and nutrition interventions on muscle mass, strength, and function in 17 studies in the elderly. This review also concluded that the evidence was insufficient to make recommendations.

The recent systematic review by Beaudart et al., (2017) also assessed the effect of combined exercise and nutrition intervention on muscle mass and muscle function in 37 RCTs. They concluded that exercise has a beneficial effect on muscle mass and function in the elderly, but that the impact of dietary supplementation was limited.

Morton et al*.,* (2017) performed a systematic review to determine if protein supplementation enhances the impact of resistance training on muscle mass and strength in healthy adults. They included 49 RCTs that were six weeks and longer and included both resistance training and protein supplementation. They concluded that protein supplementation (up to 1.6g/kg/day) significantly improved changes in muscle strength and muscle mass in healthy adults, but that the beneficial effects decreased as age increased. Similarly, the meta-analysis of Cermak et al*.* (2012) included data from six RCTs related to the impact of protein supplementation in untrained older subjects. Five studies included only dairy protein (whey, milk or casein) and one included a combination of egg, meat and dairy. Although the individual studies failed to find a significant benefit of protein supplementation versus placebo on fat free mass gain, the combined data from 215 older subjects showed that protein supplementation resulted in 38% more fat free mass and a 33% increase in strength when compared to placebo.

## 2.7 Conclusion

Aging is associated with frailty and malnutrition in a significant proportion of the elderly, especially in developing countries. Adequate nutrition and remaining physically active have the potential to maintain quality of life throughout the life cycle. The factors that contribute directly or indirectly to health and quality of life include physiological, psychological, socioeconomic and sociocultural factors.

There is a growing body of evidence showing that the intake of milk-based proteins has biological effects that may improve the beneficial effects of exercise, since these proteins are an effective protein source for stimulating muscle protein synthesis, slowing muscle protein breakdown and improving muscle mass. The anabolic effect of milk may be an effective, practical and cost-effective way for maintenance of muscle mass in the healthy elderly and fast recovery in the frail and malnourished elderly.

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# CHAPTER 3

# METHODOLOGY

## 3.1 Introduction

This chapter describes the study design, population and sampling, operational definitions, data collection process and tools, and techniques (i.e. questionnaire and anthropometric measurements) that have been applied. This is followed by a description of the steps taken to ensure validity and reliability and the statistical methods used to analyse the data.

## 3.2 Study Design

The study was conducted in two phases: a baseline assessment followed by the implementation and assessment of an intervention. The baseline assessment (phase 1) applied a cross-sectional study design, while phase 2 applied a pre-test-post-test study design.

## 3.3 Study Area

The study was conducted in Maseru which is the National Capital of Lesotho. It is a fast growing district and it houses all the arms of government. It covers an area of about 138 square kilometres and has a total population of 431,998 (BoS, 2007). The map of the study area is depicted in figure 3.1.

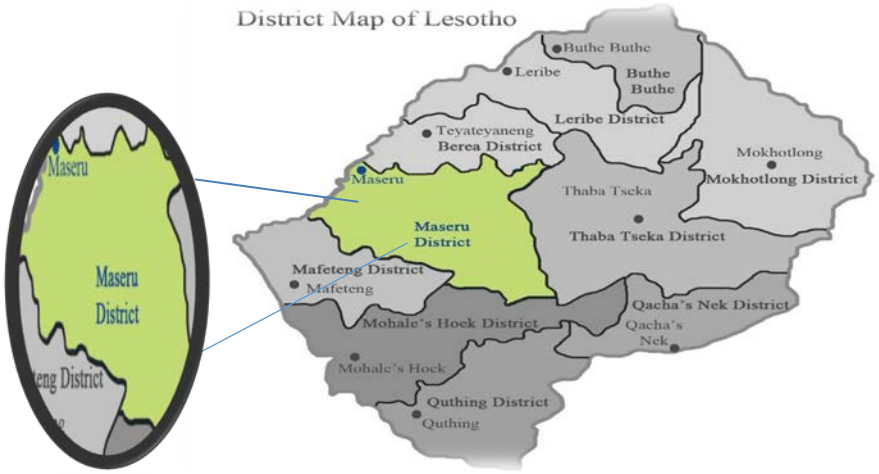


**Figure 3.1 Map of Lesotho showing Maseru District**

### 3.3.1 Study Population

According to the most recent 2016 Lesotho census, the population of people aged 65 years and older increased from 5.7 % in 2006 to 6.1% in 2016 with a total population of 122 576 of the country's total population of 2 007 201 (BoS, 2016). In 2016, the number of people aged 65-69 years accounted for 37 358 of the elderly, those aged 70-74 years accounted for 30 808 of the elderly, while those aged 75-79 years included 24 174 people. In the age group 80-84 years there were 18 621 people and in the group aged 85 years and older, there were 11 615 elderly people in 2016 (BoS, 2016).

In Lesotho, there are ten main administrative districts and a total of 80 constituencies led by administrative heads. Maseru District is the national Capital of Lesotho and the largest urban area (BoS, 2016). It has 18 constituencies, including urban and rural areas. The urban constituencies include Abia, Lithabaneng, Lithoteng, Maseru Central, Stadium Area and Qualing Motimposo. Table 3.1 depicts the population of the elderly by sex, age group and urban constituencies in Maseru district during 2006, which was the most recent census at the time that the study was conducted.

**Table 3.1 Population of the elderly in Urban Constituencies in Maseru District by Sex and Age group (BoS, 2007)**

| **Constituency** | **Males** | | | | | **Females** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Age (years)** | 65- 69 | 70- 74 | 75- 79 | 80- 84 | 85 + | 65- 69 | 70- 74 | 75- 79 | 80 - 84 | 85 + |
| Abia | 97 | 60 | 52 | 18 | 7 8 | 111 | 87 | 42 | 22 | 26 |
| Lithabaneng | 114 | 71 | 36 | 15 | 14 | 144 | 115 | 77 | 36 | 53 |
| Lithoteng | 108 | 73 | 28 | 23 | 16 | 155 | 118 | 55 | 48 | 51 |
| Maseru Central | 113 | 93 | 31 | 19 | 17 | 146 | 120 | 72 | 47 | 31 |
| Stadium Area | 114 | 120 | 39 | 24 | 19 | 181 | 138 | 87 | 53 | 47 |
| Qoaling | 138 | 109 | 70 | 32 | 32 | 229 | 180 | 110 | 56 | 56 |
| Motimposo | 121 | 107 | 50 | 18 | 20 | 168 | 161 | 83 | 62 | 53 |
| **Total** | 805 | 633 | 306 | 149 | 196 | 1134 | 919 | 526 | 324 | 317 |
| **Overall Total** | **2089** | | | | | **3220** | | | | |

### 3.3.2 Sample for the baseline (phase one)

As mentioned above, Maseru has seven (7) urban constituencies that are also made up of community councils. The researcher used random sampling to obtain the constituencies as well as community councils (this was done by writing the names of the constituencies on pieces of paper and placing them in a hat, after which four constituencies were drawn out of the seven). From the four selected constituencies (16 communities in total), four communities each were selected randomly from the list of villages under the selected community councils in the Maseru District using the same procedure. Since participants were recruited during the election period, the voting list was used to identify the elderly 65 years and above. A new list that included the names and particulars of these persons was then compiled. Participants were selected by systematic sampling where the names on the list were numbered 1, 2, 3...1, 2, 3 … and every 3rd name was selected until the desired numbers were obtained.

This district was selected purposively for the study because it was close to the researcher for practical reasons (to facilitate daily visits by the researcher to the experimental communities).

The sample size for phase 1 was calculated as follows:

In 2006, the total population of the elderly aged 65 years and older in Maseru district was 28 108 (BoS, 2007). The sample size for phase one of the study included 300 participants. This was obtained using Epi info software version 6.0 from Center for Disease Control. The total population of the elderly aged 60-79 years was 28 108 in Maseru (BoS, 2007) with the expected frequency of 20%, confidence limit of 5%, design effect of 1.0, cluster of 4 and confidence interval of 97%, the sample size for the study was 302 (i.e.) 76 per cluster, adjusted to 300.

Inclusion and exclusion criteria for phase 1 included:

- Persons aged 65 years and older who lived in the selected community and did not plan to relocate during the time that the study was implemented.
- Elderly who voluntarily agreed to be participate in the study after the information document had been explained to them **(appendix 1)** and signed or thumb printed the consent form **(appendix 2).**

**Persons that were excluded included:**

- Those who were bedridden
- Those with dementia that were unable to participate in the interview.

### 3.3.3 Sample for the intervention (phase 2)

During the intervention phase, a nutrition and physical activity intervention was implemented. All participants that were identified to be frail (according to the Rockwood scale) and/or malnourished (according to the MNA) in phase 1 of the study were eligible to participate in phase two of the study. For practical reasons, the study area was divided into three geographic areas and eligible participants were grouped according to the geographic areas where they resided. The three geographic areas were then randomly allocated to the three groups to be included in phase 2. In each of these groups, 40 participants were randomly selected to be included in the study. The division of the study area into three groups and the random selection of the groups into the three legs of the intervention was managed by the biostatistician.

The three groups included experimental group 1 that received both the physical activity and fermented milk supplementation intervention; experimental group 2 that received the fermented milk supplementation intervention; and the control group (no intervention).

Two of the constituencies (10 communities) in phase 1 (baseline) were randomly allocated to the two intervention groups, by the biostatistician.

- Five (5) communities in the Abia Constituency and one in Lithabaneng Constituency namely Ha Mapetla, Ha Penapena, Ha Bosofo, Ha Matala, Makhoakoeng and Ha Nelese respectively, were randomly selected for the fermented milk and physical activity intervention.
- Four (4) other communities in the Motimposo Communities namely Ha Tsui, Ha Tsenola Ha Tsosane and Motimposo were randomly assigned for the milk only intervention.

- The other six (6) communities in the Stadium Area and Lithabaneng constituencies namely Stadium area, Fokothi, Moshoeshoe II, Sea-point, Upper Thamae and Lower Thamae were assigned to the control group.

**Inclusion criteria for phase 2 of the study:**

- Elderly who participated in the baseline and were classified as frail and/or malnourished (according to the Mini Nutritional Assessment (MNA) and the frailty scale) were included.
- Elderly who were willing and gave consent to participate in the intervention phase.

## 3.4 Measurements

### 3.4.1 Variables and operational definitions

The following variables were assessed as part of the study:

#### 3.4.1.1 Socio-demographic and household information (Appendix 3):

For the purpose of the study, the socio-demographic and household information included: age (date of birth), gender, educational level, employment status, marital status, living conditions (access to drinking water, sanitation).

#### 3.4.1.2 Reported health (Appendix 4)

Reported health referred to an assessment of social support (group membership, network of friends and family structure); tobacco and alcohol consumption patterns, medical history and medications, level of stress and behaviours related to the control of stress.

#### 3.4.1.3 Nutritional Status (Appendices 5 & 6)

For the purpose of this study, nutritional status included information about dietary intake (i.e. Individual Dietary Diversity Score [IDDS]), and information obtained with the Mini Nutritional Assessment (MNA) (anthropometric assessment, global evaluation, dietetic assessment and subjective assessment).

The purpose of this study was to determine the dietary diversity and not nutrient adequacy. For this reason, an IIDDS was calculated from a 24-hour dietary recall for each participant of the number of portions from 9 possible food groups to classify dietary diversity as low (≤ 3), medium (4 and 5) or high (≥ 6) (Kennedy et al*.,* 2011).

The total list of food groups that were assessed were as follows: 1) cereals; 2) vitamin A-rich vegetables and tubers; 3) white roots and tubers; 4) dark green leafy vegetables; 5) other vegetables; 6) vitamin A-rich fruit; 7) other fruits; 8) organ meat; 9) flesh meat); 10) eggs; 11) fish; 12) legumes, nuts and seeds; 13) milk and milk products; 14) oils and fats; 15) sweets; and 16) spices, condiments and beverages. In order to obtain the 9 food groups required for the IDDS, some of these food groups were combined as follows: 1) starchy staples 2) dark green leafy vegetables 3) other vitamin A rich fruits and vegetables 4) other fruits and vegetables 5) organ meat 6) meat and fish 7) eggs 8) legumes, nuts and seeds; 9) milk and milk products.

The MNA is a tool comprised of the following four main categories (Guigoz et al*.,* 1994):

A. **Anthropometric assessment** – this includes weight, height, weight loss, calf circumference and mid upper arm circumference

B. **Global evaluation** – this section includes six questions related to lifestyle, medication and mobility

C. **Dietetic assessment** - this includes eight questions related to number of meals, food and fluid intake and autonomy of feeding.

D. **Subjective assessment** – this section assesses the self-perception of health and nutrition.

The scoring of each part allows the elderly to be classified as adequately nourished, at risk of malnutrition and malnourished:

- < 17 points is regarded as an indication of malnutrition
- 17-23.3 points indicates risk for malnutrition
- >23.5 points indicates that the person is well nourished

**A. Anthropometric measurement**

The Anthropometric assessment included measurements of weight, height, knee height, mid arm circumference and calf circumference. Body Mass Index (BMI) was calculated by dividing weight by height squared. BMI provides a reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems (CDC, 2013).

**i. Body Mass Index** (in kg/$m^2$) of the elderly is classified as follows (Guigoz et al., 1994):

0= BMI <19 indicates underweight

1= 19 ≤BMI < 21 indicates normal weight

2= 21≤BMI <23 indicates over weight

3=BMI≥23 indicates obesity

**ii. Mid Arm Circumference (MAC in cm)**

Mid arm circumference measurements were categorised as follows (Guigoz et al*.,* 1994):

0.0=MAC<21

0.5=21≤MAC ≤22

1.0=MAC >22

**iii. Calf circumference (CC in cm)**

Calf circumference was categorised as follows (Guigoz et al*.,* 1994):

0= CC<31cm

1=CC ≥ 31

**3.4.1.4 Level of physical activity (Appendix 7)**

For the purpose of this study, the Physical Activity Scale for the Elderly (PASE) was used to measure the level of physical activity for individuals aged 65 and older. PASE includes an assessment of self-reported occupational, household and leisure items undertaken over a

one-week period (Washburn et al., 1993). Participants were asked to first report the number of days per week the activity was performed and then the time (reported in number of hours per day) spent on the activity. PASE scores were calculated from weights and frequency values for each of the 10 types of activities. Responses to the first question about sitting were not scored (table 3.2).

**Table 3.2 Activity Frequency Values used to score the PASE (NERI, 1993)**

| PASE Item | Type of Activity | Activity weight | Activity Frequency | Activity weight times frequency |
|---|---|---|---|---|
| **2** | Walk outside home | 20 | A | |
| **3** | Light sport /recreational activities | 21 | A | |
| **4** | Moderate sport/recreational activities | 23 | A | |
| **5** | Strenuous sport/ recreational activity | 23 | A | |
| **6** | Muscle strength /endurance exercise | 30 | A | |
| **7** | Light house chores | 25 | B | |
| **8** | Heavy house chores | 25 | B | |
| **9a** | Home repairs | 30 | B | |
| **9b** | Lawn work or yard care | 36 | B | |
| **9c** | Outdoor gardeninging | 20 | B | |
| **9d** | Caring for other person | 35 | B | |
| **10** | Work for pay or as a volunteer | 21 | C | |

The hours per day conversion table (Table 3.3) was used as follows: If an activity was reported in the last week it was scored as 1, if no activity was reported it was scored as 0.

Activity hours are determined as follows: for example, divide work hours reported in item 10a. in the questionnaire by seven; if no work hours or if job involves mainly sitting with slight arm movement (item 10.b = 1) then activity frequency = 0.

**Table 3.3 Activity Time to hours per day conversion table (NERI, 1993)**

| Days of Activity | Hours per day of activity | Hours per day |
|---|---|---|
| **0. never** | | 0 |
| **A. Seldom (1-2 days)** | 1. less than 1 hour<br>2. 1-2 hours<br>3. 2-4 hours<br>4. More than 4 hours | 0.11<br>0.32<br>0.64<br>1.07 |
| **B. Sometimes (3-4 days)** | 1. less than 1 hour<br>2. 1-2 hours<br>3. 2-4 hours<br>4. More than 4 hours | 0.25<br>0.75<br>1.50<br>2.50 |
| **C. Often (5-7 days)** | 1. Less than 1 hour<br>2. 1-2 hours<br>3. 2-4 hours<br>4. More than 4 hours | 0.43<br>1.29<br>2.57<br>4.29 |

### 3.4.1.5 Frailty scale (Appendix 8)

For the purpose of this study the frailty scale developed by Rockwood et al., (1999) was used to assess the elderly for functional status. A score of 0-1 on the scale is considered fit or fit with bladder incontinence, 2 is considered pre–frail, and 3 is considered frail.

**Table 3.4 Frailty Scale (Rockwood et al, 1999)**

| **Performance** | Level | Status |
|---|---|---|
| • Walks without help<br>• Performs basic activities of daily living (eating, bathing, dressing, bed transfer).<br>• Continent of bowel and bladder<br>• not cognitively impaired | 0 | fit |
| • Walks without help<br>• Performs basic activities of daily living (eating, bathing, dressing, bed transfer).<br>• Continent of bowel but not of bladder<br>• not cognitively impaired | 1 | fit but bladder incontinent |
| **One or more of following (2 if incontinent)**<br>• Need assistance with activities of daily living or mobility<br>• Bowel or bladder incontinent<br>• Cognitive impairment without dementia | 2 | pre-frail |
| **Two of following (3 if incontinent)**<br>• Totally dependent for transfers<br>• Totally dependent with one or more activities of daily living<br>• Bowel and bladder incontinent<br>• Demented | 3 | frail |

## 3.5 Techniques

The techniques that were applied in the study included questionnaires and anthropometric assessment. Trained field assistants and the researcher administered the questionnaires in an interview with each participant in Sesotho or English.

### 3.5.1 Socio-demographic and household information

A questionnaire was used to collect data related to socio demographic status as well as household information. This questionnaire was adapted from the one used for the Assuring Health in the Free State (AHA FS) study (Walsh and van Rooyen, 2015), and modified to suit the geographic location and the specific culture of participants (e.g. Maloti is equivalent to Rands which is the currency used in Lesotho). The interviews were conducted by the researcher, assisted by trained field assistants who were Nutrition graduates. A structured interviewing technique was used to complete the questionnaire in Sesotho or English.

### 3.5.2 Reported health

An adult health questionnaire was completed for each participant. This questionnaire was adapted from the one used for the AHA study (particulars related to morbidity and mortality of family members was removed). Information was collected in a structured interview with each participant by the researcher and trained field assistants.

### 3.5.3 Dietary and anthropometric information

A 24-hour recall of usual food intake was completed during the structured interview with each participant. The meals of the day were each evaluated according to what was eaten for breakfast, lunch and supper, then foods, drinks and snacks eaten between meals were also included. Added foods such as sugar in tea, oil in mixed dishes or fried foods were also included. The questionnaire included all foods eaten by the elderly, consumed inside or outside the home, irrespective of where they were prepared (Kennedy et al., 2011).

In terms of the MNA, the following techniques were applied:

All anthropometric measurements were taken with participants wearing light clothing, without shoes. Anthropometric measurements were taken by the trained nutrition graduates/field assistants and the researcher, using standardised methods prescribed in the MNA manual (Nestle MNA, 2014 in accordance with WHO recommendations).

**Height** was measured using a stadiometer to the nearest 0.1cm. The participants were asked to remove shoes and stand up straight with heels together, and with heels, buttocks and shoulders pressed against the stadiometer which was placed on an even and firm surface. The participant's arms hanged freely with palms facing thighs. Measurement were taken with the participant standing tall, looking straight ahead with the head upright and not tilted backwards, ensuring that the participant's heels remained flat on the floor. The stadiometer was lowered until it made contact with the top of the head.

**Knee height** was measured by asking the participants to bend the knee and ankle of one leg at a 90-degree angle while sitting on a chair with legs on the floor. A non-stretchable tape measure under the heel of the foot in line with the ankle bone was used and recorded to the nearest 0.1 cm.

**Weight** was measured with the participant standing unsupported on a digital electronic weighing Scale (UNI SECA), and measured to the nearest 0.1kg. The scale was placed on a smooth level surface. Measurements were taken near a support to assist the aged to mount the platform with ease. With the participants standing unsupported, feet together, motionless and looking straight ahead, the weight was measured.

MAC was measured at the middle point of the upper arm on the non-dominant arm halfway between the acromion and the olecranon. The measurements were recorded to the nearest 0.1 cm, with the arm at 90 degrees.

Calf circumference was measured with the participant sitting on a chair with the right or left feet about 20 cm (8 inch) apart with body weight equally distributed on both feet. A non-stretchable tape measure was looped horizontally around the calf and moved up and down until the greatest circumference was found. The tape was tightened around the calf so that it

contacts the skin without indenting or compressing the soft tissues. The measurements were recorded to the nearest 0.1cm.

Questions related to the global evaluation, dietetic assessment and subjective assessment were completed by the researcher and research assistants in a structured interview with each participant (Guigoz et al., 1994).

### 3.5.4 Physical Activity Scale for the Elderly

The PASE was completed by the researcher in a personal interview with each participant.

### 3.5.5 Frailty scale

In this study the Frailty scale proposed by Rockwood and colleagues was administered by structured interview (Rockwood et al., 1999).

## 3.6 Validity and reliability

### 3.6.1 Validity

Validity refers to the extent to which a research procedure measures what it is supposed to measure (Gibson, 2005). To ensure validity, all questions related to the objectives of the study and questionnaires were developed based on issues discussed in the relevant literature.

In order to ensure validity of results, all anthropometric measurements were determined in accordance with accepted WHO recommendations (WHO, 2016). Scales were at the zero point before each measurement was taken and the weight recorded by the scale was compared with a known weight. The scale was calibrated by the researcher after every twentieth participant had been measured.

### 3.6.2 Reliability

Reliability refers to the degree to which the same results can be reproduced after repeating the measurement (Gibson, 2005). Reliability was ensured by using trained fieldworkers to complete the questionnaires and applying standardised techniques recommended by WHO.

### 3.7 Measurement and methodology errors

- Some of the elderly who had signed the consent form were lost to follow-up due to circumstances beyond their control.
- Contamination between treatment groups and control groups was overcome by randomisation between communities instead of between participants residing in the same area.
- In order to overcome the problem of illiteracy, the information document was explained verbally by fieldworkers and any questions were answered to ensure that all participants understood what the study entailed and what was expected of them.
- Due to high prevalence of food insecurity in the population, there was the likelihood that milk was shared with family members, even though the researchers ensured that at least half was consumed daily 15 minutes after the physical activity session.

### 3.8 Statistical Analysis

The Department of Biostatistics at UFS performed the analysis of all data. Descriptive statistics namely means and standard deviations or medians and percentiles for continuous data and frequencies and percentages for categorical data were calculated per group. The change from baseline to 3 months was calculated per group. The groups were compared by means of 95% confidence intervals. The data was analysed using SAS/SAT software (version 9.3) of the SAS system for windows (Copyright© 2010 SAS Institute Inc).

### 3.9 Study procedure

The study was conducted in the following phases:

***Phase 1***

**Step 1: Obtaining permissions and ethics approval**

- Approval to conduct the study was obtained from the Health Sciences Research Ethics Committee of the Faculty of Health Sciences, UFS and the Ethical Review Committee of the Ministry of Health, Lesotho **(appendices 9 and 10)**

- Community leaders (chief and elders) were informed and permission granted.

**Step 2: Preparation for data collection**

**Training of field assistants**

- Five (5) field assistants were trained for five days on the recruitment of participants into the study, questionnaire administration, and use of tools (scale, stadiometer, tape measure etc.). All the techniques required for the accurate collections of data were practiced under supervision of the researcher to minimise any errors. Field assistants assisted the researcher in the administration of questionnaires and taking of anthropometric measurements.

**Step 3: Sample selection and obtaining of informed consent**

- Within the selected constituencies, four communities each were selected randomly (described earlier). The chiefs of those communities were contacted and a list of households where the elderly reside were obtained from the chiefs. The community volunteers were contacted to assist in locating the sampled households (households were sampled by first obtaining the list from the local council, applying systematic sampling (names were numbered 1, 2, 3...1, 2, 3 … and every 3$^{rd}$ name were selected). The sample of elderly who met the inclusion criteria were then selected.
- A pilot study (described in section 3.11) was undertaken to determine how many questionnaires could be administered in a day and to determine whether all questions were clearly understood.
- The selected participants were approached in their households and invited to participate in the study.
- Informed consent was obtained from eligible participants. Consent forms were signed or thumb printed in cases where the elderly could not sign.
- Questionnaires were administered sequentially after which anthropometric measurements were taken by the researcher with assistance from the trained field

staff. All data forms and anthropometric measurements were completed at the home of the participant.

- The IDDS Dietary diversity score, frailty questionnaire, PASE and anthropometry were administered by the researcher with the help of the trained assistants, while other sections on socio-demographic background, reported health etc. were completed by the trained assistants under supervision of the researcher.

**Step 4: Analysis of baseline data**

- Data analysis was done by the Department of Biostatistics of the UFS.

***Phase II***

**Step 5: Developing the physical activity Intervention**

- The physical activity intervention was designed and implemented by a Masters student in Sport and Exercise Science at the UFS.
- After the baseline assessment, all the frail and/ or malnourished elderly who were selected to participate in phase 2 were asked to provide consent to participate in phase 2.
- A total of 120 were selected of which 115 gave consent to undergo exercise testing and prescription.

**Step 6: Implementation of the interventions**

- Two interventions, (fermented milk and physical activity) were implemented over a period of 3 months in the two experimental groups (one intervention group received the physical activity and fermented milk and the other only the fermented milk).
- The nutrition intervention included the provision of fermented milk. 500ml of fermented milk was given on five days of the week for a period of three months (2 on a Monday, 1 on Wednesday and 2 on Friday). The milk was taken at any time after it had been delivered.
- In the group that also received the physical activity intervention, the fermented milk was taken about 15 minutes after physical activity on the three days per week that

the physical activity intervention was administered and any time of the day on days when the physical activity intervention was not administered.

- The physical activity intervention was designed and implemented by a Masters student in Sport and Exercise Science at the UFS. The physical activity intervention was based on an individual assessment of each participant in the physical activity intervention group.
- Before intervention, each participant was assessed by the Masters student. The exercise testing included an assessment of cardiovascular fitness (6-minute walk test); upper body strength (arm curl- and handgrip test); lower body strength (chair stand test); flexibility (modified sit and reach test); balance, speed and agility (8-foot up and go test).
- After exercise testing, an exercise programme was designed for each participant. Physical activity was prescribed for 3 days of the week for a period of three months and consisted of a multicomponent physical activity programme of low to moderate intensity, for 45 – 60 minutes at a time. Components that were included were 10 minute walking (warm up), sit-to-stand, standing march, lateral raises, triceps extensions, cone drills and stretching.

**Step 7: Evaluation of the nutrition and physical activity intervention**

- After three months of implementing the intervention, the post-test survey was completed in all participants (assessment of nutritional status (IDDS, and MNA), PASE and frailty) at their homes.

### 3.10 Pilot study

A pilot study is defined as a test of methods and procedures to be used in a bigger anticipated study conducted to enable the researcher to improve upon the main study. Pilot studies are done to make sure that tools that are to be used for the large-scale study are comprehensive and suitable (Thabane et al*.,* 2010).

A pilot study was undertaken in the Maseru district on the first ten elderly persons and their results were included in the analysis because no changes were made to the questionnaires. The average time needed to complete the questionnaire was determined to be 20 minutes.

### 3.11 Ethical aspects

Approval to undertake the study was obtained from the Health Sciences Research Ethics Committee of the UFS (ECUFS NR 217/2014) and the Ethics Committee of the National Institution Review Board, of the Ministry of Health Lesotho with reference number ID71-2015. The participants, who were recruited for the baseline study, were asked to complete informed consent in English or Sesotho. In cases where participants were not literate, the information document was explained to them and they made a thumb print on the consent form instead of signing. Participation in the study was voluntary. All information about the baseline study (information document) was explained to the participants before they signed consent. A second consent form was completed by participants that were selected to participate in phase 2 in their language of choice, after the intervention phase was explained in an information document. All information was kept strictly confidential. Codes were used on all questionnaires and no names were included. Only the researcher had a list of the codes and names of participants in order to make the implementation of the intervention possible.

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# CHAPTER 4

# FACTORS ASSOCIATED WITH FRAILTY IN THE ELDERLY IN LESOTHO: A BASELINE STUDY

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**ABSTRACT**

**Objectives:** The purpose of this study was to determine levels of frailty amongst the elderly in Lesotho, and how this is associated with socio-demography, reported health, dietary diversity and levels of physical activity.

**Methods:** This baseline study had a cross-sectional design. The elderly (N=300) aged 65 years and older were recruited from 16 communities in urban Maseru. A questionnaire was administered to acquire information on socio-demography, reported health and individual dietary diversity. The Physical Activity Scale for the Elderly (PASE) was used to measure levels of physical activity, while the Rockwood frailty scale was applied to assess the degree of frailty in participants.

**Results:** There were more females (73%) than males, about two thirds (65.8%) had primary education and 11.7% did not have any formal education. More than half (61%) were widowed. More than forty percent (43.1%) of participants were unemployed and almost half (46.3%) reported a household income of R500 or less. Most (81.3%) resided in brick/concrete dwellings, 61% used pit toilets and 51.3% had access to electricity at their homes. Gas was the most common fuel used for cooking (44.1%).

The most prevalent reported symptom was joint pain (59.7%). Loss of appetite (54%), involuntary weight loss (46.6%) and swelling of the feet (44.5%) were also common. More than half (63.2%), of participants were diagnosed with high blood pressure, and 36% suffered from heart disease/ heart related diseases. Almost all (90.7%) of the participants were members of a local church. Feelings of sadness and depression were reported by 47%. Almost 60% (57.1%) reported using medication regularly, and 7.2% had been hospitalised during the previous 12 months. Individual Dietary Diversity Score showed that more than half of participants (53.5%) had low levels of dietary diversity, consuming mostly starchy staples (97.3%). Frequency of consumption of meat and dairy was low (38% and less than 1% respectively). The median PASE Score of 106.1, (range 87.2-122.8) fell below the recommendation of $\geq$120.

In terms of frailty, 26.2% of participants were classified as fit; 52.4% as fit but bladder incontinent, 9.7% as pre-frail and 11.7% as frail. There was no significant difference between the prevalence of frailty in men and women (p=0.68).

Compared to the fit group, participants that were pre-frail or frail were more likely to use paraffin as fuel for cooking (p=0.02), less likely to go out (p=0.01), more likely to experience breathlessness with usual exercise (p<0.01) and wheezing or coughing (p=0.03). A significantly higher percentage of elderly in the frail group (13%) had been diagnosed with stroke as compared to the fit group (5.0%) (p=0.04). Diagnoses of lung disease such as asthma was significantly higher in the frail group (22.0%) than in the fit group (10.3%) (p=0.02).

**Conclusion:** A large percentage of elderly participants included in this study were characterised by poverty, ill health, low dietary diversity, and high risk of frailty. Physical activity levels were relatively higher as compared to other studies. Frailty was associated with a lower socio-economic situation, lower mobility and higher risk of symptoms and disease.

**Keywords:** elderly, frailty, poverty, poor diet

## 4.1 Introduction

According to a recent report by He et al*., (*2016), about 8.5% (617 million) of the world's population are 65 years and older. This percentage is estimated to increase to nearly 17% (1.6 billion) by the year 2050. It is also believed that by 2050, the world's elderly population (65 years and older), will possibly outnumber the proportion of children under 5 years of age (UNDESA, 2013).

Sub-Saharan Africa is also experiencing an increase in the number of elderly. Since 1990, the number of people that are 60 years and older has doubled to 46 million in 2015. A projection of 161 million is expected in 2050, and this growth rate is faster than that experienced in other regions (UN, 2016). Despite this, the average life expectancy in Sub-Saharan Africa is less than 60 years compared to developed countries where it is estimated to be 80 years (Narayan and Donnenfeld, 2016).

The increase in the number of elderly people in the world is a challenge in both developed and developing countries alike. Although the developed world might have policies and measures in place to support the elderly, the developing world does not seem to be as well equipped (Charlton and Rose, 2001; National Research Council (US), 2001).

Synergistic epidemics – known as syndemics, includes the clustering of epidemics or conditions that occur in a population that worsen the burden and prognosis of disease (Tsai et al., 2017). Syndemics highlight the effects of social conditions on health as a result of poverty, politics, stress and other circumstances. Syndemic theory assists in understanding epidemics by considering interrelated conditions or burdens that worsen burden of disease in a population (Singer, 2009).

Although the elderly often depend on working relatives and other individuals for their survival (BoS, 2006), a large percentage have to work in order to provide for themselves and their families. Younger family members are often not able to care for the elderly like they used to in the past due to the fact that they are working, often away from home, or ill (Ranotsi and Ayiku, 2012).

As age increases, the risk for developing frailty, malnutrition, disability and multiple disease conditions increases (Drewnowski, 2001), impacting on the ability to perform activities of daily living (ADL) and resulting in vulnerability and dependence on others (Dorne et al., 2013). Although aging is often associated with progressive illness and frailty, this does not have to be the case. While some elderly become frail at a younger age, others experience a delayed onset in their 90s, because frailty does not necessarily occur with sequential age (Bergman et al., 2007). Despite this, frailty is a common phenomenon among the elderly and occurs as a result of multiple factors including sarcopenia, nutrient deficiencies and inflammation (Dorne et al., 2013; Cherniack et al., 2007; Izaks and Westenorp, 2003).

Disability contributes to malnutrition, while malnutrition is a major component of the frailty syndrome (Banerjee et al., 2010; Pepersack, 2009). According to Fried et al. (2001), inadequate dietary intake is a component of the frailty syndrome. The daily consumption of a diverse and varied diet are generally considered to be measurements of diet quality (Clausen et al., 2005). According to FAO (2015), the assessment of dietary diversity has been proposed as an indicator of diet adequacy and food security, since income and food access are strongly related. Poor access to a diverse diet can affect nutritional status and health, leading to reduced quality of life.

In addition to poverty and chronic food insecurity (LVAC, 2017), the high prevalence of the HIV/AIDS pandemic in Lesotho (one in every four people is infected), has had a major impact on the elderly, who are often responsible for caring for their sick children and orphaned grandchildren. This baseline study aimed to determine the factors that affect frailty in the elderly in Lesotho, in order to be able to plan relevant and culturally acceptable interventions.

## 4.2 Methodology

### 4.2.1 Study design, setting and sample

This baseline phase of the study had a cross-sectional design. It was undertaken in Maseru District. Maseru is the largest urban area in Lesotho with 18 constituencies with 7 of these classified as urban and the rest rural. Four urban constituencies were randomly selected for the study. From these constituencies, 16 communities were further selected randomly with

4 communities from each of the constituencies. Maseru district was selected because of its practical proximity to where the researcher was based.

The principal chiefs and sub chiefs were then contacted for the list of the elderly within their communities who were eligible to participate in the study, and for guidance to locate their homes. In each of the 16 communities, 20 elderly people were randomly selected, until a total of 300 had been included.

Inclusion criteria included elderly persons aged 65 years and older in the selected communities who did not plan to relocate during the study period. Inclusion criteria also included voluntary participation and written informed consent (signed or thumb printed the consent form). Elderly persons who were bedridden or had dementia were excluded from the study.

### 4.2.2 Operational definitions and techniques

Information on socio-demographic status, reported health, dietary diversity, physical activity and frailty were collected by the researcher and research assistants in a personal interview with each participant at their homes.

Socio-demographic and household information included information on age (date of birth obtained from passport and health cards), gender, educational background, employment status, marital status, and living conditions (e.g. access to drinking water, sanitation, and cooking facilities).

Information about reported health included social support (group membership, network of friends and family structure), tobacco and alcohol consumption patterns, medical history and medications, level of stress and behaviours related to the control of stress.

For dietary intake assessment, an Individual Dietary Diversity Score (IDDS) was calculated from a 24-hour dietary recall that was completed for each participant. From this the intake of nine food groups was assessed (eaten or not eaten during the previous 24 hours): 1) starchy staples 2) dark green leafy vegetables 3) other vitamin A rich fruits and vegetables 4) other fruits and vegetables 5) organ meat 6) meat and fish 7) eggs 8) legumes, nuts and seeds 9)

milk and milk products. The IDDS was calculated by means of a simple count of the food groups that were eaten and was classified as low (≤ 3), medium (4 and 5) or high (≥ 6) (Kennedy et al., 2011).

Level of physical activity was assessed using the Physical Activity Scale for the Elderly (PASE). PASE a valid and reliable physical activity tool specifically designed for the elderly by Washburn et al., (1993), over 20 years ago. It entails a 7 day recall of self-reported leisure, household and occupational activity. PASE scores were calculated from weights and frequency values for each of the 10 types of activities, using the hours per day conversion table below (Table 4.1). If an activity was reported during the last week it was scored as 1, if no activity was reported it was scored as 0. Activity hours were determined as follows, for example, divide work hours reported in item 10a in the questionnaire by seven; if no work hours or if job involved mainly sitting with slight arm movement (item 10.b, then activity frequency = 0).

**Table 4.1: Activity Frequency Values used to score the PASE (NERI, 1993)**

| PASE Item | Type of Activity | Activity weight | Activity Frequency | Activity weight times frequency |
|---|---|---|---|---|
| **2** | Walk outside home | 20 | A | 20*A |
| **3** | Lightsports /recreational activities | 21 | A | 21*A |
| **4** | Moderate sports/recreational activities | 23 | A | 23*A |
| **5** | Streneous sports/ recreational activity | 23 | A | 23*A |
| **6** | Muscle strength /endurance exercise | 30 | A | 30*A |
| **7** | Light house chores | 25 | B | 25*B |
| **8** | Heavy house chores | 25 | B | 25*B |
| **9a** | Home repairs | 30 | B | 30*B |
| **9b** | Lawn work or yard care | 36 | B | 36*B |
| **9c** | Outdoor gardening | 20 | B | 20*B |
| **9d** | Caring for other person | 35 | B | 35*B |
| **10** | Work for pay or as a volunteer | 21 | C | 21*C |
| | Total : PASE SCORE | | | |

The frailty scale developed by Rockwood et al., (1999) was used to assess the degree of frailty of participants. This scale included questions about the person's ability to walk with or without assistance; perform activities of daily living such as eating, dressing and washing; bowel and/or bladder continence; and cognitive impairment. Based on the responses, participants were categorised as fit, fit with bladder incontinence, pre-frail and frail.

### 4.2.3 Data collection/ procedures

Data was collected by the researcher and trained field assistants (nutrition graduates who were trained for 5 days prior to data collection) in a personal interview with each participant. A pilot study was undertaken to determine how many questionnaires could be administered in a day and to determine whether the wording of questions could be clearly understood. The information document was explained to participants in their homes and those who agreed to voluntarily participate were made to either sign or thumb print the consent form. Questionnaires were completed and anthropometric measurements taken.

## 4.3 Statistical analysis

Data was analysed by the Department of Biostatistics at UFS. The data analysis for this study was generated using SAS software, Version 9.4 of the SAS System for PC. Descriptive statistics namely medians and percentiles for continuous data and frequencies and percentages for categorical data were calculated. Categories of the frailty scale were combined to form two groups (0=fit & 2=frail). The two groups were assessed to establish associations by means of Chi-square test or Fisher's exact test (if the sample size was small for categorical variables).

## 4.4 Ethical consideration

Ethical approval was obtained from the Health Sciences Research Ethics Committee of the University of the Free State (ECUFS NR 217/2014) and the National Institution Review Board of the Ministry of Health in Lesotho (ID71-2015). Participants completed informed consent in English or Sesotho after being informed about the study. Participation was voluntary and all information was kept confidential. Only the researcher had access to a list of the names and addresses of participants in order to contact them for the intervention phase of the project.

## 4.5 Results

### 4.5.1 Socio-demographic information

The majority of participants were female (71%) and the median age was 74 years (range 64-95 years). In terms of language spoken, almost all spoke Sesotho (99%), which is the official language in Lesotho. In terms of educational level, more than half (65.8%) had primary education, while about 11.7% did not have any formal education, and only 6.3%, had tertiary education. Results on marital status showed that only 15% were living with a partner, while 61% were widowed and 7.6 % were either separated, divorced or never married (table 4.2).

Almost half of participants (46.9%) were receiving pensions, while 43.1% were unemployed, 7% were self-employed and still engaged in economic activities and 3% were full time wage earners (table 4.2). With reference to the economic status of participants, 74.3 % earned between M100 and M 1000, (M1 is equivalent to R1) with only 2.4%, earning above M5000 monthly. Seventy percent reported that over the past 6 months they had had the same income, while 22.6 %, reported that their income was less. Furthermore, most (96.3%) indicated that three or fewer people contributed to the income in their households (table 4.2). With regard to length of stay in urban areas, 10.7% had lived in an urban area for less than 10 years, while more than half (56.3%) had lived in an urban area for more than 41 years.

#### 4.5.1.2 Household amenities

The results related to the type of dwelling, toilet facilities, source of water, electricity etc. are noted in Table 4.3. Most participants lived in brick or concrete houses (81.3%) and the majority used pit toilets (61.7%), with only 11.3% having access to flush toilets.

The type of fuel used mostly for cooking was gas (44.1%), followed by paraffin, wood, coal, open fire or sun (29.2 %). More than two thirds (77%) obtained water from their own tap, while 9.3% obtained water from rivers, dams, bore holes or wells and other sources. Most indicated that they had electricity in their homes (69.2 %) and 51.3% had a working TV, while two thirds (72.3%) had a radio and 51.3% had a refrigerator. The majority had a gas or electric stove (73.8%), working paraffin stove (63.7%), and only 29.1% had a working microwave oven.

**Table 4.2 Socio-demographic and socio-economic information (N =300)**

| Categories | *n* | % |
|---|---|---|
| **Gender** | | |
| Males | 87 | 29 |
| Females | 213 | 71 |
| **Age (years)** | | |
| 65-69 | 84 | 28.0 |
| 70-74 | 81 | 27.0 |
| 75-79 | 66 | 22.0 |
| 80-84 | 37 | 12.3 |
| 85+ | 32 | 10.7 |
| **First language** | | |
| Sesotho | 297 | 99 |
| English | 2 | 0.7 |
| Other (indian) | 1 | 0.3 |
| **Educational Status (299)** | | |
| None | 35 | 11.7 |
| Primary School | 197 | 65.9 |
| Secondary | 47 | 15.7 |
| Tertiary | 19 | 6.4 |
| Don't know | 1 | 0.3 |
| **Marital Status** | | |
| Never married | 17 | 5.6 |
| Currently married | 48 | 16.0 |
| Married/ living with partner | 46 | 15.3 |
| Widowed | 183 | 61.0 |
| Separated | 3 | 1.0 |
| Divorced | 3 | 1.0 |
| **Occupation** | | |
| Unemployment | 129 | 43.1 |
| Self-employment | 21 | 7.0 |
| Full time wage earner | 9 | 3.0 |
| Pension | 140 | 46.9 |
| **Household income (n=288) M *** | | |
| None | 26 | 8.6 |
| M100-M500 | 138 | 46.3 |
| M501-M1000 | 181 | 27.1 |
| M1001-M3000 | 43 | 14.4 |
| M3001-M5000 | 3 | 1.0 |
| Over M5000 | 7 | 2.3 |

| Number of years stayed in urban area | | |
|---|---|---|
| >10 years | 32 | 10.7 |
| 10-20 | 29 | 9.7 |
| 21-30 | 23 | 7.6 |
| 31-40 | 47 | 15.7 |
| 41 + | 169 | 56.3 |

**M1* ***(M=Maloti)*** *is equivalent to* ***R1 (R=Rand)***

**Table 4.3 Basic household amenities (N=300)**

| Categories | *n* | % |
|---|---|---|
| ***Type of dwelling (n=299)*** | | |
| Brick, concrete | 243 | 81.3 |
| Traditional mud | 11 | 3.7 |
| Tin | 8 | 2.7 |
| Plank, wood | 1 | 0.3 |
| Others | 36 | 12.0 |
| ***Toilet*** | | |
| Flush | 34 | 11.3 |
| Pit | 185 | 61.7 |
| Bucket, pot | 66 | 22 |
| VIP | 15 | 5 |
| ***Fuel for cooking (n=299)*** | | |
| Electric | 79 | 26.4 |
| Gas | 132 | 44.1 |
| Paraffin | 67 | 22.4 |
| Wood, coal | 11 | 3.6 |
| Sun | 5 | 1.6 |
| Open fire | 5 | 1.6 |
| ***Source of drinking water*** | | |
| Own tap | 232 | 77.3 |
| Communal tap | 40 | 13.3 |
| River, dam | 4 | 1.3 |
| Borehole, well | 13 | 4.3 |
| Other sources | 11 | 3.7 |
| **Electricity** | 207 | 69.2 |
| **Working TV** | 154 | 51.3 |
| **Working radio** | 217 | 72.3 |
| **Working refrigerator** | 145 | 48.6 |
| **Working stove (gas/ electricity)** | 220 | 73.8 |
| **Working primus/paraffin stove** | 190 | 63.7 |
| **Working microwave** | 87 | 29.1 |

### 4.5.2 Reported Health

#### 4.5.2.1 Smoking, snuffing and alcohol use

Information obtained on lifestyle patterns related to smoking, snuffing and alcohol consumption is presented in Table 4.4. and Table 4.5.

**Table 4.4 Smoking and alcohol (N= 300)**

| Categories | *n* | % |
|---|---|---|
| **Smoking history (299)** | | |
| Never Smoked | 252 | 84.3 |
| Currently smoked | 26 | 8.7 |
| Formerly smoked | 21 | 7.0 |
| **Number of cigarettes smoked a day (31)** | | |
| 1-5 | 22 | 70.9 |
| 6-10 | 5 | 16.1 |
| 17-40 | 4 | 13.0 |
| **Snuffing history (298)** | | |
| Never Snuffed | 211 | 70.8 |
| Currently snuffed | 69 | 23.2 |
| Formerly snuffed | 18 | 6.0 |
| **Number of times snuffed in a day (69)** | | |
| 1 -4 | 57 | 82.7 |
| 5 -10 | 12 | 17.3 |
| **History of alcohol use (296)** | | |
| Never | 199 | 67.2 |
| Current | 65 | 22.0 |
| Formerly | 32 | 10.8 |
| **Types of alcoholic drinks taken (64)** | | |
| Spirits | 6 | 9.4 |
| Wine | 2 | 3.1 |
| Beer | 11 | 17.2 |
| Homemade beer | 45 | 70.3 |
| **more than 5 alcoholic drinks per day once a month** | | |
| Yes | 20 | 44.4 |
| **Number of alcoholic drinks consumed per weekend (n=57)** | | |
| 1-3 | 43 | 75.4 |
| 4-10 | 14 | 24. 6 |
| **Tired on Mondays after heavy drinking** | 24 | 39.3 |

Of the 300 participants, 84.3% had never smoked, while the rest either formerly smoked or were currently smokers (15.7%). Of those who smoked, 70.9% smoked between 1-5 cigarettes with an average of 3 a day, with 13% smoked between 10-17 cigarettes per day. The average number of cigarettes smoked daily was 3. About a quarter currently snuffed (23.2%), while more than 70% indicated that they had never snuffed. The majority (82.7%) of those who snuffed indicated that they snuffed 1-4 times per day, and the rest reported snuffing about 5-10 times a day. The average number of times that they snuffed a day was 3. The history of alcohol consumption revealed that 22%, of participants currently drank alcohol, while 10.8% formerly drank alcohol. The majority (70.3%) of those who drank alcohol, drank homemade beer, 17.2% commercial beer, while the rest drank spirits and wine. More than half (56%) began drinking alcohol between the ages of 17 and 39 years. Of those who drank alcohol, 75.4% indicated that they consumed up to 3 alcoholic drinks every weekend, and 39.3% reported feeling very tired on Mondays after heavy drinking (Table 4.4).

**Table 4.5 Median values for smoking, snuffing and alcohol consumption**

| | Median | Range |
|---|---|---|
| Number of cigarettes smoked per day (N=31) | 3 | 0 – 40 |
| Age smoking began (years) | 51 | 12 – 18.5 |
| Number of times snuffed per day | 3 | 0 – 10 |
| Age snuffing began (N=58) | 45.5 | 7 – 91 |
| Age begun alcohol use | 36 | 6 – 70 |
| Alcoholic drinks consumed per weekend (n=57) | 2 | 0 |

#### 4.5.2.2 Disability

About a third of participants reported having a disability (34.4%), while 40.4% had trouble walking. However, the most prevalent form of disability was related to sight, with 30.8 % and 34% of participants respectively reporting having trouble seeing someone across the room and trouble reading or seeing individual grains of rice/corn on a plate. Furthermore, about 17.4% indicated that they had trouble speaking and being understood, and 30% reported a hearing disability as shown in Table 4.6.

**Table 4.6 Current disability (n=300)**

| Categories | *n* | % |
|---|---|---|
| Current disability | 103 | 34.4 |
| Trouble walking about | 120 | 40.4 |
| Trouble seeing someone across room | 91 | 30.8 |
| Trouble reading or seeing individual grains of rice/corn on plate (with glasses) | 101 | 34.0 |
| Trouble speaking and being understood | 51 | 17.4 |
| Trouble hearing | 87 | 30.0 |

#### 4.5.2.3 Reported disease symptoms and diagnoses

**Table 4.7 Reported symptoms/disease experienced and diagnosed in last 6 months (n=300)**

| Reported symptoms/diseases | *n* | % |
|---|---|---|
| Chest pain or tightness | 124 | 41.5 |
| Breathlessness | 72 | 24.3 |
| Cough for at least 2 weeks | 88 | 29.3 |
| Wheezing or whistling in the chest | 87 | 29.0 |
| Loose stools/ diarrhea for at least 3days | 49 | 16.4 |
| Vomiting | 37 | 12.4 |
| Loss of appetite | 163 | 54.3 |
| Swelling of feet | 133 | 44.5 |
| Blood in urine | 19 | 6.4 |
| Involuntary weight loss>3kg | 139 | 46.6 |
| Skin rash | 50 | 16.7 |
| Joint pain | 179 | 59.7 |
| Sexually transmitted diseases | 7 | 2.4 |
| **Diagnosed diseases** | | |
| Diabetes | 57 | 19.1 |
| High blood pressure | 189 | 63.2 |
| Stroke | 20 | 6.8 |
| Heart disease/angina/heart attack | 108 | 36 |
| Cancer | 5 | 1. 7 |
| Liver disease/ jaundice/hepatitis | 5 | 1.7 |
| Lung disease | 38 | 12.7 |
| Tuberculosis | 21 | 7 |
| HIV/AIDS | 10 | 3.3 |
| Epilepsy | 7 | 2.3 |
| Allergy | 59 | 20.1 |

The most prevalent reported health symptom was joint pain (59.7%), followed by loss of appetite (54%), involuntary weight loss (46.6%) and swelling of feet (44.5%). More than half (63.2%) had been diagnosed with high blood pressure, and 36% suffered from heart disease/ heart related diseases. One in five (19.1%) had been diagnosed with diabetes, whilst 20.1% were prone to allergy (table 4.7).

#### 4.5.2.4 Social situation, stress, medication use, hospitalisation and HIV/AIDS

Almost all participants were members of a church (90.7%). Feelings of sadness and depression were reported by almost half (47%) of the elderly. Other common social stress situations included loss of business or crop failure (37.7%), death in the family/ major illness of family members (37.1%), major family conflicts (16.5%) and personal illness (21.2%). More than half (57.1%) were using medication regularly, and only 7.2% had been hospitalised during the past 12 months (Table 4.8).

**Table 4.8 Social situation and stress (n=300)**

| Social situation | *N* | % |
|---|---|---|
| Member of a church | 272 | 90.7 |
| Attend service at least 2x a month | 189 | 64.1 |
| Sad, depressed blue, for 2 weeks in past 12 months | 135 | 47.0 |
| Loss of job | 14 | 4.7 |
| Retirement | 15 | 5.1 |
| Loss of crop/business failure | 113 | 37.7 |
| House break in | 29 | 9.8 |
| Marital separation/divorce | 8 | 3.8 |
| Major intra family conflict | 45 | 16.5 |
| Major personal injury or illness | 63 | 21.2 |
| Violence | 20 | 6.7 |
| Death of a spouse | 40 | 13.4 |
| Death or major illness of another family member | 111 | 37.1 |
| Wedding of family member | 69 | 23.0 |
| New job | 22 | 7.4 |
| Birth in the family | 50 | 16.7 |
| Separation from family | 30 | 10.0 |

The result showed that 57.1% used various medication two or more times a week due to ill health. These ranged from analgesics, drugs for hypertension, drugs for diabetes, cancer

treatment drugs, tuberculosis treatment, anti-retroviral drugs, multivitamins, and traditional concoctions and herbs. Of those that had been hospitilised, (7.2%), 75% were hospitalised once. More than half (50.9%) of participants sometimes cared for people living with HIV/AIDS, of whom most were orphans (55%), community members (47.7%) and family members (38%).

**Table 4.9 Medication use, hospitalisation and HIV/AIDS–related questions**

| **Category** | ***n*** | **%** |
|---|---|---|
| **Regular medication (2 or more time a week)** | 170 | 57.1 |
| **Hospitalised in past 12 months** | 20 | 7.2 |
| **No. of times** | | |
| Once | 12 | 75 |
| Twice | 2 | 12.5 |
| Three times | 2 | 12.5 |
| **Sometimes care for people with HIV/AIDS** | 27 | 50.9 |
| Who are they?: | | |
| Children | 37 | 33.9 |
| Grandchildren | 37 | 33.9 |
| Spouse | 3 | 2.8 |
| Family members | 41 | 38.0 |
| Friends | 20 | 18.4 |
| Community members | 52 | 47.7 |
| Orphans | 110 | 55 |

### 4.5.3 Individual Dietary Diversity

As expected, staple foods (like 'papa' from maize meal, samp from maize, sorghum, bread, rice, potatoes) were consumed by almost all the elderly (97.3%), while vitamin A rich fruits and vegetables (carrot, peaches, apricot) were consumed by more than half (51.7%). Only a quarter consumed meat (mainly poultry) (Table 4.10).

The overall dietary diversity scores indicated that more than half (53.7%) of participants had a low dietary diversity score, while 38.5% had a medium score and only 8% had a high diversity (Table 4.11).

**Table 4.10 Individual Dietary Diversity (n=300)**

| New food group of 9 | | Aggregated From original food group of 16 | *n* | % |
|---|---|---|---|---|
| **1** | Starchy staples | 1,2 | 292 | 97.3 |
| **2** | Dark green leafy vegetables | 4 | 7 | 2.3 |
| **3** | Other vitamin A rich fruits and vegetables | 3,6 | 155 | 51.7 |
| **4** | Other fruits and vegetables | 5,7 | 111 | 37.0 |
| **5** | Organ meat | 8 | 76 | 25.3 |
| **6** | Meat and fish | 9,11 | 114 | 38.0 |
| **7** | Eggs | 10 | 20 | 6.7 |
| **8** | legumes and nuts and seeds | 12 | 3 | 1.0 |
| **9** | Milk and milk products | 13 | 1 | 0.33 |

**Table 4 .11 Individual Dietary Diversity Score**

| Dietary diversity Scores | n | % |
|---|---|---|
| Low dietary diversity (≤ 3) | 160 | 53.5 |
| Medium dietary diversity (4 and 5) | 115 | 38.5 |
| High dietary diversity **(≥ 6)** | 24 | 8.0 |

### 4.5.4 Physical Activity Scale for the Elderly (PASE)

#### 4.5.4.1 Leisure time activities

Results of leisure time activities showed that 39.1% of the elderly never walked outside the home, 34.6% seldom walked and 3.7% often walked. Only 36% spent more than 4 hours walking, while 11.6% walked for less than an hour a day. Only 11 participants reported ever participating in leisure activities that included light sports. Of these, 45.5% seldom engaged in light sports, whilst 18.2% hardly ever engaged in light sports (Table 4.12).

## Table 4.12 Leisure time activities during the past 7 days

| **Walk outside your home n=(240)** | **n** | **%** |
|---|---|---|
| **Never** | 94 | 39.1 |
| Seldom (1-2days) | 83 | 34.6 |
| Sometimes (3-4 days) | 54 | 22.5 |
| Often (5-7 days) | 9 | 3.7 |
| **Hours spent walking** | | |
| Less than 1 hour | 25 | 10.4.6 |
| 1 but less than 2hours | 66 | 24.6 |
| 2-4 hours | 63 | 27.6 |
| More than 4 hours | 86 | 36 |
| **Engaged in light sports (n=11)** | | |
| Never | 2 | 18.2 |
| Seldom (1-2days) | 5 | 45.4 |
| Sometimes (3-4 days) | 4 | 36.4 |
| **Hours engaged in light sports activity (n=8)** | | |
| Less than 1 hour | 5 | 62.5 |
| 1hr but less than 2hours | 3 | 37.5 |
| **Moderate sports activity (n=1)** | | |
| Never | 1 | 20.0 |
| Seldom (1-2days) | 1 | 20.0 |
| Sometimes (3-4 days) | 1 | 20.0 |
| Often (5-7 days) | 2 | 40.0 |
| **Hours engaged in activity** | | |
| Less than 1 hour | 1 | 25.0 |
| 1 but less than 2hours | 1 | 25.0 |
| 2-4 hours | 1 | 25.0 |
| More than 4 hours | 1 | 25.0 |
| **Strenuous sports activity** | | |
| Never | 1 | 16.7 |
| Seldom (1-2days) | 3 | 50.0 |
| Often (5-7 days) | 2 | 33.3 |
| **Hours engaged in Strenuous sports activity** | | |
| Less than 1 hour | 4 | 80.0 |
| 2-4 hours | 1 | 20.0 |
| **Exercise to increase muscle strength** | | |
| Never | 1 | 0.9 |
| Seldom | 27 | 24.5 |
| Sometimes | 28 | 25.5 |
| Often | 54 | 49.0 |
| **Hours engaged in Exercise to increase muscle strength activity** | | |
| Less than 1 hour | 70 | 62.5 |
| 1 but less than 2 hours | 29 | 25.8 |
| 2-4 hours | 13 | 11.5 |

#### 4.5.4.2 Household activities and work for pay or as volunteer

Most participants engaged in light housework (83.3%), while 70.4% reported engaging in heavy household chores. Only 19% of participants engaged in home repairs, while 60.2% did lawn or yard work and 62.9% did outdoor gardening. About 60% cared for other children or dependents. Only 10.3% had worked for pay or as volunteers during the past 7 days. Of those who worked, 34.5% worked between 0-2 hours, 34.5% worked between 4-8 hours and 30.7% worked for more than 9 hours (Table 4.13). The median PASE score was 106.1 (range 0 - 263.7). Males had a median score of 107.1 while females had a median score of 106.7.

**Table 4.13 Household activities (N=300)**

| Categories | n | % |
|---|---|---|
| **Light house work** | 249 | 83.3 |
| **Heavy house chores in past 7 days** | 209 | 70.4 |
| Home repairs (n=298) | 57 | 19.1 |
| Lawn or yard work | 180 | 60.2 |
| Outdoor gardening | 188 | 62.9 |
| Caring for another person, (child or dependent) | 179 | 60.3 |
| **Work for Past 7 days for pay or as a volunteer** | 31 | 10.3 |
| **Hours work as volunteer** | | |
| 0-2 | 8 | 34.8 |
| 4-8 | 8 | 34.8 |
| 9-25 | 7 | 30.4 |
| **Category of work that was done during volunteering** | | |
| Mainly sitting | 4 | 12.1 |
| Sitting or standing | 8 | 24.2 |
| Walking and some handling of material | 15 | 45.5 |
| Walking & heavy manual work | 6 | 18.2 |

### 4.5.5 Frailty Scale

Almost all participants (92.6%) reported that they could walk without help, 97.3% could perform basic activities of daily living, 57.9% reported bowel and/or bladder incontinence, and 69.3% had some form of cognitive impairment (Table 4.14).

**Table 4.14 Questions related to frailty**

| Categories | *n* | % |
|---|---|---|
| Walk without help | 276 | 92.6 |
| Perform basic activities of daily living (bathing, using toileting, dressing, eating) | 260 | 97.3 |
| Total dependence on transfers | 11 | 3.7 |
| Bowel and/or bladder incontinent | 104 | 57.9 |
| Some form of cognitive impairment | 188 | 63.1 |

When the scoring was applied, only 26.2 % of participants were categorised as fit, while 52.4% were classified as fit but bladder incontinent. About 10% were categorised as pre-frail (9.7%) and 11.7% were frail.

**Table 4.15 Frailty Scores**

| Score (status) | N | % |
|---|---|---|
| **0 (Fit)** | 78 | 26.2 |
| **1 (Fit, but bladder incontinent)** | 156 | 52.4 |
| **2 (Pre-frail)** | 29 | 9.7 |
| **3 (Frail)** | 35 | 11.7 |

### 4.5.6 Associations

There was no significant difference between the prevalence of frailty in men and women (p=0.68). Participants that were pre-frail or frail were more likely to use paraffin as fuel for cooking compared to the fit group that were more likely to use gas (p=0.02). In terms of mobility, a significantly smaller percentage of frail participants were able to go out (89.1%) compared to the fit group (97%) (p=0.01).

A significantly smaller percentage of the elderly in the fit group (20.4%) experienced breathlessness with usual exercise as compared to the frail group (39.1%) (p<0.01). More participants in the frail group (40.6%) experienced wheezing or coughing compared to the fit elderly (26.1%) (p=0.03). A significantly higher percentage of elderly in the frail group (13%) had been diagnosed with stroke as compared to the fit group (5.0%) (p=0.04). Diagnoses of

lung disease such as asthma was significantly higher in the frail group (22.0%) than in the fit group (10.3%) (p=0.02).

## 4.6 Discussion

Owing to the pivotal role played by the elderly in society and also the fact that their numbers are increasing, the study set out to evaluate the prevalence of frailty and associated factors among the elderly in Lesotho.

### 4.6.1 Socio Demographic Status

As expected, almost all of the participants in the current study (99%) were Basotho (meaning people from Lesotho) and their first language was Sesotho. The fact that the majority of participants in the current study were female (71%) is consistent with findings from other studies (European Institute of Womens Health, 2006; UNDESA, 2013). The latest population and household census in Lesotho also showed that there were more elderly females than males (BoS, 2016).

In terms of marital status, most participants were widowed (61%). These figures are similar to those reported in an earlier study that included pensioners in Manonyane community in Maseru district, which found that 65% of their participants were widowed (Croome and Mapetla, 2007). Being married provides emotional, physical and financial support. A study by Carr et al., (2000) found that widows were more likely to experience anxiety and depression than married persons.

In terms of socio-economic variables, the sample was characterised by poverty and low levels of education (65.8% had only been educated to primary school level). Despite the fact that 81.3% lived in brick and concrete housing, income was low (73.4% earned between M100-M1000 monthly) and access to basic facilities was not ideal (61.7% used a pit latrine only 77% had access to water from their own tap). Education plays an important role in the health and nutritional wellbeing of people. Compared to those with higher academic levels, people with lower educational levels are more likely to become malnourished (Zimmerman et al., 2015). Participants that were pre-frail or frail were significantly more likely to use a cheaper source

of fuel for cooking (paraffin) compared to the fit group that were more likely to use gas, indicating that a lower socio-economic status is related to frailty.

In the current study, most participants were dependent on non-contributory pension allowances that they receive from the government on a monthly basis. Lesotho is one of the few countries in Sub Saharan Africa that have adopted the free non-contributory monthly pension scheme for the elderly 70 years and above (Croome et al*.,* 2007). The introduction of the pension system has narrowed the age dependency ratio (UNDESA, 2013) since there is less reliance on the income and resources of the working class. Despite this, 8.6% of participants reported that they do not earn anything and they are not entitled to pension grants. Very often, the elderly in Lesotho have dependents such as orphaned grandchildren, sick children and other elderly that they are responsible for (Croome and Mapetla, 2007). This was confirmed in the current study where more than half (50.9%) of participants sometimes cared for people living with HIV/AIDS.

More than half of the sample reported that they had lived in an urban area for more than 41 years (53.6%). Compared to rural areas, living in an urban area generally comes with a higher cost of living and families may be more nuclear. In rural areas communal sharing and trading or exchanging foods is more common than in rural areas (e.g. vegetables may be exchanged for maize meal). On the other hand, Bourne et al. (2010), have indicated that rural dwellers are less likely to have access to health care, social services and other goods and services required for healthy living and improved quality of life.

The majority of participants lived in brick and concrete housing. Considering the nature of the weather in Lesotho, brick housing is more likely to provide warmth during winter compared to traditional mud, tin, plank and wood housing. Informal housing is also more likely to be characterised by poor sanitation, insulation and hygiene. As previously mentioned, a large percentage of participants used a pit latrine (61.7%) and 22% used a bucket or pot toilet system that is associated with poorer sanitation (Mara et al., 2010; WHO, 2008).

About a quarter of participants did not have access to water from their own tap and 9.3% reported using water from rivers, dams, boreholes and wells. Water is an essential commodity

and access to safe drinking water contributes to health and quality of life (UNDESA 2014). The water supply in Lesotho is more than adequate (water is exported to neighbouring South Africa) and thus it is unacceptable that access to safe drinking water is not available to all.

Only about half of participants reported that they had access to electricity and household amenities such as a television, radio, refrigerator, stove and/ or paraffin stove. Most participants used gas for cooking, while only 26.4% used electricity for cooking. Access to basic household appliances is an important indicator of quality of life (Wentworth, 2013).

### 4.6.2 Reported health

#### 4.6.2.1 Smoking, alcohol use, symptoms and disease

Almost one in ten participants in the current study currently smoked (8.7%), which is very similar to findings amongst the elderly in America (9.5% of those 65 years and older) (Older Americans, 2010). Smoking predisposes to conditions like lung cancer, hypertension and other respiratory tract infections and is thus discouraged.

More than two in ten participants in the current study used alcohol (22%), with homemade beer being consumed most often. A study by Schoenborn et al., (2014) amongst elderly Americans, showed that 12.5% of elderly participants were moderate drinkers (3-14 drinks per week for men and 3-7 drinks for women), which is lower than the percentage reported in the current study. It is concerning that those that did use alcohol used large amounts of the substance. About a quarter (75.4%) used between 1-3 bottles of alcohol (% alcohol by volume is approximately 5.5% in the Maluti mountain beer and one 750ml bottle of beer contains 3 units. Thus those who drink up to 3 bottles will be consuming close to 9 units) on weekends, while the rest used even more at 4-6 bottles on weekends. These findings are similar to those of a study amongst the elderly in Europe that reported that their participants drank 3-4 units of alcohol a day and about 21 units a week for men and 2-3 units and 14 units for women (a unit is equivalent to 10 ml of pure alcohol) (Frisher, 2015).

Since alcohol crosses the blood brain barrier, excessive intake affects cognition, awareness, focus and behaviour. In addition, alcohol consumption is likely to aggravate health conditions because drug alcohol interactions are common (Sugar et al., 2014).

Assessing health status in the elderly is challenging, especially in developing countries (Rahman and Barsky, 2003). The Survey of Health Ageing and Retirement in Europe (SHARE) reported that close to 40% of the elderly had various degrees of limitations due to health issues, with about 50% reporting long-term health problems (Europa-Eurostat, 2006). In the current study, more than half (54.3%) of participants reported experiencing joint pain and involuntary weight loss (59.7%), while a large percentage experienced a wide range of other symptoms (table 4.9). Self-reported diagnosis of chronic diseases was common, with about two thirds reporting hypertension, type 2 diabetes mellitus (19.1%), heart disease, angina and heart attack (36%), HIV (3.3%) and TB (7 %) (Table 4.9). These chronic diseases predispose the elderly to frailty, malnutrition and consequently increased mortality (Amarya et al*.,* 2015). This was confirmed in the current study where a significantly smaller percentage of the elderly in the fit group experienced breathlessness with usual exercise, wheezing or coughing as compared to the frail group. Furthermore, a significantly higher percentage of elderly in the frail group had been diagnosed with stroke and lung disease than in the fit group. Disability and disease obviously increase the burden on the health care system. According to SHARE, the most prevalent chronic diseases in European elderly include diabetes, hypertension, respiratory tract infections and cardiovascular conditions (Borsch–Supan et al*.,* 2005).

#### 4.6.2.2 Social isolation and stress

Isolation and prolonged stress significantly affect the health and overall wellbeing of an individual, resulting in an increased risk for disease and mortality (White et al*.,* 2009). The elderly often feel as if the younger generation is not involved or interested in them (Ranotsi and Ayuik, 2012. The elderly that are actively involved in social, religious and cultural gatherings are less likely to experience loneliness. In the current study, nine out of ten participants reported being involved in their church, and 64.1% of them attended services at least twice a month. Almost half of participants had, however, experienced some form of

sadness, for 2 weeks in the past 12 months. In view of their socio-economic situation, this is understandable. Other stressors include divorce or separation, violence or death (table 4.9). In Lesotho the burden of HIV/AIDS is a major source of stress.

The elderly are prone to polypharmacy which may result in drug nutrient interactions and a reduced capacity to metabolise drugs. According to Heuberger and Karly (2011), polypharmacy among the elderly in Europe was high 43.4% for those taking 5 or more drugs. In the current study, 57.1% of participants were taking 2 or more drugs. Drugs may also result in side effects such as reduced food intake, nausea, loss of appetite, diarrhoea, weight changes, digestive complications and consequently malnutrition.

### 4.6.3 Dietary diversity

Consumption of a diverse diet containing a variety of food groups is required to achieve nutrient adequacy and health benefits (Vakili et al., 2013; Clausen et al., 2005). Since much of the food that is eaten in Lesotho is imported from South Africa, it is often very expensive (Leduka et al.,2015).

The current study confirmed that the most frequently consumed food was starchy staples (97.3%), which is similar to the findings of other studies undertaken in Lesotho (Rothman et al., 2018) and South Africa (Oldewage-Theron et al., 2011; Steyn et al., 2006; Kennedy 2009). Monotonous diets, based mainly on starches (such as maize meal and bread), and diets that often include little or no animal products and small amounts of fresh fruit and vegetables, have been associated with food insecurity (Kennedy, 2009; Ruel, 2002). In the current study, more than half (51.7%) of participants reported consuming vitamin A rich fruits and vegetables. The fact that peaches were in season at the time that the study was undertaken and that most households have a peach tree (Morris, 2018) is most probably the reason for the relatively high intake of vitamin A rich foods. Only 37% of participants reported consuming other fruits and vegetables. Fruits and vegetables are important sources of vitamins and minerals, fiber and phytochemicals which have major health benefits (Morris, 2018).

Charlton et al. (2001), have documented that the poor micronutrient intake by older black South Africans can be related to the small number of portions consumed from the vitamin C or carotene-rich vegetable and fruit groups.

In the current study, a relatively low percentage of participants consumed healthy protein-rich foods such as dairy (less than 1%), meat and fish (38%), eggs (6.7%), legumes and nuts (1.0%). The intake of protein-rich foods is directly related to socio-economic status (Walsh and Van Rooyen, 2015). Results from the Transition in Health during Urbanisation of South Africans (THUSA) study (Vorster, 2007) performed in the North West Province of South Africa showed higher total and animal-derived protein intake in subjects with the highest incomes.

In terms of scoring, more than half of participants had a low dietary diversity (53.5%), increasing the risk of multiple nutrient deficiencies (Oldewage-Theron et al*.,* 2011; Kruger, 2008) and food insecurity (Kennedy, 2016).

### 4.6.4 PASE

Physical inactivity is a major cause of decline in lean muscle mass and strength (sarcopenia) that may result in the elderly becoming too unfit to carry out activities of daily living, immobility and loss of independence (Campbell, 2012).

The PASE is a measure of physical fitness in the elderly and their ability to maintain quality of life (Campbell, 2012). The PASE Score has been shown to correlate with health status and other physiological and functional measurements, such as hand grip strength and perceived health status (Campbell, 2012) and waist circumference (Logan et al, 2015).

In the current study, the median PASE score was 106.1. This was higher than that found in a Dutch study by Schuit et al*.,* (1997) where the overall Score was 85.5. However, it was similar to that of studies from England where a mean score of 102.7 was noted (Washburn et al., 1993); Japan with a mean score of 114.9 (Hagiwara et al., 2008) and Hong Kong with a mean score of 124.8 (Ku et al., 2012). The median score of men and women in the current study was similar (107.4 in men and 106.0 in women), in contrast to other studies where females had higher scores than men (Ku et al., 2012; Hagiwara et al., 2008; Washburn et al., 1999;

Schuit et al., 1997). Activities that contributed to PASE included housework and gardening, as well as the responsibility of caring for others.

#### 4.7.4.1 Leisure activities

Physical activity that involves walking or other regular exercise and occupational activities promotes good health in the elderly (Keogh et al., 2009; SPARC 2008). In the current study, a relatively large percentage of participants (78%) walked on a daily basis and most spent more than 1 hour a day walking. Walking has been identified as the most common form of physical activity for older people. Although the intensity and duration of walking may differ, research has shown that regular walking is likely to extend one's life span (Rettner, 2017). Furthermore, most elderly seem to prefer light activity to moderate and vigorous activity, since they often fear injury and falls (Rosenberg, et al*.,* 2011). In terms of sports activities, only 11% of participants in the current study reported participating in light activities and only 10% in moderate or strenuous activities during the past 7 days (5% each). The benefits of the elderly being involved in physical activity are numerous. Loprinzi et al. (2015) have shown that the elderly who participated in light-intensity exercise activities for 300 minutes or more a week were 18% healthier than their peers who did not do the activities (Loprinzi et al, 2015). According to these authors, these participants had a lower BMI, smaller waist circumference and better insulin sensitivity and were thus less likely to have chronic morbidities. In terms of the duration of activity, the WHO recommends at least 150 minutes a week moderate activity or 75 minutes a week vigorous activity (WHO, 2018). Very few participants in the current study reached this duration of activity. In terms of mobility, a significantly smaller percentage of frail participants were able to go out compared to the fit group (p=0.01).

#### 4.6.4.2 Household activities and work for pay or volunteering

Engaging in daily activities such as shopping, cleaning, gardening etc. improves the likelihood of maintaining mobility (Nicklett et al., 2016; Lavelle, 2006). The current study found more than 83.3% of participants had done light housework (dusting and washing dishes) within the past 7 days. Furthermore, 70.4% had been involved in doing heavy house chores like scrubbing floors, washing windows, carrying wood and water etc. Others had done repairs

(painting, electrical work, yard work, outdoor gardening etc.). More than 60% were caring for othersand one in ten were still involved in working for pay. According to Sau et al. (2015), the responsibility of caring for others makes a significant contribution to physical activity.

### 4.7 Frailty

The prevalence of frailty was assessed by determining ability to walk without assistance, perform basic activities of daily living, bowel and bladder continence and cognitive impairment. In the current study, almost all participants (92.5%) could walk without assistance. A study by Samawi (2013), showed that the elderly who walked every day were more likely to live longer than those who did not. Furthermore, being able to walk without help signifies independence without reliance on others for activities of daily living (Fonda et al., 2018; LeWine, 2018). Additionally, 93.7% of participants could perform activities of daily living without assistance, confirming independence in the elderly (Covinsky, 2006).

Bladder incontinence is a disability that occurs commonly amongst the elderly. A study of the prevalence of bladder incontinence among community dwelling elderly in Veneto showed that about 53% of women and 59% of men suffered from incontinence (Maggi et al., 2001). Another longitudinal study among elderly women in Japan found that 20% of the participants in their study suffered from bladder incontinence (Kobayashi et al., 2013). In the current study, more than half of participants were classified as fit, but bladder incontinent, indicating that it was the most common form of disability experienced. Bladder incontinence may be caused by stress, haemorrhoids, pelvic floor disorders, neurologic diseases, diabetes or side effects of medication, urine retention, diarrhoea, constipation, damage to nerves in sphincter muscle (Bladder and Bowel dysfunction, 2018).

### 4.8 Conclusion

A large percentage of elderly participants included in this study were characterised by poverty, ill health, low dietary diversity, and high risk of frailty. Frailty was associated with a lower socio-economic situation, lower mobility and higher risk of symptoms and disease. In Lesotho, the HIV epidemic affects the young and the old in different ways. Vulnerability to

frailty and malnutrition among the elderly in Lesotho is increased as a result of social factors that occur as a result of the high HIV burden, increased caregiving responsibilities and financial responsibilities and poverty. In Lesotho, the elderly thus experience a syndemic of HIV/AIDS, caregiving responsibilities, the way that society is treating older people in Lesotho and poverty. Addressing the needs of the elderly requires a comprehensive approach that takes into account the variety of factors that are associated with malnutrition and frailty in the context of the population in which they reside.

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# CHAPTER 5

# MALNUTRITION IN THE ELDERLY AND ASSOCIATIONS WITH SOCIO DEMOGRPAHIC FACTORS AND INDICATORS OF NUTRITIONAL STATUS

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**ABSTRACT**

***Introduction*:** The objective of this study was to establish the nutritional status of elderly residents in Lesotho and to determine how it is associated with socio demographic factors.

***Methods*:** In a cross-sectional survey, a total of 300 elderly participants were recruited from 16 semi-urban communities in Maseru district. Socio-demographic data was collected using a questionnaire. Nutritional status was determined using the Mini Nutritional Assessment (MNA) original questionnaire. Indicators of nutritional status included in the MNA were anthropometry, dietary assessment, global assessment and subjective assessment. Scores of <17, 17-23.5, ≥24, were interpreted as undernutrition, at risk of malnutrition and well-nourished respectively.

***Results:*** More than half (66.0%) of participants were at risk of malnutrition, while 19.4% were malnourished. A significantly higher percentage that were well-nourished used electricity for cooking (39.6%) compared to participants (23%) that were malnourished and at risk of malnutrition combined [95% CI -30.2%; -3.5%]. A significantly higher percentage of well-nourished respondents used flush toilets compared to those that were malnourished and at risk of malnutrition [95% CI -30.8%; -7.7%]. Perceived poor health status and nutritional problems were significantly (positively) associated with malnutrition [95% CI 19.3%; 36.0%] and [95% CI 22.2%; 37.8%] respectively. A significantly higher percentage (9.5%) of respondents that were malnourished had cognitive impairment/depression compared to those that were well-nourished (0%) [95% CI 2.6%; 13.9%].

***Conclusion:*** A large percentage of this elderly sample were at risk of malnutrition or malnourished. These findings further confirm the role of socio economic status and perceived health, on nutritional status, and the need for routine screening thereof in the elderly to ensure timely diagnoses and management of malnutrition.

***Key words***: elderly, community dwelling, Mini Nutritional Assessment, nutrition screening, Lesotho

## 5.1 Introduction

Currently there are more than 46 million elderly people living in Sub-Saharan Africa, and it is estimated that by the year 2050 this number would have increased to 161 million (United Nations Population Division, 2016). The World Health Organization (WHO) defines the elderly as people aged 60 years and older (WHO, 2018). The risk of developing nutrition-related disorders is much higher in the elderly population due to their vulnerability, and also the decrease in daily consumption of food with old age; therefore, timely diagnoses of malnutrition is crucial to ensure appropriate nutritional care (Saghafi-Asl et al., 2018). Malnutrition in the elderly increases the risk of impaired health, quality of life and also leads to increased mortality (Ahmed and Haboubi, 2010; Abolghasem Gorji et al., 2017). Factors that may contribute to poor nutritional status in elderly persons include; reduced appetite, poor dentition (Lee and Frongillo, 2001; Chapman, 2006), malfunction of the gastrointestinal system, chronic diseases, polypharmacy, loneliness and depression (Oliveira et al., 2009; Morley, 2012). These factors often affect eating patterns and food choices (Broeska and Lengyel, 2013). Previous research in Syrian Arab Republic reported that age, level of education, source of income, duration of stay in the nursing home, number of diseases, number of medications taken, anthropometric data and dentition and vision problems significantly affected the nutritional status of people residing in homes for the elderly (Hallaj, 2015).

The Mini Nutritional Assessment (MNA) is a validated nutrition screening tool that was developed for routine screening of the elderly, so as to identify and treat nutrition-related problems in a timely manner (Guigoz and Vellas, 1999). The MNA has proven to be a useful diagnostic tool in the identification of malnutrition in geriatric patients aged 65 years and older, both freely living in the community or institutionalised (Charlton et al., 2007; Inoue and Kato, 2007; Kaiser et al., 2009). In South Africa, malnutrition prevalence of 14.2% has been reported in institutionalized elderly patients using the MNA tool, with the prevalence being higher in those residing in a long-term care facility situated in a lower socio-economic area (Robb et al., 2017).

Lesotho, popularly known as the “mountain kingdom”, is a small country located in the southern part of Africa and surrounded by the Republic of South Africa. Lesotho has a population of about 2.1 million, with the elderly aged 65 years and older forming 8% of the country’s total population (International Food Policy Research Institute, 2015; WFP, 2018). Lesotho faces great socioeconomic challenges such as the HIV/AIDS pandemic, widespread poverty and food insecurity, which have a considerable impact on the economy of the country and on the health and nutritional status of the inhabitants. The nationwide prevalence of HIV is 25%, ranking second highest in the world (UNDP and Lesotho Government, 2015). Furthermore, about 57.1% of people live below the poverty line and 709 394 people are said to be food insecure (FAO, 2010; WFP, 2018). Although only about 9 percent of the country’s total landmass is suitable for cultivation, agriculture remains an important source of livelihood for a greater part of the population. In addition, many poor households, especially those in the rural areas, lack access to arable land, and those who possess land, often do not have the skills and resources to increase on yields (WFP, 2018). In the agricultural areas of the country, subsistence farmers rely widely on rain for the production of maize crop, which is the country’s staple food (FAO, 2010); therefore in times of drought or poor rains, many households become food insecure. High levels of malnutrition have been documented throughout the country, especially in children aged under five years, women of child bearing age and adults (The World Bank, 2015; Rothman et al., 2018). The prevalence of micronutrient deficiencies is also on the rise, co-existing with obesity due to inadequate diet quality and diversity (The World Bank, 2015). In spite of all these challenges, to date, no data exists on the nutritional status of the elderly in Lesotho.

In order to improve the quality of life of the elderly, the government of Lesotho provides a non-contributory monthly pension allowance for the elderly aged 70 years and older (International Labour Organisation, 2016). However, studies have shown that, although this pension has had a positive impact on the physical and social needs of the elderly, it is still insufficient, as most of the funds are often used to support other family members, such as grandchildren that are orphaned as a result of HIV (Croome and Mapetla, 2007; Mugomeri et al., 2017). Consequently, many of the elderly tend to engage in economic activities to improve their livelihoods, which may greatly impact their health and wellbeing. In 2011, 78.9% of the

elderly aged between 60 and 80 years were reported to be involved in active economic activities (Lesotho National Institute of Statistics, 2015). In view of these circumstances, this research aimed to establish the nutritional status of community dwelling elderly participants in urban areas of Maseru, Lesotho and to determine how it is associated with socio demographic factors.

## 5.2 Methodology

### 5.2.1 Participants, study site and sampling

The present study comprised a cross-sectional survey among the elderly residing in Maseru district, Lesotho. Maseru District is the national capital of Lesotho and the largest urban area (BoS, 2007; UNDP, 2016) situated in the northwest of the country bordering the Free State Province of South Africa. The total population of Maseru is 267 000 (2014) (CIA, 2018). To be included in the study, participants had to: 1) be 65 years and older, 2) not intend to relocate during the study period and 3) voluntarily sign informed consent. Elderly persons who were bedridden, and those who were cognitively impaired to such an extent that they could not complete the interview were excluded.

***Sampling***

Maseru is sub-divided into 18 constituencies. For the purpose of this study, four urban constituencies were randomly selected. From the four selected constituencies, 16 communities were further randomly selected within each constituency. Using a list of all the eligible elderly participants, provided by the prospective community authorities (chiefs), 300 participants were randomly selected using Epi info version 6 from Center for Disease Control. Out of a total population of 28,108 elderly people aged 60-79 years living in Maseru (based on the 2006 census) (BoS, 2007), with expected frequency of 20%, confidence limit of 5%, design effect of 1.0, cluster of 4 and confidence interval of 97%, the desired sample size was achieved.

### 5.2.2 Data collection and ethical considerations

The study was approved by the Health Sciences Research Ethics Committee of the University of the Free State, South Africa (ECUFS NR 217/2014). Approval was also granted by the Ethics Committee of the National Institution Review Board of the Ministry of Health, Lesotho (ID71-2015). A site map, together with a list of the elderly aged 65 years and older were used to locate and recruit participants. The study was explained by a field worker to all participants in a preferred language (English or Sesotho), and only participants who signed informed consent were included in the study. In case of illiterate participants, a thumbprint was used as a signature for consent. Participants were informed that participation in the study was voluntary and that all the information obtained would be kept strictly confidential.

Trained field workers (nutritionists) collected the data. All study participants were interviewed at their homes individually on a face-face basis, after which anthropometric measurements were taken.

### 5.2.3 Operational definitions and techniques

Information related to socio-demographic status was collected using a questionnaire adapted from the one used for the Assuring Health in the Free State (AHA-FS) study (Walsh and van Rooyen, 2015). The MNA tool was used to obtain data on the nutritional status of the elderly participants. The tool consists of 18 questions grouped into four sections namely: anthropometric measurements, dietary assessment, a global evaluation and a subjective evaluation (Guigoz, 2006). For anthropometric assessment, weight, height, mid-upper arm circumference (MUAC) and calf circumference (CC) relevant to the elderly population were all measured. All anthropometric measurements were taken in duplicate using standardised techniques (WHO, 1995), and an average of the two measurements was calculated. Weight and height were measured to determine body mass index (BMI). The elderly were measured wearing minimal clothing, and barefoot. Weight was measured using on a high capacity electronic flat scale (Seca 813, Germany) and recorded to the nearest 0.1 kg. Support was provided for the participants to mount the scale with ease. Height was measured using a rigid standiometer and recorded to the nearest 0.1 cm. For participants who were too weak to

stand, calculated weight and height using knee height and mid-upper arm circumference were used. To measure knee height, the participant had to bend the knee and ankle of one leg at a 90 degree angle while sitting on a chair with legs on the floor. A non-stretchable tape measure was placed under the heel of the foot in line with the ankle bone. Measurements were recorded to the nearest 0.1 cm (Nestle Nutrition Institute (NNI), 2011). Mid-upper arm circumference (MUAC) was measured to the nearest 0.1 cm on the non-dominant arm, at the midpoint between the acromion and the olecranon. Calf circumference (CC) was measured to the nearest 0.5 cm, as the largest circumference of the calf, with the knee and ankle bent to 90-degree angle, using a non-stretchable tape measure (Charlton et al., 2007; NNI, 2011).

The dietary assessment included eight questions related to how many full meals were consumed daily; daily servings of dairy; weekly servings of beans or eggs; daily consumption of meat, fish or poultry; daily servings of fruits or vegetables; food intake decline over the past three months due to loss of appetite, digestive problems, chewing or swallowing difficulties; the daily fluid intake; and the need for feeding assistance.

The global evaluation consisted of six questions related to where the participants live (either alone or in a nursing home); prescription drug use; presence of psychological stress or acute disease; mobility; neuropsychological problems and the presence of pressure sores or ulcers.

The subjective assessment included questions that enabled participants' to express their self-view of nutritional status and how participants perceived their own health status in comparison to their peers.

The total MNA scores ranges from 0 to 30 points and were categorised and interpreted as follows: MNA score <17 points indicated malnutrition; MNA score from 17 to 23.5 points indicated a risk of malnutrition and a good nutritional status (well-nourished) was defined by an MNA score ≥ 24 points (Guigoz and Vellas, 1999).

BMI values were grouped into the following categories on the MNA questionnaire to calculate the total MNA score; 0= BMI < 19 kg/$m^2$; 1= BMI 19 kg/$m^2$ to < 21 kg/$m^2$; 2= BMI 21 kg/$m^2$ to < 23 kg$m^2$; and 3= BMI > 23 kg/$m^2$. In addition, BMI values were further interpreted according to the optimal BMI range for the elderly as described by Winter et al. and the Leading nutrition recommendations for BMI in the elderly aged 65 years and older. The authors in the

publication by Winter et al. demonstrated that a BMI range of 24.0-30.9 kgm$^2$ was associated with the lowest all-cause mortality in the elderly (Winter et al., 2014), while the Leading nutrition new BMI classifications are as follows: <22.9 (Underweight); 23-30.9 (Healthy weight) and >31 Overweight (Leading Nutrition, 2018).

### 5.2.4 Pilot study

A pilot study was conducted on 10 elderly participants from the selected communities to determine whether the questions in the questionnaire were well understood by participants and to establish the average time needed to complete the questionnaire and anthropometric measurements. No changes were made to the questionnaire after the pilot; therefore, the data obtained was included in the study.

### 5.2.5 Statistical analysis

The data analysis for this study was generated using SAS software, Version 9.4 of the SAS System for PC. Copyright © 2018 SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA. Descriptive statistics, namely frequencies and percentages were calculated for categorical data. Prevalence of malnutrition or at risk of malnutrition was calculated and presented as percentages. The MNA classifications of malnutrition and at risk of malnutrition were grouped together and compared to the well-nourished group. The two groups were assessed to establish their relationship with socio-demographic factors by means of 95% confidence intervals (CI).

## 5.3 Results

### 5.3.1 Participant characteristics and household data

A total of 300 elderly participants were included in the study. Of these, 87 (29.0%) were male and 213 (71.0%) were female. The median age was 74 years (range: 64-95 years). Table 5.1 presents data on the socio-demographic and household profile of the study population.

**Table 5.1 Socio-demographic and household profile (N =300)**

| | N | % |
|---|---|---|
| Age category (years) | | |
| **65-69** | 84 | 28.8 |
| **70-74** | 81 | 27.0 |
| **75-79** | 66 | 22.0 |
| **80-84** | 37 | 12.3 |
| **85+** | 32 | 10.7 |
| **Gender** | | |
| Males | 87 | 29 |
| Females | 213 | 71 |
| **Number of years residing in urban area** | | |
| >10 years | 32 | 10.7 |
| 10-20 | 29 | 9.7 |
| 21-30 | 23 | 7.6 |
| 31-40 | 47 | 15.7 |
| 41+ | 169 | 56.3 |
| **Marital status** | | |
| Never married | 17 | 5.6 |
| Currently married | 48 | 16.0 |
| Living with partner | 46 | 15.3 |
| Widowed | 183 | 61.0 |
| Separated | 3 | 6.3 |
| Divorced | 3 | 0.3 |
| **Level of education (n=299)** | | |
| None | 35 | 11.7 |
| Primary school | 197 | 65.9 |
| Secondary school | 47 | 15.7 |
| Tertiary | 19 | 6.4 |
| Don't know | 1 | 0.3 |
| **Occupation (n=299)** | | |
| Unemployed | 129 | 43.1 |
| Self-employed | 21 | 7.0 |
| Full-time wage earner | 9 | 3.0 |
| Pension[a] | 140 | 46.9 |
| **Household income[b] (n=298)** | | |
| None | 13 | 4.4 |
| 100-500 | 138 | 46.3 |
| 501-1000 | 81 | 27.2 |
| 1001-3000 | 43 | 14.4 |
| 3001-5000 | 3 | 1.0 |
| Over 5000 | 7 | 2.3 |
| Don't know | 13 | 4.4 |
| **Number of people contributing to household income** | | |
| 0-3 | 289 | 96.3 |
| 4-8 | 11 | 3.7 |

[a] Monthly household income in Lesotho Maloti (M); M1 is approx. $0.08

[b] Includes non-contributory old age pensions & normal pensions

Fifty-six percent of the elderly had been residing in the urban area for over 41 years. The majority (65.5%) had primary school education, with only 6.3% having obtained tertiary education. More than half of the elderly (61.0%) were widowed. Unemployment was present in 43.1% and 46.9% were pensioners. The monthly household income reported by most (73.5%) elderly participants ranged from 100 to 1000 Lesotho Maloti (approximately US$8.3 to US$83); and in almost all the households (96.3%), an average of three people contributed to this income. Furthermore, 70% of the participants reported the income to be the same in the 6 months prior to the research being conducted. Results on basic household amenities (Table 5.2) shows that most of the elderly had access to electricity (69.2%), and water from their own tap (77.3%). The majority of participants did not have access to flush toilets (88.7%), with the pit latrine (61.7%) being the most commonly used toilet facility. Gas (44.1%) was the main source of fuel for cooking in most households. Most households had working stoves (73.8%), television (51.3%) and radio (72.3%).

**Table 5.2 Basic household amenities (N=300)**

| | ***n*** | **%** |
|---|---|---|
| **Type of dwelling (n=299)** | | |
| Brick, concrete | 243 | 81.3 |
| Traditional mud | 11 | 3.7 |
| Tin | 8 | 2.7 |
| Plank, wood | 1 | 0.3 |
| Other | 36 | 12.0 |
| **Electricity** | 207 | 69.2 |
| **Type of toilet** | | |
| Flush | 34 | 11.3 |
| Pit | 185 | 61.7 |
| Bucket ,pot | 66 | 22 |
| VIP | 15 | 5 |
| **Fuel for cooking (n=299)** | | |
| Electric | 79 | 26.4 |
| Gas | 132 | 44.1 |
| Paraffin | 67 | 22.4 |
| Wood, coal | 11 | 3.6 |
| Sun | 5 | 1.6 |
| Open fire | 5 | 1.6 |

| | | |
|---|---|---|
| **Source of drinking water** | | |
| Own tap | 232 | 77.3 |
| Communal tap | 40 | 13.3 |
| River, dam | 4 | 1.3 |
| Borehole, well | 13 | 4.3 |
| Other sources | 11 | 3.7 |
| **Household appliances** | | |
| Working TV | 154 | 51.3 |
| Working Radio | 217 | 72.3 |
| Working Refrigerator | 145 | 48.6 |
| Working Stove (gas/ electricity) | 220 | 73.8 |
| Working Primus/paraffin stove | 190 | 63.7 |
| Working microwave | 87 | 29.1 |

### 5.3.2 Anthropometric assessment

The median BMI of participants was 25.2 (14.5-46.1) kg/m$^2$, which according to the new classifications by Winter et al. are within the ideal range for BMI for the elderly (Winter et al., 2014).

**Table 5.3: Body mass index, mid-upper arm circumference, calf circumference and perceived weight loss (N=300)**

| | *n* | % |
|---|---|---|
| ***BMI (kg/m$^2$)*** | | |
| BMI < 19 | 42 | 14 |
| 19 ≤ BMI < 21 | 29 | 9.6 |
| 21 ≤ BMI <23 | 38 | 12.6 |
| BMI ≥ 23 | 191 | 63.6 |
| ***Mid Arm circumference (cm)*** | | |
| MUAC < 21 | 6 | 2.0 |
| 21 ≤ MUAC ≤ 22 | 4 | 1.3 |
| MUAC >22 | 290 | 96.7 |
| ***Calf circumference (cm)*** | | |
| CC < 31 | 34 | 11.3 |
| CC ≥ 31 | 266 | 88.7 |
| ***Perceived weight loss in last 3 months*** | | |
| Weight loss during last 3 months | 52 | 17.3 |
| Does not know | 63 | 21 |
| Weight loss between 1 and 3 kg | 64 | 21.3 |
| No weight loss | 121 | 40.3 |

More than half (63.6%) had a BMI > 23 kg/m2, and 23.6% had BMI < 21 kg/m2, which are classified as healthy weight and underweight respectively in the elderly 65 years and older (Leading Nutrition, 2018). Calf circumference measurements showed that 88.7% had CC ≥33 cm, and results for MUAC revealed that almost all the participants (96.7%) had MUAC greater than 22 cm. Finally, 40.3% perceived no weight loss during the past three months (Table 5.3).

### 3.3 Dietetic assessment

Most (62.3%) participants consumed three full meals daily. Fifty-three percent reported to consume none, or just one type of protein rich food on a daily basis, while 69.3% reported a daily consumption of two or more servings of fruit and vegetables.

**Table 5.4 Recent decline in food intake, consumption of fluids, and the need for feeding assistance (N = 300)**

| | *n* | % |
|---|---|---|
| ***Full meals eaten per day (n=299)*** | | |
| 1 meal | 6 | 2.0 |
| 2 meals | 107 | 35.7 |
| 3 meals | 186 | 62.3 |
| ***Consumption of dairy, beans/egg, meat etc.*** | | |
| 0 or yes to 1 | 160 | 53.3 |
| Yes to 2 | 92 | 30.6 |
| Yes to 3 | 48 | 16.0 |
| ***Consume 2 or more serving of fruits or vegetables daily*** | | |
| Yes | 208 | 69.3 |
| No | 92 | 30.7 |
| ***Daily fluid consumption (water, juice, coffee, tea, milk, wine) (n=299)*** | | |
| Less than 3 glasses | 35 | 11.7 |
| 3 to 5 glasses | 80 | 26.7 |
| More than 5 glasses | 184 | 61.5 |
| ***Need for feeding assistance (n=299)*** | | |
| Unable to eat without assistance | 0 | 0 |
| Self-fed with some difficulties | 3 | 1 |
| Self-fed without any problem | 296 | 99 |
| ***Declining food intake over the past three months (n=299)*** | | |
| Severe loss of appetite | 34 | 11.3 |
| Moderate loss appetite | 116 | 38.8 |
| No loss of appetite | 149 | 49.8 |

Almost all the elderly participants self-fed without any problem (99.0%); however, 50.1% reported loss of appetite in the past three months, with 11.3% having severe appetite loss, whilst 38.8% had moderate appetite loss (Table 5.4).

### 5.3.4 Global evaluation

The majority (80.7%) of the elderly participants resided independently. Thirty percent reported using more than three medications daily, and only 4.4% were physically immobile. Of all the participants, 7.3% reported pressure sores. Psychological stress was reported in 25.0% of participants and 46.3% experienced some form of cognitive impairment (Table 5.5).

### 5.3.5 Subjective assessment

**Table 5.5: Mobility, neuropsychological problems, perceived health and perceived nutritional problems (N=300)**

| | *n* | % |
|---|---|---|
| ***Global assessment*** | | |
| **Mobility** | | |
| Bed bound | 4 | 1.4 |
| Able to get out of bed/chair but does not go out | 9 | 3.0 |
| Goes out | 287 | 95.6 |
| **Neuropsychological Problem** | | |
| Severe dementia | 23 | 7.6 |
| Mild dementia | 116 | 38.7 |
| No psychological problems | 161 | 53.7 |
| ***Subjective assessment*** | | |
| **Perceived Health status compared to others *(n=299)*** | | |
| Not as good | 81 | 27.0 |
| Does not know | 36 | 12.0 |
| As good | 115 | 38.4 |
| Better than others | 67 | 22.4 |
| **Perceived Nutritional problem** | | |
| Major malnutrition | 81 | 27 |
| Does not know or moderate malnutrition | 101 | 33.7 |
| No nutritional problem | 118 | 39.3 |

Results relating to self-view on health and nutritional status revealed that 60.8% of the elderly participants perceived their health status to be either “as good” or “better” as compared to

others, while one in four (27.0%) perceived themselves to have a major nutritional problem. Lastly, 39.3% felt that they did not have any nutritional problems (Table 5.5).

### 5.3.6 Final score

The median MNA score was 20.5 (range 9.0-28.0). The final scores obtained for each of the four sections included in the MNA illustrate that 66.0% of the elderly participants were at risk of malnutrition, 19.4% were malnourished and 14.6% were well-nourished (Table 5.6). There was no differences in gender with regards to being malnourished or healthy.

**Table 5.6 Final MNA Score (N=300)**

| MNA Score | *n* | % |
|---|---|---|
| Malnutrition (score of <17) | 58 | 19.4 |
| At risk of malnutrition (score of 17-23.5) | 198 | 66.0 |
| Well-nourished (Score of ≥24) | 44 | 14.6 |

A significantly higher percentage of respondents that were malnourished used pit latrines as a toilet facility as compared to those that were well nourished [95% CI 8.8%; 36.2%]. In addition, a significantly higher percentage of well-nourished respondents used flush toilets as compared those that were malnourished [95% CI -30.8%; -7.7%]. A significantly higher percentage of respondents (39.6%) that were well-nourished used electricity as a fuel for cooking compared to respondents (23%) that were malnourished [95% CI -30.2%; -3.5%]. Of those who perceived weight loss greater than 3kg (17.3%), the percentage in the malnourished group was significantly higher than that in the well-nourished group [7.7%; 23.3%]. A significantly higher percentage (9.5%) of respondents that were malnourished had cognitive impairment/depression as compared to those that were well-nourished (0%) [95% CI 2.6%; 13.9%]. Perceived “poor” health status and nutritional problems were significantly associated with malnutrition [95% CI 19.3%; 36.0%] and [95% CI 22.2%; 37.8%] respectively.

## 5.4 Discussion

This study population was characterised by high levels of poverty and poor nutritional status as determined by the overall MNA score. The findings from the current study revealed that a

large percentage of the elderly residing in urban Maseru were generally at risk of malnutrition. Previous research in Lesotho has reported malnutrition to be a common problem affecting the elderly, both institutionalised and community dwelling (Ministry of Social Development, 2014; Sello et al., 2018). In Lesotho, the causes of malnutrition in the elderly have been attributed to both economical and physiological circumstances. Elderly persons tend to be food insecure due to lack of money to purchase food (Ministry of Social Development, 2014). Moreover, those involved in subsistence farming face challenges of poor food production due to adverse weather conditions, pests, lack of fertilizers and lack of high yield seeds (WFP, 2018). Outcomes from focus group discussions amongst the elderly in Lesotho revealed that this group suffered from physiological problems such as dental problems, sensory losses and loss of appetite due to chronic medication intake, which hindered food intake. Furthermore, at times, the incapability to cook also contributed to the elderly skipping meals (Ministry of Social Development, 2014). Most of the participants in this study resided independently, and often had to prepare their own food.

In this research, better living conditions were associated with good nutritional status. The use of flush toilets and electricity as a fuel for cooking played a significant role on the nutritional status of participants as determined by the MNA scores. The use of flush toilets and electric stoves was associated with better nutrition, whilst using a pit latrine was associated with being malnourished. Nationally, the pit latrine with slab has been reported to be the most commonly used toilet facility in both urban and rural areas of Lesotho (Lesotho National Institute of Statistics, 2015). Hence, the findings were consistent with what was observed at a national level in Lesotho. In low-income countries, the use of pit latrines is popular due to their low cost and availability (Cairncross et al., 2010). Several reasons could explain why the toilet facility may influence nutritional status such as increased risk of infections due to poor sanitation (WHO, 2015). However, in this current population, the link between the toilet facility and malnutrition may have been related to low household income and food insecurity. Although food insecurity was not measured in this research, results from household income show that most participants had a monthly household income of less than US$100, increasing their risk for food insecurity. Furthermore, although the results from the dietary assessment

shows that most participants ate three full meals daily, the quantity and quality of these meals was not assessed and may have been largely inadequate.

Despite the high levels of malnutrition and malnutrition risk in this study population, a large number of participants (63.6%) had BMI greater than 23 kg/m$^2$. BMI is known to normally increase with advancing age (Babiarczyk and Turbiarz, 2012; Mathus-vliegen, 2012), and therefore the high percentage of elderly with higher BMI observed in this research is in line with other findings. According to the recommended classifications of BMI in the elderly (Leading nutrition, 2018), the study participants fell within the healthy weight and/ or overweight categories. Of those participants that had a BMI greater than 23 kg/m$^2$, 21% (n=63) had a BMI greater than 31 kg/m$^2$ which is classified as overweight in the elderly. Furthermore of those same participants, 9.7% (n=29) had a BMI greater than 35 kg/m$^2$, posing great concern (results not shown). Obesity and overweight in the elderly often leads to increased morbidity, functional disability and poor quality of life (Amarya, et al., 2014; Boateng et al., 2017). A 21% increased risk for mortality was previously reported in the elderly with a BMI range of 35.0-35.9 kg/m$^2$ (Winter et al., 2014). On the contrary, 23.6% of elderly participants were underweight (BMI <22.9 kg/m$^2$) based on BMI criteria set by the Leading Nutrition group (Leading nutrition, 2018). Winter et al., (2014) also reported a 37% increase in mortality risk associated with a BMI <21.0 kg/m$^2$ (HR: 1.37; 95% CI: 1.30, 1.46) in elderly people. With all this stated, it crucial to constantly monitor the weight of the elderly. However, it is also important to note that using BMI as a tool for reporting malnutrition in the elderly has its limitations. According to Leading Nutrition, BMI does not take into account fat, muscle or fluid mass, and in the elderly muscle mass is often lower than fat mass, and some medical conditions can elevate fluid mass (Leading nutrition, 2018). Moreover, the loss of height in the elderly may alter BMI calculations and lastly, the presence of sarcopenia is not considered in BMI calculations (Ribeiro and Kehayias, 2014).

Malnutrition and the risk for malnutrition is common in elderly that are cognitively impaired (Isaia et al., 2011; Roque, Salva and Vellas, 2013). The results is this study showed that the percentage of elderly suffering from cognitive impairment was significantly greater in those that were malnourished as compared to those that were well nourished. Amongst community

dwelling elderly, the risk for malnutrition has been previously associated with, and predicted by depression, poor cognition and difficulty in meal preparation (Iizaka et al., 2008; Suzana et al., 2013; Naidoo et al., 2015). In this study perceived "poor" health and nutritional status was higher in participants that were malnourished. These findings were consistent with previous findings in the elderly (Chavarro-Carvajal et al., 2015).

## 5.5 Conclusion

The present study showed that malnutrition and the risk of malnutrition was of great concern in the elderly residing in urban areas of Maseru, Lesotho. Socio demographic factors such as the type of toilet facility and the fuel used for cooking were significantly associated with nutritional status. Malnutrition was also associated with cognitive impairment and perceived poor health and nutritional status. These findings confirmed the role of socio economic status and perceived health, on nutritional status, and the need for routine nutritional screening in the elderly to ensure timely diagnoses and management of malnutrition and associated conditions.

## 5.6 Reference list


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# CHAPTER 6

# THE IMPACT OF A FERMENTED MILK AND PHYSICAL ACTIVITY INTERVENTION ON INDICATORS OF FRAILTY AND MALNUTRITION IN THE ELDERLY IN LESOTHO

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**ABSTRACT**

**Objectives:** The study aimed to assess the impact of a fermented milk and physical activity intervention on indicators of frailty and malnutrition in the elderly in Lesotho

**Methods:** A pre-test–post-test study design was applied in four urban constituencies (16 communities) in the Maseru District. After completion of a baseline study during which the level of frailty and malnutrition was determined in 300 elderly participants (65 years and above living freely in the community), 120 of those that were classified as pre-frail, frail and/or malnourished were selected to participate in the intervention phase of the study. Information about socio-demography, reported health, Individual Dietary Diversity (IDD), nutritional status (Mini Nutritional Assessment, MNA), physical activity (Physical Activity Scale in the Elderly, PASE) and frailty (Rockwood scale) were collected before and after the three month interventions.

The 120 participants were divided into three groups of 40 each. Group 1 received the fermented milk and exercise intervention; Group 2 received only the fermented milk intervention and Group 3 comprised the control group. The interventions were delivered over a 12 week period. In Groups 1 the physical activity intervention consisted of sessions lasting for 1 hour a day on three days a week. After the exercise session the fermented milk was given to participants. In Groups 2 the fermented milk was delivered to participants every second day.

**Results:** About two thirds of the study population were female, with a median age of between 74.4-76.1 years (range 64.3-94 years). More than 60% were widowed and had a low literacy level (primary school). More than 80% lived in brick or concrete houses, and used pit latrines. Chest pain, loss of appetite and joint pain were the most commonly experienced symptoms, while hypertension and heart disease were the most commonly diagnosed conditions. More than 85% of participants regularly attended church. Major sources of stress included crop or business failure and major intra family conflict. More than 70% of participants in the intervention groups had cared for people infected with HIV/AIDS at some time.

At baseline more than 70% of all participants fell in the low dietary diversity score category (70.7% in the both group, 82.2% in the milk group and 70.2% in the control group). Only 4.9% of participants in the both group, 17.8% of those in the milk group and 12.8% in the control group were classified as well-nourished according to the NMA score. At baseline the median PASE score of all was 113.3 in the both group, 102.9 in the milk group and 103.7 in the control group, indicating a low level of physical activity. In terms of the frailty score, at baseline 12.5% of the participants in the both group, 28.9% of those in the milk group and 28.9% in the control group were categorised as pre frail and frail. After twelve weeks of intervention, no significant improvements in any of the indicators of frailty or malnutrition were observed in any of the groups.

**Conclusion:** It is probable that the amount of fermented milk that was provided was not enough to impact on measures of frailty and malnutrition in participants. The socio-economic and food security situation of the elderly in Lesotho resulted in sharing of the food supplement. Research related to the unique nutrition situation and development, implementation and evaluation of relevant nutrition interventions are urgently required.

**Keywords:** Elderly, Lesotho, frailty, malnutrition, nutrition and exercise interventions

## 6.1 Introduction

In both the developed and developing world, the number of elderly people (aged 60 years and older) is steadily increasing (Lorenzo-Lopez et al., 2017), due to improved survival and longer life expectancy (He et al., 2016). According to the United Nations (UN, 2015), the global number of elderly is projected to increase from 901 million in 2015 to 1.4 billion in 2030.

The latest Human Development Index shows that Lesotho is among the 49 poorest countries in the world and is ranked 161 out of 188 (Human Development Index, 2016). According to Ranotsi and Aiyuk (2012), there has been a decline in the care for elderly people by younger ones in Lesotho. Reasons for this include the increasing number of younger people who attain higher levels of education, especially women, and often work away from home for career and financial reasons, (Ranotsi and Aiyuk, 2012) and the fact that the adult children of the elderly are ill or have died from Acquired Immune Deficiency Syndrome (AIDS), increasing the care-giving responsibilities of the elderly (LDHS, 2013).

Adequate nutrition, physical activity, healthy aging and the ability to function independently are essential components of good quality of life (Wolfe, 2015; Ismail and Pieterse, 2003). Most of the elderly in developing countries reach their senior years after a lifetime of poverty and deficiency, poor access to health care services and an inadequate diet (Nguyen et al., 2015; Charlton and Rose, 2001; Ismail, 1999).

The concepts of ageing and frailty are evolving. According to Clegg et al. (2013), frailty is a clinical state characterised by an increased risk of becoming dependent on others when exposed to a stressor. On the one hand researchers such as Fried et al., (2001) have focused on the physical components of frailty such as unintentional weight loss, muscle weakness (sarcopenia), slow walking speed, low physical activity and fatigue, while other researchers such as Rockwood (2005), are of the view that a measure of frailty that incorporates a diverse range of deficits including functional limitations, morbidity, disability, psychosocial status and cognitive ability is a better predictor of autonomy, institutionalisation and mortality (Rockwood et al., 2005). Some or all manifestations of frailty are caused by underlying factors,

separate from aging but most likely to develop and progress with aging (Cruz-Jentoft et al., 2017).

Frailty is significantly associated with disability (Chang et al., 2017; Cruz-Jentoft et al., 2014; Coker et al., 2012; Cereda et al., 2008) and malnutrition is an important component of the frailty syndrome (Cruz-Jentoft et al., 2017; Combs et al., 2013; Pepersack, 2009). Good nutrition is paramount to successful aging and ensuring that the body is adequately nourished is essential to achieving this goal. On the contrary, failure to consume a well-balanced diet over time results in malnutrition, morbidity and mortality (Chang, 2017; Chang and Lin, 2016; Manal et al., 2015; Guigoz et al., 2002).

According to Lee et al., (2014), however, appropriate interventions have the potential to prevent, postpone or even reverse frailty and malnutrition. The results from a number of systematic reviews of intervention studies have shown that the elderly that are frail and sarcopenic can benefit from exercise (Jadczak et al., 2018; Silva et al., 2017; de Labra et al., 2015) and nutrition interventions (Manal et al., 2015; Schultz et al., 2016), especially when they are combined (Lozano-Montoya et al., 2017; Dedeyne et al., 2017; Artaza-Artabe et al., 2016). In contrast to the developed world, limited research has been undertaken amongst the frail elderly in the developing world (Nguyen et al., 2015; Charlton and Rose, 2001). Important differences between developed and developing countries, such as those related to food security and socio-economic status, complicate the situation of the elderly in developing countries.

## 6.2 Methodology

### 6.2.1 Study design, setting, population and sampling

Lesotho has a total population of 2 007 201 (BoS, 2016). The current study was conducted in Maseru which is the National Capital of Lesotho. According to the most recent 2014 Lesotho census, the population of people aged 65 years and older increased from 5.7 % in 2006 to 6.1% in 2014 with a total elderly population of 122 576 (BoS, 2016).

The intervention phase of the study was preceded by a baseline study undertaken amongst 300 elderly participants in Lesotho. The elderly who had participated in phase one of the study and were classified as frail pre-frail (according to the Rockwood scale) and/or malnourished (according to the Mini Nutritional Assessment (MNA)) were eligible to participate in the intervention phase (phase 2).

Two of the constituencies (10 communities) in phase 1 (baseline) were randomly allocated to the two intervention (experimental) groups, by a biostatistician. Five (5) communities in the Abia Constituency and one in Lithabaneng Constituency namely Ha Mapetla, Ha Penapena, Ha Bosofo, Ha Matala, Makhoakoeng and Ha Nelese respectively, were randomly selected for the fermented milk and physical activity intervention. Four (4) other communities in the Motimposo Communities namely Ha Tsui, Ha Tsenola Ha Tsosane and Motimposo were randomly assigned for the milk only intervention. The other six (6) communities in the Stadium Area and Lithabaneng constituencies namely Stadium area, Fokothi, Moshoeshoe II, Sea-point, Upper Thamae and Lower Thamae were assigned to the control group.

In each group, 40 participants were randomly selected to participate in phase two of the study. The three groups included experimental group 1 that received both the physical activity and fermented milk supplementation intervention; experimental group 2 that received the fermented milk supplementation intervention; and the control group (no intervention).

### 6.2.2 Data collection and ethical considerations

The study was approved by the Health Sciences Research Ethics Committee of the University of the Free State, South Africa (ECUFS NR 217/2014). Approval was also granted by the Ethics Committee of the National Institution Review Board of the Ministry of Health, Lesotho (ID71-2015). A site map, together with a list of the elderly aged 65 years and older were used to locate and recruit participants. The study was explained to all participants by a field worker in their preferred language (English or Sesotho), and only participants who signed informed consent were included in the study. In case of illiterate participants, a thumbprint was used as a signature for consent. Participants were informed that participation in the study was voluntary and that all the information would be kept strictly confidential.

Trained field workers (nutritionists) together with the researcher collected the information related to socio-demography, reported health, dietary diversity, physical activity, malnutrition and frailty in a face to face interview with each participant. Anthropometric measurements were also taken. At follow-up information related to socio-demography and reported health were not collected again.

### 6.2.3 Operational definitions and techniques

For dietary intake assessment, an Individual Dietary Diversity Score (IDDS) was calculated from a 24-hour dietary recall that was completed for each participant. From this the intake of nine food groups was assessed (eaten or not eaten during the previous 24 hours): 1) starchy staples 2) dark green leafy vegetables 3) other vitamin A rich fruits and vegetables 4) other fruits and vegetables 5) organ meat 6) meat and fish 7) eggs 8) legumes, nuts and seeds 9) milk and milk products. The IDDS was calculated by means of a simple count of the food groups that were eaten and was classified as low ($\leq$ 3), medium (4 and 5) or high ($\geq$ 6) (Kennedy et al., 2011).

To obtain data on the nutritional status of the elderly, the MNA® original tool was used. The MNA is made up of 18 questions grouped into four segments namely: anthropometric assessment , dietary assessment, a global evaluation and a subjective evaluation (Guigoz, 2006). Anthropometric assessment conducted included weight, height, mid-upper arm circumference (MUAC) and calf circumference (CC). All anthropometric measurements were taken in duplicate using standardised techniques (WHO, 2016), and an average of the two measurements was calculated. Weight and height were measured to determine body mass index (BMI). Participants were measured wearing minimal clothing, and barefoot. Weight was measured using a high capacity electronic flat scale (SECA 813, Germany) and recorded to the nearest 0.1 kg. Support was provided for the participants to mount the scale with ease. Height was measured using a rigid standiometer and recorded to the nearest 0.1 cm. For participants who were too weak to stand, calculated weight and height using knee height and mid-upper arm circumference were used. To measure knee height, the participant had to bend the knee and ankle of one leg at a 90 degree angle while sitting on a chair with legs on the floor. A non-

stretchable tape measure was placed under the heel of the foot in line with the ankle bone. Measurements were recorded to the nearest 0.1 cm (Nestle Nutrition Institute (NNI), 2014). Mid-upper arm circumference (MUAC) was measured to the nearest 0.1 cm on the non-dominant arm, at the midpoint between the acromion and the olecranon. Calf circumference (CC) was measured to the nearest 0.5 cm, as the largest circumference of the calf, with the knee and ankle bent to 90-degree angle, using a non-stretchable tape measure (Charlton et al., 2007; NNI, 2011).

The dietary assessment included eight questions related to how many full meals were consumed daily; daily servings of dairy; weekly servings of beans or eggs; daily consumption of meat, fish or poultry; daily servings of fruits or vegetables; decline in food intake over the past three months due to loss of appetite, digestive problems, chewing or swallowing difficulties; daily fluid intake; and the need for feeding assistance.

The global evaluation consisted of six questions related to where the participants live (either alone or in a nursing home); prescription drug use; presence of psychological stress or acute disease; mobility; neuropsychological problems and the presence of pressure sores or ulcers.

The subjective assessment included questions that enabled participants to express their self-view of nutritional status and how they perceived their own health status in comparison to their peers.

The total MNA scores ranges from 0 to 30 points and were categorised and interpreted as follows: MNA score <17 points indicated malnutrition; MNA score from 17 to 23.5 points indicated a risk of malnutrition and a good nutritional status (well-nourished) was defined by an MNA score ≥ 24 points (Guigoz & Vellas, 1999).

BMI values were grouped into the following categories on the MNA questionnaire to calculate the total MNA score; 0= BMI < 19 kg/m$^2$; 1= BMI 19 kg/m$^2$ to < 21 kg/m$^2$; 2= BMI 21 kg/m$^2$ to < 23 kgm$^2$; and 3= BMI > 23 kg/m$^2$. In addition, BMI values were further interpreted according to the optimal BMI range for the elderly as described by Winter et al., (2014), and the Leading Nutrition recommendations for BMI in the elderly aged 65 years and older. The authors in the publication by Winter et al., (2014) demonstrated that a BMI range of 24.0-30.9 kgm$^2$ was

associated with the lowest all-cause mortality in the elderly, while the Leading Nutrition BMI classifications are as follows: <22.9 (Underweight); 23-30.9 (Healthy weight) and >31 Overweight (Leading Nutrition, 2018).

MNA scores were categorised as **Malnutrition** (score of <17), **At risk of malnutrition** (score of 17-23.5) and **Well-nourished** (Score of ≥24).

Level of physical activity was assessed using the Physical Activity Scale for the Elderly (PASE). PASE a valid and reliable physical activity tool specifically designed for the elderly by Washburn et al., (1993), over 20 years ago. It entails a 7day recall of self-reported leisure, household and occupational activity. PASE scores were calculated from weights and frequency values for each of the 10 types of activities, using an hours per day conversion table. A PASE score of ≥140 in men and ≥120 in women has been associated with a favourable waist circumference (Logan et al., 2013).

The frailty scale developed by Rockwood et al., (1999) was used to assess the degree of frailty of participants. The Rockwood frailty scale included questions related to the person's ability to walk with or without assistance; perform activities of daily living (ADL) such as eating, dressing and washing; bowel and/or bladder incontinence; and cognitive impairment. Based on the responses to these questions, participants were categorised as fit, fit with bladder incontinence, pre-frail and frail.

### 6.2.4 The nutrition and physical activity interventions

Two interventions, (fermented milk and physical activity) were implemented over a period of 3 months in the two experimental groups (one intervention group received the physical activity and fermented milk and the other only the fermented milk).

The nutrition intervention included the provision of fermented milk. 500ml of fermented milk was given on five days of the week for a period of three months (2 on a Monday, 1 on Wednesday and 2 on Friday). The milk was taken at any time after it had been delivered.

In the group that also received the physical activity intervention, the fermented milk was taken about 15 minutes after physical activity on the three days per week that the physical

activity intervention was administered and any time of the day on days when the physical activity intervention was not administered.

The physical activity intervention was designed and implemented by a Masters student in Sport and Exercise Science at the UFS and is reported elsewhere. The physical activity intervention was based on an individual assessment of each participant in the physical activity intervention group. Before intervention, each participant was assessed by the Masters student. The exercise testing included an assessment of cardiovascular fitness (6-minute walk test); upper body strength (arm curl- and handgrip test); lower body strength (chair stand test); flexibility (modified sit and reach test); balance, speed and agility (8-foot up and go test). After exercise testing, an exercise programme was designed for each participant. Physical activity was prescribed for 3 days of the week for a period of three months and consisted of a multicomponent physical activity programme of low to moderate intensity, for 45 – 60 minutes at a time. Components that were included were 10 minute walking (warm up), sit-to-stand, standing march, lateral raises, triceps extensions, cone drills and stretching.

## 6.3 Statistical analysis

The data was analysed using SAS/SAT software (version 9.3) of the SAS system for windows (Copyright© 2010 SAS Institute Inc.). Descriptive statistics, namely frequencies and percentages were calculated for categorical data and medians and ranges for continuous data. The change from baseline to follow-up was compared by means of 95% confidence intervals. All analyses were done by the Department of Biostatistics at the University of the Free State.

## 6.4 Results

### 6.4.1 Socio demographic and reported health information

About two thirds of the study population were female (63.4% in the both group, 71.1% in the milk only group and 76.6% in the control group), with a median age of between 74.4-76.1 years (range 64.3-94 years). Regarding marital status, 31.6 % participants in the both group 21.2% milk only group and 28.8% in the control group were married. More than 60% of

participants were widowed (68.2% in the both group, 62.2% in milk only group, and 65.9 % in control group). More than two thirds (75.6% in the both group, 71.1% in the milk group and 65.9% in the control group) had low literacy level (primary school). In terms of economic status, 12.1% in the both group, 9.0% in the milk group, and 2.1% in the control group were either self-employed or full wage earners. About half of participants in the both group reported receiving a pension, compared to 27.2% in the milk group and 31.4% in the control group. In all groups, more than two thirds of participants reported receiving an income of between M100-M1000 (equivalent to 100- 1000 Rands) per month.

Most the participants in all the groups (>89.3%) lived in brick or concrete houses, and used pit latrines. Only about more than half reported having their own tap as a source of water (70.7 % in the both group, 57.8% in the milk group and 87.2% in the control group). Of those participants who had their own tap as a source of water, there was significant difference between the control and milk group [95%CI 11.3; 45.4]. With regard to basic household amenities, items like gas or electric stove, paraffin stove, working radio over half of them in all the groups reported having them.

Information related to reported health included lifestyle pattern, disability, symptoms and diseases experienced, diagnosed diseases, and information on HIV/AIDS.

In terms of lifestyle patterns, a maximum of about 15 participants in all the groups were currently smoking (17.1% in the both group, 6.7% in the milk group and 2.1% in the control group), drinking alcohol (50 % in the both group, 13 % in the milk group and 27.3% in the control group) or snuffing (25.0% in the both group, 26.7% in the milk group and12.7% in the control group). Of these, 2-17% smoked cigarettes, with an average number of 3 cigarettes per day (range 1-40). The median age at which they begun smoking was between 20-29 years. Between 12-25% of participants reported currently using alcohol. A large percentage of those who consumed alcohol said they consumed more than 5 alcoholic drinks per day once a month (66.7% in the both group, 30% in the milk group and 66.7% in the control group).

The current disability profile showed that a higher percentage of participants in the milk group had trouble walking (39.0% in the both group, 59.1% in the milk group and 36.2% in

the control group), seeing someone across a room (32.5% in the both group,43.2% in the milk group and 23.4% in the control group), reading (29.3% in the both group, 48.8% in the milk group and 25.5% in the control group) and hearing (37.5% in the both group, 50.0% in the milk group and 21.7% in the control group). The major symptoms that were experienced included chest pain (51.2% in the both group, 52.3% in the milk group and 34.0% in the control group), loss of appetite (65.8% in the both group, 57.8% in the milk group and 55.3% in the control group) and joint pain (70.7% in the both group, 62.2% in the milk group and 53.2 % in the control group).

More than 85.1% of the elderly attended church at least twice a month (95.1% in the both group, 93.3% in the milk group and 85.1% in the control group). The major sources of stress that they encountered included crop or business failure (29.3% in the both group, 60.0% in the milk group and 31.9% in the control group) and major intra family conflict (11.1% in the both group, 32.5% in the milk group and 15.6% in the control group).

High blood pressure and heart disease were the most commonly diagnosed conditions with hypertension occurring in 65.8% in the both group, 68.9% in the milk group and 61.7 % in the control group. Many participants were using medication regularly (43.9% in the both group, 65.1% in the milk group and 57.4% in the control group). These included analgesics, medication for hypertension, diabetes, tuberculosis and HIV. Seventy two (72.7%) in the both group, 75% in the milk group and 33.0% in the control group had cared for people infected with HIV/AIDS at some time.

### 6.4.2 Individual Dietary Diversity

At baseline more than 70% of all participants fell in the low dietary diversity score category (70.7% in the both group, 82.2% in the milk group and 70.2% in the control group). At follow-up 82.8% in the both group, 74.3% in the milk group and 68.9% in the control group had a dietary diversity in the low dietary diversity category. No significant differences in the percentage of participants with low dietary diversity between the three groups was observed at baseline or at follow-up. Despite this, the percentage of participants with low dietary diversity increased by 12% in the both group (from 70.7% at baseline to 82.8% at follow-up)

and decreased by 8% in the milk group (from 82.2% at baseline to 74.3% at follow-up) (Table 6.1).

### 6.4.3 Mini Nutritional Assessment (MNA)

At baseline only 4.9% of participants in the both group, 17.8% of those in the milk group and 12.8% of those in the control group were classified as well-nourished according to the NMA score. Thus, the vast majority of all participants were either undernourished or at risk of malnutrition. At follow-up this 9.7% in the both group, 8.6% in the milk group and 17.2% in the control group fell in the well-nourished category. Although there were no significant differences in the percentage of participants that were undernourished between the three groups at baseline or at follow-up, there was a trend for more in the both group to be undernourished than in the control group (95% CI for the percentage difference [-26.1; 1.0]) and in the milk group (95% CI for the percentage difference [-29.7; 0.6]) at baseline.

At follow-up, the percentage of participants that were undernourished increased by 9% in the both group (from 7.3% at baseline to 16.3% at follow-up) and remained more or less unchanged in the milk and the control groups (Table 6.2).

### 6.4.4 PASE scores

At baseline the median PASE score was 113.3 in the both group, 102.9 in the milk group and 103.7 in the control group. The PASE score of the both group was significantly higher than that of the control group (95% CI for the median difference [1.4; 26.2]). At follow up the median score for the both group remained the same (113.1), but in the milk group it improved by 16.7 points to 119.6 and the control group it also increased by 14 points to 117.7. There were no significant differences in median scores between groups at follow-up (Table 6.3).

### 6.4.5 Frailty scores

In terms of the frailty score, at baseline 12.5% of the participants in the both group, 28.9% of those in the milk group and 28.9% in the control group were categorised as pre frail and frail. Although the 95%CI for the percentage difference was not significant there was the tendency

for the both group to have more fit (0 +1) participants than the control group (-25.6 %; 2.1%] and the milk group [-26.8; 1.5].

At follow up, 35.7% of participants in the both group, 26.7% of participants in the control group and 5.5% in the milk group were classified as pre-frail and frail. In contrast to the baseline results, the 95%CI for the percentage difference shows that the percentage of fit (0 +1) participants in the both group was significantly lower than the percentage in the milk group [2.5; 32.6]. The percentage of participants in the control group that were classified as pre-frail and frail at baseline (29.0%) remained the same at follow up (26.6%) (Table 6.4).

## Table 6.1 Individual Dietary Diversity Scores (9 food group) of the three groups at baseline and at follow-up

| Category | Baseline | | | | | | 95%CI for % difference of low IDDS | Follow up | | | | | | 95%CI for % difference of low IDDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Both | | Milk | | Control | | | Both | | Milk | | Control | | |
| | n | % | n | % | N | % | | n | % | n | % | n | % | |
| **Low IDDS** | 29 | 70.7 | 37 | 82.2 | 33 | 70.2 | Both – control [ -18.3;18.9 ] | 24 | 82.8 | 26 | 74.3 | 20 | 68.9 | Both – control [ -8.3;34.4] |
| **Medium IDDS** | 12 | 29.3 | 8 | 17.8 | 12 | 25.5 | Both – milk [-28.9;6.4] | 5 | 17.2 | 8 | 22.8 | 8 | 27.6 | Both – milk [-12.3;27.5] |
| **High IDDS** | 0 | 0 | 0 | 0 | 2 | 4.3 | Control - milk [-28.5;5.5] | 0 | 0 | 1 | 2.9 | 1 | 3.5 | Control -milk [-26.9;16.1] |

## Table 6.2 MNA scores of the three groups at baseline and at follow-up

| | Baseline | | | | | | 95%CI for the % difference of undernourished | Follow up | | | | | | 95%CI for the % difference of undernourished |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Both | | Milk | | Control | | | Both | | Milk | | Control | | |
| **MNA Score** | n | % | n | % | N | % | | n | % | n | % | n | % | |
| **Under nutrition** | 3 | 7.3 | 10 | 22.2 | 9 | 19.1 | Both – control [-26.1;1.0] | 5 | 16.3 | 7 | 20 | 6 | 20.7 | Both – control [-24.4;15.2] |
| **At risk of malnutrition** | 36 | 87.8 | 27 | 60.0 | 32 | 68.1 | Both – milk [-29.7:0.6] | 23 | 74.2 | 25 | 71.4 | 18 | 62.1 | Both –milk [-22.2;15.4] |
| **Well-nourished** | 2 | 4.9 | 8 | 17.8 | 6 | 12.8 | Control-milk [-19.6,13.6] | 3 | 9.7 | 3 | 8.6 | 5 | 17.2 | Control -milk [-18.5;21.0] |

**Table 6.3 Median PASE score of the three groups at baseline and at follow-up**

| | **Baseline** | | | **95% CI for median difference** | **Follow up** | | | **95% CI for median difference** |
|---|---|---|---|---|---|---|---|---|
| **Category** | **Both** | **Milk** | **Control** | | **Both** | **Milk** | **Control** | |
| | N=41 | N=45 | N=47 | | N=31 | N=34 | N=30 | |
| Median | 113.3 | 102.9 | 103.7 | Both – control [1.4;26.2]* | 113.1 | 119.6 | 117.7 | Both – control [-20.3;37.3] |
| Minimum | 0 | 0 | 2.2 | Both – milk [-1.4;23.6] | 8.6 | 23.0 | 0 | Both – milk [-25.2;24.6] |
| Maximum | 191.8 | 238.0 | 114.6 | Control – milk [-15.1;9.4] | 271.3 | 202.5 | 191.6 | Control – milk [-31.3;15.8] |

**Table 6.4 Frailty Scores of the three groups at baseline and at follow-up**

| | **Baseline** | | | | | | | **Follow up** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Category** | **Both** | | **Milk** | | **Control** | | **95 % CI for % difference in fit (0 + 1)** | **Both** | | **Milk** | | **Control** | | **95 % CI for % difference of fit (0 + 1)** |
| | n | % | N | % | N | % | | **n** | **%** | **n** | **%** | **n** | **%** | |
| 0 (Fit) | 12 | 30 | 9 | 20 | 16 | 34.0 | | 2 | 6.5 | 6 | 17.7 | 7 | 23.3 | |
| 1 (Fit, but bladder incontinent) | 23 | 57.5 | 23 | 51.1 | 17 | 36.2 | Both – control [-25.6;2.1] Both – milk [-26.8;1.5] | 18 | 58.1 | 26 | 76.5 | 15 | 50.0 | Both – control [-11.9;23.9] Both – milk [2.5;32.6]* |
| 2 (Pre-frail) | 3 | 7.50 | 5 | 11.1 | 6 | 12.8 | Control –milk [-16.6;14.9] | 6 | 19.4 | 2 | 5.8 | 5 | 16.6 | Control – milk [-2.1;25.6] |
| 3 (Frail) | 2 | 5.0 | 8 | 17.8 | 8 | 17.0 | | 5 | 16.1 | 0 | 00 | 3 | 10.0 | |

## 6. 5 Discussion

Socio-demographic results indicated that about two thirds of the elderly participants included in the current study were female and widowed. Most participants resided in informal housing with pit latrines, and were characterised by poverty, low literacy levels, and lack of basic amenities. These findings are consistent with those of other researchers that have reported that the majority of the poor elderly in developing countries such as Lesotho are poverty-stricken and destitute, increasing their risk for vulnerability, malnutrition, frailty and chronic disease (Nguyen et al., 2015).

In terms of reported health, a relatively large percentage of participants reported smoking and using alcohol. Disabilities that were reported included trouble walking, affected vision and poor hearing. Many experienced symptoms such as chest pain, joint pain and loss of appetite. Although more than 80% reported attending church regularly, they also experienced major stress, including family conflict. The most common diseases that the elderly had been diagnosed with included hypertension and heart disease. Many had cared for others with HIV/AIDS at some time. The HIV/AIDS pandemic and death of a large number of the younger generation has resulted in an increase in the number of elderly headed households (Chikokob and Nabalambaa, 2011). According to UNICEF (2003), more than half of the orphans in Africa currently live with their grandparents. In these elderly headed households, extreme poverty and poor food security are often present. In most sub-Saharan African countries, very few safety nets are available to meet the needs of the elderly, resulting in neglect and deprivation. Health care systems are very often poor, distances to health care centres are often far, and transport is limited and expensive. Even when health facilities are accessed, services are often inadequate and fragmented.

As expected, a large percentage of the participants included in the intervention phase of this study had low dietary diversity scores, were undernourished or at risk of malnutrition, had PASE scores below that associated with a favourable waist circumference and were pre-frail or frail. To be eligible to participate in the intervention phase of the study, participants had to fall in the pre-frail or frail category of the Rockwood scale or/ and be undernourished or at risk of malnutrition according to the MNA. It is worth mentioning, however, that of the 300

participants that were included in the baseline phase of the study (reported elsewhere), the vast majority did not have a high dietary diversity and a high percentage were also at risk of malnutrition and had low levels of physical activity.

Although information related to the elderly in African countries are limited, available studies confirm our findings. At the start of the millennium, Charlton and Rose (2001) described a situation of poor nutritional status, inadequate household food security, war and famine, and the indirect impact of HIV infection and AIDS in the elderly in Africa. The syndemic effect of HIV/AIDS and food insecurity in sub-Saharan Africa has been described by others (Himmelgreen et al., 2009). In terms of dietary diversity, the results of the current study are consistent with studies undertaken in neighbouring South Africa that have shown that dietary diversity in the majority of elderly participants is low (Oldewage-Theron and Kruger, 2008). Populations with low socio-economic status are less likely to eat a diverse diet (Pampel et al., 2010).

The nutrition intervention that was implemented in the current study consisted of fermented milk (in total 2.5 litres of milk was provided to each participant per week). Fermented milk was chosen as the food of choice since it is very well accepted in Lesotho, where traditionally fermented milk is known as mafi, while it is called amasi/emasi in some parts of South Africa, Zimbabwe and Swaziland (Gadaga et al., 2013; Beukes et al., 2001). Fermented milk is made by leaving cow milk to ferment at 25 to 30 degrees for a period of 2-3 days until thick curds form (Gadaga et al., 2013). The curds are consumed with porridge called papa or as a drink. Fermented milk that is industrially produced is also widely available in South Africa and Lesotho by adding living lactic acid bacteria to milk to ferment it (Gadaga et al., 2013). Fermented milk is easily digested and absorbed. The proteins in fermented milk become partly degraded by the action of bacterial proteolytic system and are thus less likely to cause intolerance (Wijesinha-Bettoni and Burlingame, 2013). The quantity of lactose in fermented milk is lower than in whole milk because some of it is converted to lactic acid. Lactic acid is the responsible for the typical sour taste of fermented foods. Fermented milk has a longer shelf-life and microbiological safety than fluid milk (Wijesinha-Bettoni and Burlingame, 2013).

Dairy products have a high nutrient density and palatability, making them beneficial in the diet of both healthy and frail elderly persons (Drenowski, 2011; van Staveren and de Groot, 2011). Milk contains both macronutrients and micronutrients essential for growth, development and repair of tissues (Muehlhoff et al., 2013). According to the FAO STAT (2012), milk is a major source of dietary protein and fat. The main proteins found in cow milk are whey and casein and they are of high biological value and quality to support maximal growth due to a good balance of all essential amino acids (Gryson et al., 2013; Bonjour et al., 2013). Of these two, whey protein supports the rapid increase in muscle protein synthesis, while casein enhances continual increase in muscle protein synthesis and decreases muscle protein break down (Gryson et al., 2013; Forbes et al., 2012; Chale et al., 2013). There is a growing body of evidence showing that the intake of milk-based proteins is an effective protein source for stimulating muscle protein synthesis, slowing muscle protein breakdown and improving muscle mass (Alemán-Mateo et al., 2014; Cermak et al., 2012). The anabolic effect of milk may be an effective, practical and cost-effective way for maintenance of muscle mass in the healthy elderly and fast recovery in the frail and malnourished elderly (Gryson et al., 2013; Bonjour et al., 2013).

The physical activity intervention that was implemented in the current study consisted of a multicomponent physical activity programme of low to moderate intensity, for 45 – 60 minutes at a time on 3 days of the week for a period of three months. The intervention programme followed the recommendations of the American College of Sports Medicine (ACSM, 2009) for exercise prescription for the elderly and included the following components: cardiovascular endurance (walking), flexibility (stretching), muscle strength (sit-to-stand and standing march), speed and agility (cone drills) and neuromuscular support (sit-to-stand). Although the heterogeneity of exercise programmes implemented in intervention studies has produced inconclusive results regarding the best type of programme, it is generally accepted that a multicomponent exercise programme including resistance training leads to improved functioning in the elderly (De Labra et al., 2015).

Based on the measures of DD, MNA, PASE and frailty that were included in this study, the nutrition and physical activity interventions that were implemented for a period of three

months did not have a significant impact. Although there did seem to be trend toward improvement in the milk group (dietary diversity and frailty score), the participants in the both group were worse off after the intervention than at baseline (dietary diversity, MNA, frailty score). The systematic review by Clegg et al., (2013) showed that the elderly that were frail at the start of an exercise intervention became more frail at follow-up, while those that were fit at the start became more fit. They propose that frail participants that are exposed to increased physical activity may exceed their reserve capacity to adopt to increased physical activity, while those that are still fit have adequate reserve capacity. Many of the elderly included in the current study were both frail and malnourished. This could explain why those that received only the fermented milk showed a tendency to improve while those that exercised did not.

Despite the fact that a number of other recent systematic reviews have shown that nutrition and physical activity interventions have the potential to improve measures of frailty and sarcopenia in the elderly, none of these have included studies undertaken in African countries (Jadczak et al., 2018; Beaudart et al., 2017; Dedeyne et al., 2017; Lozano-Montoya et al., 2017; Morton et al., 2017; Silva et al., 2017; Schultz et al., 2016; Da Labra et al., 2015; Denison et al., 2015; Manal et al., 2015; Cruz-Jentoft et al., 2014; Cermak et al., 2012).

Reasons for the lack of impact in the current study may be related to the socio-economic and food security situation of the elderly population in Lesotho. It is probable that the amount of fermented milk that was provided was not enough to impact on measures of frailty and malnutrition in participants. With so many mouths to feed, limited resources to purchase food and high levels of stress, sharing of the food supplement was very likely. After years of deprivation, the level of malnutrition and frailty in the participants may have required a longer and more intense period of both nutrition and exercise intervention.

The following limitations are acknowledged. To be eligible to participate in the intervention, participants had to be classified as pre-frail, frail, at risk of malnutrition or malnourished. They were not, however, selected based on their socio-economic situation. Ideally, the three groups included in the intervention phase of the study should have been comparable in terms of socio-demographic circumstances at baseline. Differences related to availability of water

and the use of gas as cooking fuel did, however occur. The relatively small sample size of the intervention groups and the dropouts that occurred may have affected the power of the study. The sample size in the intervention phase was dependent on the limited budget and logistical challenges.

## 6.6 Conclusion

The fermented milk and exercise programme did not succeed in addressing indicators of frailty and malnutrition in the study population. The findings from the current study highlight the plight of the elderly in Lesotho and emphasise the pressing need for increased attention to this group. Research related to the unique nutrition situation and development, implementation and evaluation of relevant nutrition interventions is urgently required.

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# CHAPTER 7

# CONCLUSIONS AND RECOMMENDATIONS

## 7.1 Introduction

Healthy aging encompasses good nutrition, physical fitness, a sound mind, the ability to function independently and above all good quality of life. In developing countries, the elderly are often characterised by poverty, food insecurity, poor access to health care services and ill health (both under nutrition and non-communicable diseases).

In Africa, the limited resources are most often spent on programmes that focus on HIV/AIDS, pregnant women and malnourished children, with much less attention being given to the elderly. This is also true in Lesotho, where the elderly are often responsible for taking care of their HIV-infected children (who often also have tuberculosis) and orphaned grandchildren and thus play a critical role in maintaining the family environment. In view of this, it is imperative that their overall health and nutritional wellbeing remain a priority.

The current study included a baseline survey amongst the elderly in Lesotho, with the aim of determining levels of frailty and malnutrition and associated factors. Based on these findings, a nutrition and exercise intervention was implemented in a sample of those that were found to be frail and/or malnourished in the baseline. Three groups were included in the intervention phase of the study including a group that received both fermented milk as a food supplement and an exercise intervention, a second group that received only the fermented milk supplement, and a third control group.

In the following section a short overview of the main findings from the baseline and intervention phases of the study are given.

## 7.2 Conclusions

### 7.2.1 Factors associated with frailty

The findings from the current study confirmed that the elderly participants included in this study were characterised by poverty, ill health, low dietary diversity, low physical activity and high risk of frailty. More than half of participants had cared for people with HIV/AIDS, including their own children and orphaned grandchildren.

Frailty was significantly associated with:

- A lower socio-demographic situation: Participants that were classified as pre-frail and frail were significantly more likely to use a cheaper fuel (paraffin) for cooking compared to the fit elderly that were more likely to use gas or electricity.
- Poorer mobility: Significantly fewer frail participants were able to go out compared to the fit group.
- Ill health: A significantly higher percentage of pre-frail and frail participants reported experiencing symptoms such as breathlessness with usual activity, wheezing or coughing than their fit counterparts. Furthermore, a significantly higher percentage of pre-frail and frail elderly had been diagnosed with stroke and lung disease such as asthma than those in the fit group.

### 7.2.2 Factors associated with malnutrition

The majority of the elderly in the current study were at risk of malnutrition (66.0%) or malnourished (19.4%).

Malnutrition was significantly associated with:

- A lower socio-demographic situation: A significantly higher percentage of participants that were well-nourished used electricity for cooking compared to participants that were malnourished and at risk of malnutrition. Furthermore, a significantly higher percentage

of well-nourished respondents used flush toilets compared to those that were malnourished and at risk of malnutrition.

- A perception of poor health status: A significantly higher percentage of participants that were malnourished or at risk of malnutrition perceived their health to be poor.
- Nutritional problems: A significantly higher percentage of participants that were malnourished or at risk of malnutrition experienced nutritional problems.
- Cognitive impairment: A significantly higher percentage of respondents that were malnourished had cognitive impairment/depression compared to those that were well-nourished.

### 7.2.3 Impact of the interventions

As expected, a large percentage of the participants included in the intervention phase of this study had low dietary diversity scores, were undernourished or at risk of malnutrition, had PASE scores below that associated with a favourable waist circumference and were pre-frail or frail. Vulnerability to frailty and malnutrition among the elderly in Lesotho is increased as a result of social factors that occur as a result of the high HIV burden, increased caregiving responsibilities and financial responsibilities and poverty. In Lesotho, the elderly thus experience a syndemic of HIV/AIDS, caregiving responsibilities, the way that society is treating older people in Lesotho and poverty.

The fermented milk and exercise programme did not succeed in addressing indicators of frailty and malnutrition in the study population.

- Based on the measures of DD, MNA, PASE and frailty that were included in this study, the nutrition and physical activity interventions that were implemented for a period of three months did not have a significant impact.
- Although there did seem to be trend toward improvement in the milk group (dietary diversity and frailty score), the participants in the both group were worse off after the intervention than at baseline (dietary diversity, MNA, frailty score).

## 7.3 Limitations of the study

The following limitations are acknowledged:

- The lack of other African intervention studies made it difficult to compare our findings. The unique situation of the elderly in Africa, and especially in Lesotho, complicate comparisons with other studies undertaken in developed countries.
- Ideally, the three groups included in the intervention phase of the study should have been comparable in terms of socio-demographic circumstances at baseline. Differences related to availability of water and the use of gas as cooking fuel did, however occur.
- Although the fermented milk supplement was consumed by those participants in the group that received the physical activity intervention on days that they exercised under supervision, there was no guarantee that the participants consumed the supplement themselves at home. In view of the high levels of poverty experienced by participants, it is possible (probable) that they shared the fermented milk with family members.
- The relatively small sample size of the intervention groups and the dropouts that occurred may have affected the power of the study. The sample size in the intervention phase was dependent on the limited budget and logistical challenges.

## 7.4 Recommendations

The increase in the number of elderly people in the world is a challenge in both developed and developing countries alike. Addressing the needs of the elderly requires a comprehensive approach that takes into account the variety of factors that are associated with malnutrition and frailty in the context of the population in which they reside. In Lesotho, the issues that exacerbate vulnerability in the elderly often occur in combination and include:

- Lack of expertise in identifying those at risk
- Poverty and the associated food insecurity
- High prevalence of HIV/AIDS and the increased reliance on the elderly to care for sick adult children and orphaned grandchildren

- Lack of political commitment, policies and programmes that focus on and address the needs of the elderly

The following section will consider recommendations to address each of these challenges.

### 7.4.1 Lack of expertise in identifying those at risk

Assessment of health, nutritional status and frailty in the elderly can be a complicated process, requiring complex and sometimes expensive tools and techniques that need to be applied by professional health care workers. In the African context, this expertise is often not available. The result is that screening for vulnerability in the elderly and early intervention does not happen. As malnutrition and frailty advance, a vicious cycle of reduced physical capacity, illness, vulnerability, isolation, loss of dependence, reduced life expectancy and reduced capacity to withstand environmental stresses develops.

Comprehensive and regular screening and assessment should ideally be an essential component of the primary health care system. In this regard, appropriate nutrition assessment tools should be identified. More than 25 years ago (in 1992), the London School of Hygiene and Tropical Medicine and HelpAge International initiated a research project amongst the elderly in Tanzania and Malawi (Charlton and Rose, 2001). They concluded that BMI was not an appropriate tool to use in the elderly (due to the fact that the height of the elderly is affected by kyphosis) and proposed measurement of mid-upper arm circumference (MUAC) as an alternative. This measure was found to be significantly associated with functional ability. Measurement of MUAC is easy to perform and interpret, does not require expensive equipment and can easily be applied by nursing staff in the primary health care setting. Studies to determine the effectiveness of this tool in predicting malnutrition and frailty in Lesotho are thus recommended.

### 7.4.2 Poverty and the associated food insecurity

The non-contributory pension that is available to the elderly above 70 years in Lesotho is one of the interventions that has been implemented by the Lesotho government to address poverty in the elderly. Addressing poverty on a national level in Lesotho is, however a

challenge. It needs to be recognised that nutrition security of individuals and households are influenced by various factors, especially those related to the immediate environment. In Lesotho, economic growth has to take place and employment opportunities have to increase in order for all households to have access to food, water, sanitation and healthcare. In the short-term, interventions that improve food availability and access to food by vulnerable groups need to be emphasised. Such interventions should focus on improving domestic food production, food preservation, and food aid related to budgeting and food purchasing. In this regard it is recommended that communities be taught skills on how to use available resources effectively and be empowered to become involved in food production and income generating projects that will increase income and address food insecurity. In contrast to international food assistance programmes that provide a solution in the short-term, attention should be given to enabling people to improve food security using locally available and culturally acceptable methods (Himmelgreen et al., 2009). In this regard, viable and sustainable income generating and household food production programmes need to be implemented:

- Organisations that develop and coordinate household food gardening activities should work together to provide relevant training and support to gardeners.
- A clear definition of the purpose of the interventions should be drafted - this should focus on the specific requirements of the target group.
- Local circumstances should be taken into account. Encourage gardeners and organisations to use culturally acceptable methods/ plants to improve ownership and sustainability.
- Indigenous knowledge should not be ignored, but used to strengthen programmes and to encourage ownership.
- A comparison of the resources available to the target group on the one hand, and the resources needed to effectively implement the programme is essential.
- Programmes should adopt a holistic approach, meaning that other factors/ conditions that may influence the sustainability of the gardens also need to be addressed (e.g. water, equipment, land).

- Relevant guidelines/ training manuals or pamphlets in the language of choice and on the literacy level of gardeners could be developed to strengthen knowledge and skills after training.
- Demonstration gardens can be very useful – successful gardeners with experience can provide training or support. Demonstration gardens also bring people with common interests together and provide support to improve sustainability.
- Cost effective labour-saving techniques based on local circumstances need to be identified and supported.

### 7.4.3 High prevalence of HIV/AIDS and the increased reliance on the elderly to care for sick adult children and orphaned grandchildren

Poverty and food insecurity are more likely to be present in households where HIV/AIDS is also present. According to Himmelgreen et al., (2009), food insecurity and HIV are described as "syndemic." Reducing poverty remains a concern and challenge for the Lesotho. A vicious cycle develops with poverty increasing the likelihood of contracting HIV/AIDS and HIV/AIDS contributing to poverty. In an effort to address this syndemic, these authors suggest an integrated strategy that includes sustainable household food production (see above); HIV/AIDS education; and HIV-related nutrition education. In order to support the elderly in their role of caring for those with HIV, the following recommendations are made:

- Interventions that focus on poverty alleviation can thus make a significant contribution to addressing HIV in Lesotho.
- Appropriate nutrition education emphasising the importance of adequate nutrition in the context of HIV prevention and management is of critical importance.
- Social and moral support, such as that offered by churches, makes a significant contribution to addressing the challenges of HIV. Creating a supportive environment can contribute to maintaining or improving quality of life of those infected with the virus as well as those who care for them.

- Promoting various forms of social control for HIV-prevention that are relevant in the Lesotho context through community support groups and providing social environments for challenging stigmatising ideas and practices.
- According to Campbell et al., (2011), features of supportive social environments may include: improvement of HIV/AIDS-related knowledge and skills; opportunities for critical dialogue and debate about HIV/AIDS; a sense of individual and communal ownership of the problem and responsibility for contributing to its solution; confidence in the existence of individual, group and community strengths which could be activated to fight the epidemic; a sense of solidarity amongst group members around addressing HIV/AIDS; and strong links with potential support organisations.

### 7.4.4 Lack of political commitment, policies and programmes that focus on and address the needs of the elderly

Although the developed world might have policies and measures in place to support the elderly, the developing world does not seem to be as well equipped (Charlton and Rose, 2001). Many researchers and policy makers agree that frailty is a public health problem, however, very few have come to consensus on the extent and scope of commitment to addressing this problem. In view of the above, there is the need for policymakers and stakeholders to identify the extent of the elderly that are at risk to be able to plan and incorporate programmes to prevent or delay the onset of frailty or maintain health and quality of life in the most vulnerable elderly. The global impact of frailty on healthcare systems is significant. Most elderly visit health facilities more often than younger persons and also often reside in care facilities in countries where they are available (Buckinx et al., 2015). There is the need for sensitisation programmes for health professionals as well as society at large on issues relating to the elderly and the need to make them a priority in society.

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**APPENDICES**

**APPENDIX 1**

INFORMATION DOCUMENT- **BASELINE**

**The Impact of a Nutrition and Physical Activity Intervention Programme on Frailty Syndrome in Elderly Citizens in Lesotho**

We are from the University of the Free State, Faculty of Health Sciences.

We are carrying out a study to determine the impact of a nutrition and physical activity intervention program for frailty syndrome in elderly Basotho citizens. It is very important that we gather quality data and knowledge on the elderly because they need to live long to take care of themselves, sick relatives and orphans we have in our society.

Research is just the process to learn the answer to a question.

Invitation to participate: We are asking/inviting you to participate in this research study.

What is involved in the study: The aim of the study is to determine the nutritional status and indicators of frailty in the elderly in Maseru and district. In this study we will be collecting baseline information on socio-demography, reported health, nutritional status, physical activity and frailty. The questionnaires will be completed at the homes of the participants by the researcher and trained field workers.

We will also take measurements such as weight, height, knee height, calf circumference, mid upper arm circumference.

It will take approximately one hour to complete these questionnaires and to take the measurements. You will not be paid to participate in the baseline survey and it will cost you nothing.

Researchers will endeavour to provide information about the outcome of the research. Your information will not be released for use by anyone else without consent, unless required by law.

Benefits and risks of being in the study: By participating in the study you will help us to collect nutrition and frailty information on the elderly that will benefit the senior citizens of our land. There are no risks involved.

Participation is voluntary, and refusal to participate will involve no penalty or loss of benefits to which you are entitled; you may discontinue participation at any time.

Confidentiality: Efforts will be made to keep personal information confidential. Absolute confidentiality cannot be guaranteed. Personal information may be disclosed if required by law. Organizations that may inspect and/or copy your research records for quality assurance and data analysis include groups such as the Ethics Committee of the Faculty of Health Sciences, UFS and the Ministry of Health Lesotho. If results are published, this may lead to individual/cohort identification. The results of the research may be presented at a conference or published in scientific journals.

Kind regards

Rea leboha


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INFORMATION DOCUMENT- **BASELINE**

**SEO PHEPO E NEPAHETSENG LE BOIKOETLISO LI SE ETSANG ELE HO KENA LIPAKENG FOR FRAILTY SYNDROME MAQHEKUNG LE MAQHEKOANENG A SECHABA SA LESOTHO**

Hlaha junifesiting ea foreisetata, lekaleng la mahlele a bophelo. Re etsa boithuto bo shebaneng le ts'usumetso ea phepo e nepahetseng le boikoetliso khahlanong le frailty syndrome ho maqheku a Lesotho.

Ho bohlokoa hore re fumane likarabo le tsebo hitsoa ho maqheku hobane ba hloka ho phela halelele ba itlhokomela, ba lelapa ba kulang le likhutsana sechabeng sa rona.

Lipatlisiso ke mokhoa oa ho ithuta likarabo ka lipotso kapa hotsoa lipotsong.

**Memo ea ho nka karolo:** re u kopa/mema ho nka karolo boithutong bona.

**Se kenyeletsang boithuto**: moikemisetso ea boithuto ke ho ela hloko ts'usumetso ea phepo e nepahetseng le boikoetliso ho a phepo le litlamorao tsa frailty maqhekung a seterekeng sa Maseru. U khethiloe ho ba karolong e senang ho angoa ke ho kena lipakeng ha phepo e nepahetseng ho fihlela boithuto bo felile. Ha boithuto bo felile, u tla fumana monyetla oa ho nka karolo hona boithutong moo mme u amohele melemo ea phepo e nepahetseng le boikoetliso ha u batla.

Likhoeli tse tharo, tse t'seletseng le selemo kamora lipatlisiso tsa mantlha, moithuti le sehlopha sa hae batla le etela malapeng a lona ho bokella lintlha

Re tla thabela le ho nka limetho tsa boima, bolelele, bolelele ba lengole, calf circumference, le selika likoe sa sephaka.

Ho bohlokoa ho bokella molaetsa o nepahetseng le hoba le tsebo ka maqheku hobane ba lokela ho phela ha lelele le ho ithlokomela, le ho hlokomela bang ka bona ba kulang le likhutsana tse phelang kahare ho sebaka sa bona.

Moithuti aka fana ka molaetsa o hlakisang bohlokoa bokamosong ba bophelo ba motho ea khethuoeng ho nka karolo.

Moithuti o tla leka ka matla ho fana ka molaetsa ha boithuto bo fihletsoe. Lisebelisoa tsa lona le melaetsa e keke ea lokolla sebakeng sa mabaka a mang ntle le tumello,ntle le haeba molao o tlama joalo.

**Melemo** oa ho ba karolo ea boithuto: ho nka karolo boithutong bona ho tla re thusa ho holisa phepo e nepahetseng le ho fetisa molaetsa ka frailty ho maqheku molemong oa sechaba sa rona.

**Ho nka karolo ke boithaopo**, ho hana ho nka karolo ho keke ha eba le likotlo kapo tahlehelo ea melemo e u lokelang; u ka tlohela ka lehare 'me ha hona likotlo kapo tahlehelo ea melemo e u lokelang.

**Lekunutu:** boikhathatso bo matla bo tla etsoa e le ho boloka melaetsa ea motho ka bo mong ele lekunutu. Le ha ho le joalo, ha ho bonnete ba lekunutu le tsoeleletseng. Litaba tseo eleng lekunutu ho monga tsona li ka hlaella ha fela molao o tlamo joalo. Mekhatlo e tla hlahloba/kapo ho qopitsa lipoloko tsa boithuto ba hau molemong oa netefatso ea boleng bo holimo li kenyeletsa lihlopha tse kang komiti ea ethics ea lekalana la mahlale ka bophelo, UFS le lekala la bophelo Lesotho. Ha liphetho li phatlelelitsoe

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**Control**

INFORMATION DOCUMENT-**INTERVENTION**

**The Impact of a Nutrition and Physical Activity Intervention Programme on Frailty Syndrome in Elderly Citizens in Lesotho**

We are from the University of the Free State, Faculty of Health Sciences. We are carrying out a study to determine the impact of a nutrition and physical activity intervention programme to improve frailty in elderly citizens in Lesotho. It is very important that we gather quality data and knowledge on the elderly because they need to live long to take care of themselves, sick relatives and orphans we have in our society. Research is just the process to learn the answer to a question.

**Invitation to participate:** We are asking/inviting you to participate in this research study.

**What is involved in the study:** The aim of the study is to determine the impact of nutrition and physical activity intervention on the nutritional status and indicators of frailty in the elderly in Maseru and district. You have been selected to be in a group that will not receive any intervention during the time that the study is done. After the study is completed you will have the opportunity to take part in the same programme and to receive the nutrition and physical activity intervention if you want to.

Three months after the baseline survey, the researcher and the team will come to your homes to collect information on socio-demography, reported health, nutritional status, physical activity and frailty.

We will also take measurements such as weight, height, knee height, calf circumference, mid upper arm circumference. You will not be paid to participate in the survey and it will cost you nothing.

Researchers will endeavour to provide information about the outcome of the research. Your information will not be released for other uses without consent, unless required by law.

**Benefits** of being in the study: By participating in the study you will help us to collect nutrition and frailty information on the elderly that will benefit the senior citizens of our land.

**Participation is voluntary,** and refusal to participate will involve no penalty or loss of benefits to which you are entitled; you may discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled.

**Confidentiality:** Efforts will be made to keep personal information confidential. Absolute confidentiality cannot be guaranteed. Personal information may be disclosed if required by law. Organizations that may inspect and/or copy your research records for quality assurance and data analysis include groups such as the Ethics Committee of the Faculty of Health Sciences, UFS and the Ministry of Health Lesotho. If results are published, this may lead to individual/cohort identification.

Kind regards

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**Control**

INFORMATION DOCUMENT-**INTERVENTION**

**SEO PHEPO E NEPAHETSENG LE BOIKOETLISO LI SE ETSANG ELE HO KENA LIPAKENG FOR FRAILTY SYNDROME MAQHEKUNG LE MAQHEKOANENG A SECHABA SA LESOTHO**

Re leboha ha u ikhethetse ho re thusa boithutong bona bo bohlokoa. Re lumela hore boithuto bona botla tlatsetsa ho ntlafatsa bophelo ba maqheku le maqhekoana a Lesotho.

Re hlaha junifesiting ea foreisetata, lekoleng la mahlele a bophelo. Re etsa boithuto bo shebaneng le ts'usumetso ea phepo e nepahetseng le boikoetliso khohleng le bohlokoba frailty syndrome ho maqheku a Lesotho. Boithuto ke mokhoa oa ho ithuta ka ho fana ka likarabo tsa lipotso.

**Memo ea ho nka karolo:** re u kopa/mema ho nka karolo boithutong bona.

**Se kenyeletsang boithuto**: moikemisetso ea boithuto ke ho ela hloko ts'usumetso ea phepo e nepahetseng le boikoetliso ho a phepo le litlamorao tsa frailty maqhekung a seterekeng sa Maseru. U khethiloe ho ba karolong e senang ho angoa ke ho kena lipakeng ha phepo e nepahetseng ho fihlela boithuto bo felile. Ha boithuto bo felile, u tla fumana monyetla oa ho nka karolo hona boithutong moo mme u amohele melemo ea phepo e nepahetseng le boikoetliso ha u batla.

Likhoeli tse tharo, tse t'seletseng le selemo kamora lipatlisiso tsa mantlha, moithuti le sehlopha sa hae batla le etela malapeng a lona ho bokella lintlha

Re tla thabela le ho nka limetho tsa boima, bolelele, bolelele ba lengole, calf circumference, le selika likoe sa sephaka.

Ho bohlokoa ho bokella molaetsa o nepahetseng le hoba le tsebo ka maqheku hobane ba lokela ho phela ha lelele le ho ithlokomela, le ho hlokomela bang ka bona ba kulang le likhutsana tse phelang kahare ho sebaka sa bona.

Moithuti aka fana ka molaetsa o hlakisang bohlokoa bokamosong ba bophelo ba motho ea khethuoeng ho nka karolo.

Moithuti o tla leka ka matla ho fana ka molaetsa ha boithuto bo fihletsoe. Lisebelisoa tsa lona le melaetsa e keke ea lokolla sebakeng sa mabaka a mang ntle le tumello,ntle le haeba molao o tlama joalo.

**Melemo** oa ho ba karolo ea boithuto: ho nka karolo boithutong bona ho tla re thusa ho holisa phepo e nepahetseng le ho fetisa molaetsa ka frailty ho maqheku molemong oa sechaba sa rona.

**Ho nka karolo ke boithaopo**, ho hana ho nka karolo ho keke ha eba le likotlo kapo tahlehelo ea melemo e u lokelang; u ka tlohela ka lehare 'me ha hona likotlo kapo tahlehelo ea melemo e u lokelang.

**Lekunutu:** boikhathatso bo matla bo tla etsoa e le ho boloka melaetsa ea motho ka bo mong ele lekunutu. Le ha ho le joalo, ha ho bonnete ba lekunutu le tsoeleletseng. Litaba tseo eleng lekunutu ho monga tsona li ka hlaella ha fela molao o tlamo joalo. Mekhatlo e tla hlahloba/kapo ho qopitsa lipoloko tsa boithuto ba hau molemong oa netefatso ea boleng bo holimo li kenyeletsa lihlopha tse kang komiti ea ethics ea lekalana la mahlale ka bophelo, UFS le lekala la bophelo Lesotho. Ha liphetho li phatlelelitsoe

Rea leboha

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**Physical Activity and Sour Milk**

INFORMATION DOCUMENT-**INTERVENTION**

**The Impact of a Nutrition and Physical Activity Intervention Programme on Frailty Syndrome in Elderly Citizens in Lesotho**

We are from the University of the Free State, Faculty of Health Sciences. We are carrying out a study to determine the impact of a nutrition and physical activity intervention program for frailty in elderly persons in Lesotho. It is important that we gather quality information on the elderly because they need to live long to take care of themselves, sick relatives and orphans. Research is just the process to learn the answer to a question.

**Invitation to participate:** We are asking/inviting you to participate in this research study.

**What is involved in the study:** The aim of the study is to determine the impact of a nutrition and physical activity intervention on the nutritional status and indicators of frailty in the elderly in Maseru and district. The intervention will be implemented in the elderly who are found to be frail during the baseline of the study in which you participated. In this study you will be given sour milk to drink for three months. You may or may not also receive guidance about being physically active during this time (an appropriate exercise programme will be designed for you e.g. walking in group). Together with the researcher and the team you will choose appropriate days in the week to begin the program. You are required to participate in the intervention for a period of 3months. After that time, the researcher and the team will come back to your home to collect information on socio-demography, reported health, nutritional status, physical activity and frailty (the same as in the first information collection process). You will not be paid to participate in the study and it will not cost you anything.

During these follow ups, questionnaires will be filled out at the homes of the participants by researcher and trained field workers. We will also take measurements such as weight, height, knee height, calf circumference, mid upper arm circumference. Researchers will endeavour to provide information about the outcome of the research. Your information will not be released for other uses without consent, unless required by law.

**Benefits and risk** of being in the study: By participating in the study you will help us to develop nutrition and frailty information on the elderly that will benefit the senior citizens of our land. There are no risks involved, other than possible stiffness associated with initiating physical activity. One of the benefits is that you will receive free sour milk and some participants will be given advice about an exercise programme for a period of three months.

**Participation is voluntary,** and refusal to participate will involve no penalty or loss of benefits to which you are entitled; you may discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled.

**Confidentiality:** Efforts will be made to keep personal information confidential. Absolute confidentiality cannot be guaranteed. Personal information may be disclosed if required by law. Organizations that may inspect and/or copy your research records for quality assurance and data analysis include groups such as the Ethics Committee of the Faculty of Health Sciences, UFS and the Ministry of Health Lesotho. If results are published, this may lead to individual/cohort identification.

Kind regards


_____ _____

Prof. Corinna Walsh Rose Dufe Turkson

(Promoter) +27514013818 (Researcher) +266 59501023

**Boikoetliso le lebese la mafi**

**THE IMPACT OF A NUTRITION AND PHYSICAL ACTIVITY INTERVENTION PROGRAMME ON FRAILTY SYNDROME IN ELDERLY CITIZENS IN LESOTHO**

Re leboha ha u ikhethetse ho re thusa boithutong bona ba bohlokoa. Re ts'epa hore boithuto bona botla tlatseletsa ntlafatsong ea maphelo a maqheku a Lesotho.

Re tsoa Junifesithing ea Foreisetata, lekoleng la mahlale ka bophelo. Re etsa boithuto bo shebaneng le tsusumetso ea phepo e nepahetseng le boikoetliso khohleng le bohlokoba frailty syndrome ho maqheku le maqhekoana a Lesotho. Boithuto ke mokhoa oa ho ithuta ka ho fana ka likarabo tsa lipotso.

**Memo ea ho nka karolo:** re u kopa/mema ho nka karolo boithutong bona.

**Se kenyeletsang boihuto**: moikemisetso ea boithuto ke ho ela hloko ts'usumetso ea phepo e nepahetseng le boikoetliso ho phepo le litlamorao tsa frailty maqhekung a seterekeng sa Maseru. U khethiloe ho ba karolong e senang ena e tla fanoa maqhekung le maqhekoaneng a tla fumanoa a le frail qalong ea boithuto boo u nkileng karolo ea bona. Boithutong bona u tla fuoa lebese le mafi likhoeli tse tharo. U ka nna fumana kapo ua se ke ua fumana tataiso ea boikoetliso nakong ena. Moithuti le sehlopha sa hae bat la khetha mmoho letsatsi le nepahetseng hara beke ho qala programme ea bona. U hlokahala ho nka karolo tsusumetsong ena likhoeli tse tharo.

Kamorao ho khoeli tse tharo, tse tseletseng le selemo, mothuti ke sehlopha sa hae bat la boela ba khutlela malapeng a lona ho phutha molaetsa oa

Tsalong morao tsena, mothuti le sehlopha sa hae ba tla tlatsa pampiri ea lipotso malapeng a batho ba nkang karolo.

Re tla thabela le ho nka limetho tsa boima, bolelele, bolelele ba lengoele, calf circum, le selika likoe sa sephaka.

Ho bohlokoa ho bokella moleatsa o nepahetseng le hoba le tsebo ka maqheku hobane ba lokela ho phela ha lelele le ho ithlokomela, le ho hlokomela bang ka bona ba kulang le likhutsana tse phelang kahare ho sebaka sa rona.
Boithuto bo ka fana ka molaetsa o hlakisang bohlokoa bokamosong ba bophelo ba motho ea khethuoeng ho nka karolo.

Moithuti o tla leka ka matla ho fana ka molaetsa ha boithuto bo fihletsoe. Lisebelisoa tsa lona le melaetsa e keke ea lokolla sebakeng sa mabaka a mang ntle le tumello,ntle le haeba molao o tlama joalo.

**Melemo** le likotsi tsa ho ba karolo ea boithuto: ho nka karolo boithutong bona ho tla re thusa ho holisa phepo e nepahetseng le ho fetisa molaetsa ka frailty ho maqheku molemong oa sechaba sa rona. Ha hona kotsi ha u nka karolo boithutong bona

**Ho nka karolo ke boithaopo**, ho hana ho nka karolo ho keke ha eba le likotlo kapo tahlehelo ea melemo e u lokelang; u ka tlohela ka lehare feela 'me ha hona likotlo kapo tahlehelo ea melemo e u lokelang.

**Lekunutu:** boikhathatso bo matla bo tla etsoa e le ho boloka melaetsa ea motho ka bo mong ele lekunutu. Le ha ho le joalo, ha ho bonnete ba lekunutu le tsoeleletseng. Litaba tseo eleng lekunutu ho monga tsona li ka hlaella ha fela molao o tlamo joalo. Mekhatlo e tla hlahloba/kapo ho qopitsa lipoloko tsa boithuto ba hau molemong oa netefatso ea boleng bo holimo li kenyeletsa lihlopha tse kang komiti ea ethics ea lekalana la mahlale ka bophelo, UFS le lekala la bophelo Lesotho. Ha liphetho li photlolititsoe

Rea leboha

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Prof. Corinna Walsh

(Promoter) +27514013818

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Rose Dufe Turkson

(Researcher) +266 59501023

**Appendix 2**

Consent form -Baseline

**The Impact of a Nutrition and Physical Activity Intervention Programme on Frailty Syndrome in Elderly Citizens in Lesotho**

You have been asked to participate in a research study.

You have been informed about the study by Rose Dufe Turkson.

You may contact Prof Corinna Walsh on +27514013818 or Rose Dufe Turkson on +266 59501023/63329275 at any time if you have questions about the research or if you are injured as a result of the research.

You may contact the Secretariat of the Ethics Committee of the Faculty of Health Sciences, UFS at telephone number +27(051)4052812 if you have questions about your rights as a research participant.

Your participation in this research is voluntary, and you will not be penalised or lose benefits if you refuse to participate or decide to terminate participation.

If you agree to participate, you will be given a participant information sheet, which is a written summary of the research.

The research study, including the above information has been verbally described to me. I understand what my involvement in the study means and I voluntarily agree to participate.

_____ _____

Signature or mark of participant Date

Consent form -Baseline

**SEO PHEPO E NEPAHETSENG LE BOIKOETLISO LI SE ETSANG ELE HO KENA LIPAKENG FOR FRAILTY SYNDROME MAQHEKUNG LE MAQHEKOANENG A SECHABA SA LESOTHO**

U kopuoe ho nka karolo phuputsong.

U joetsuoe boithuto ba phuputso ke Rose Dufe Turkson.

U ka ikopanya le Prof. Corinna Walsh nomorong tse latelang +2751413818 kapa Rose Dufe Turkson nomorong tsena 266 59501023 nako efe ha u na le lipotso ka liphuputso kapa ha u hlalile kotsi nakong ea liphuputso.

U ka ikopanya le ofisi ea komiti ea Ethics ea lekala la tsa mahlale le tsa bophelo, UFS nomorong tsena 27 (051) 4052812 ha u na le lipotso ka litolelo tso hau joaloka boithuto liphuputsong.

Ho nka karolo hoa hau liphuputsong ke boithaopo,ebile ha u na ho sekisetsoa kapa hona hose une molemo o itseng ha u khetha ho se nke karolo,kapa hona ho tlohela ho nka karolo ka lehare.

Ha u lumela ho nka karolo,u tla fuoa kopi ea tokomane e tekennoeng le pampiri e bontsang boithaopo e ngotsoeng kakaretso ea liphuputso.

Liphuputso, ho kkenyeletsa le litaba tsohle tse ka holimo, li ntlhake tse. Ke utluisisa bohlokoa ba ho nka karolo ho aka ‘me ke lumela ho ithaopela ho naka karolo.

_____ _____

**Tekeno ea a nkileng karolo** **letsatsi**

CONSENT TO PARTICIPATE IN RESEARCH-**INTERVENTION**

**The Impact of a Nutrition and Physical Activity Intervention Programme on Frailty Syndrome in Elderly Citizens in Lesotho**

You have been asked to participate in a research study.

You have been informed about the study by Rose Dufe Turkson.

You may contact Prof Corinna Walsh on +27514013818 or Rose Dufe Turkson on +266 59501023/63329275 at any time if you have questions about the research or if you are injured as a result of the research.

You may contact the Secretariat of the Ethics Committee of the Faculty of Health Sciences, UFS at telephone number +27(051)4052812 if you have questions about your rights as a research participant.

Your participation in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to terminate participation.

If you agree to participate, you will be given a participant information sheet, which is a written summary of the research.

The research study, including the above information has been verbally described to me. I understand what my involvement in the study means and I voluntarily agree to participate.

_____ _____

Signature or mark of Participant Date

**BOITLAMO BA HO NKA KAROLO BOITHUTONG-intervention**

**SEO PHEPO E NEPAHETSENG LE BOIKOETLISO LI SE ETSANG ELE HO KENA LIPAKENG FOR FRAILTY SYNDROME MAQHEKUNG LE MAQHEKOANENG A SECHABA SA LESOTHO**

U kopuoa ho nka karolo boithutong bona

U tsebisitsoe ka boithuto bona ke Rose Dufe Turkson

U ka letsetsa Porofessor Corinna Walsh linomorong tsa +27514013818 kapa Rose Dufe Turkson +266 59501023/63329275 ka nako tsohle ha u na le lipotso kapa u lemetse ka lebaka la boithuto bona

U ka letsetsa Mongoli oa komiti ea ethics lekaleng la mahlale ka bophelo, junifesithing ea Foreisetata linomorong tsa +27 (051) 4052812 haeba u na le lipotso ka litokelo tsa hau boithutong bona.

Tlatsetso ea hau ke boikhethelo boithutong bona, u keke ua qobelloa kapo ho lahleheloa ke melemo e u lokelang ha u hana ho nka karolo kapa u se u tlohela ka le hore ho nka karolo.

Ha u lumela ho nka karolo, u tla fuoa kopi e tekennoeng ea tokomane ena mmoho le leqephe la ho bontsa ho nka karolo, ele kakaretso ea boithuto.

Boithuto bona mmoho le molaetsa o kaholimo ke li hlaloselitsoe ka molomo. Keo utloisisa hore ho kenye letsoho boithutong bome ho bolelong ‘me ke lumelo ho uko karolo.

_____ _____

Signature of Participant Date

## Appendix 3:

### SOCIO-DEMOGRAPHIC AND HOUSEHOLD QUESTIONNAIRE

**Department of Nutrition and Dietetics**

**University of the Free States**

### THE IMPACT OF NUTRITION AND PHYSICAL ACTIVITY INTERVENTION PROGRAMME FOR FRAILTY SYNDROME IN ELDERLY BASOTHO CITIZENS

(All information in this questionnaire is confidential).

| | | | |
|---|---|---|---|
| Area | _____ | | 1-2 |
| Respondents number : | | | 3-5 |
| Interviewer: | _____ | | 6-8 |
| Interview Date: | | D D M M Y Y Y Y | 9-16 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **1. How many years have you been living in an urban area?_____** | | | | | | 18 |
| **2. What is your First language?** | | | | | | 19 |
| i. Sesotho | | | | | | 20 |
| ii. English | | | | | | |
| iii. Others Specify | | | | | | |
| **3. Gender** 1= male 2 = female | | | | | | 21 |
| **4 What is your marital status?** | | | | | | |
| i. Never | | | | | | |
| ii. Currently married/ Traditional marriage | | | | | | 22 |
| iii. Living with partner | | | | | | |
| iv. Widowed | | | | | | |
| v. Separated | | | | | | |
| vi. Divorced | | | | | | |
| vii. Other, specify_____ | | | | | | |
| | | | | | | |
| **5. What is your occupation? *(you may choose more than 1)*** | | | | | | |
| i. Housewife by choice | | | | | | |
| ii. Unemployed | | | | | | 23-24 |
| iii. Self Employed | | | | | | |
| iv. Full time wage earner (receive a salary) | | | | | | |
| v. Other, specify (part-time, piece job etc.)_____ | | | | | | |
| vi. Pension | | | | | | |
| **6.Type of dwelling:** | | | | | | |
| i. Brick, Concrete | | | | | | 25 |
| ii. Traditional mud | | | | | | |
| iii. Tin | | | | | | |
| iv. Plank, wood | | | | | | |
| v. Other, specify_____ | | | | | | |

| | | |
|---|---|---|
| 7. **Do You Have Electricity In The House?** Yes = 1 No = 2 | | 26 |
| 8**. Where Do You Get Drinking Water Most Of The Time?** | | |
| I. Own Tap | | |
| Ii. Communal Tap | | 27 |
| Iii. River, Dam | | |
| Iv. Borehole, Well | | |
| V. Other, Specify -_____ | | |
| **9. What Type Of Toilet Does This Household Have?** | | |
| I. Flush | | 28 |
| Ii. Pit | | |
| Iii. Vip | | |
| V. Other, Specify _____ | | |
| **10. What Fuel Is Used For Cooking Most Of The Time?** | | |
| i. Electric | | |
| ii. Gas | | 29 |
| iii. Parrafin | | |
| iv. Wood, Coal | | |
| V. Sun | | |
| Vi. Open Fire | | |
| **11. Does the home have a working:** | | |
| i. Television Yes = 1 No = 2 | | 30 |
| ii. Radio Yes = 1 No = 2 | | 31 |
| iii. Refrigerator and/or freezer Yes = 1 No = 2 | | 32 |
| iv. Stove (Gas, Coal or electric) Yes = 1 No = 2 | | 33 |
| v. Primus or Paraffin | | 34 |
| vi. Microwave | | 35 |
| **12. How many people contribute to the total income? _____** | | **36** |
| **13. Household income per month** (including wages, rent, grants, sale of vegs, etc.) | | |
| i. None | | 37 |
| ii. M100-M500 | | |
| iii. M501- M1000 | | |
| iv M1001-M3000 | | |
| v. M3001-M5000 | | |
| vi. Over M5000 | | |
| vii. Don't know | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **14. Is this more or less the income that you had over the past six months?** | | | | | | | | | |
| i. More | | | | | | | | | |
| ii. Less | | | | | | | | 38 | |
| iii. The same | | | | | | | | | |
| **15. What is your level of education?** | | | | | | | | | |
| i. None | | | | | | | | 39 | |
| ii. Primary School | | | | | | | | | |
| iii. Secondary | | | | | | | | | |
| iv. Tertiary Education | | | | | | | | | |
| v. Don't Know | | | | | | | | | |

# Appendix 4:

## Reported Health Questionnaire

| | | | |
|---|---|---|---|
| Area | _____ | | 1-2 |
| Respondents number : | | | 3-5 |
| Interviewer: | _____ | | 6-8 |
| Interview Date: | | D D M M Y Y Y Y | 9-16 |

**INSTRUCTIONS** **FILL IN THE BOX WITH THE APPROPRIATE ANSWERS**

| | | |
|---|---|---|
| **1. Which best describes your history of smoking?** | | |
| i. Never smoked | | |
| ii. Currently Smoked | | |
| iii.Formerly smoked | | 17 |
| b. If yes, how many cigarette per day? _____ | | 18-19 |
| c. If yes,at what age did you start? _____ | | 20-21 |
| **2. Which best describes your history of snuffing?** | | |
| i. Never snuffing | | 22 |
| ii. Currently Snuffing | | |
| iii. Formerly snuffing | | |
| b. If yes, how many times per day do you snuff. _____ | | 23-24 |
| c. If yes,at what age did you start? _____ | | 25-26 |
| | | |
| **3. Which best describes your history of alcohol use?** | | |
| i. Never used alcohol products | | 27 |
| ii. Currently use alcohol products | | |
| iii. Formerly used alcohol products | | |
| b. If Currently, what form of alcohol do you use regularly (at least once a week) | | |
| i. Spirit (rum,whisky,gin,vodka etc.) | | 28 |
| ii. Wine | | |
| iii. Beer | | |
| iv. Homemade beer | | |
| **4. At least once a month,do you consume >5 alcoholic drinks per day?** | | |
| i. At what age did you start using alcohol?_____ | | 29-30 |
| ii. On weekends, how many alcohol containing drinks do you consume? _____ (More than 5 drinks per day)during the weekend? | | 31-32 |
| iii. Do you feel tired on Mondays after heavy alcohol consumption | | |
| **1= yes 2 = No** | | 33 |
| **5. Current Disability 1= yes 2= No** | | |
| i. Do you have any trouble walking about? | | 34 |
| ii. Do you have trouble seeing someone across the room ( with glasses) | | 35 |
| iii. Do you have trouble reading or seeing individual grains of rice/corn on your plate (without glasses) | | 36 |
| iv. Do you have trouble speaking and being understood? | | 37 |
| v. Do you have trouble hearing? | | 38 |

| | | |
|---|---|---|
| **6. Have you experienced any of the following in the last six months? 1= yes 2=No** | | |
| i. Chest pain or tightness with usual activity | | 39 |
| ii. Breathlessness with usual activity | | 40 |
| iii. Cough for at least 2 weeks | | 41 |
| iv. Wheezing or whistling in the chest | | 42 |
| v. Loose stools/diarrhea for at least 3 days | | 43 |
| vi. Vomiting | | 44 |
| vii. Loss of appetitie | | 45 |
| viii. Swelling of feet | | 46 |
| ix. Blood in urine | | 47 |
| x. Involuntary weight loss of >3kg | | 48 |
| xi. Skin rash | | 49 |
| xii. Joint pain | | 50 |
| xiii. Sexually transmitted diseases | | 51 |
| **7. Have you been diagnosed with the following? 1 yes 2= No** | | |
| i. Diabetes | | 52 |
| ii. Highblood preasure | | 53 |
| iii. stroke | | 54 |
| iv. Heart diasease/ angina /heart attack | | 55 |
| v. Heart failure | | 56 |
| vi. Cancer | | 57 |
| vii. Liver disease /hepatitis /jaundice | | 58 |
| viii. Lung disease eg. Emphysema or asthma | | 59 |
| ix. tuberculosis | | 60 |
| x. HIV/AIDS | | 61 |
| xi. Epilepsy | | 62 |
| xii. Allergy | | 63 |
| **8. Are you taking medication regularly (ie. at least once a week) 1=yes 2= no** | | 64 |
| b. If yes, list the medication that you are currently using (including traditional ones. | | |
| _____ | | 65-66 |
| _____ | | |
| _____ | | |
| _____ | | |
| c. During the past 12 months have you been hospitalized? 1=yes 2= No | | 67 |
| If yes how many times | | 68 |
| **Social Situation and stress:** | | |
| **9. Are you a member of a church ? _____ 1=yes 2=No** | | 69 |
| b. Do you attend service at least 2x a month 1= yes 2= No | | 70 |

| | | |
|---|---|---|
| **10. Stress is defined as feeling irritable or filled with anxiety,or having sleeping difficulties** | | |
| as a result of conditions at work or at home. How often have have you felt stressed in | | |
| the last 2 months? | | 71 |
| i. never | | |
| ii. A few periods of stress | | |
| iii. Severalperiods of stress | | |
| iv. Permanent stress | | |
| **11. Have you experienced any of the following during the past 12 months? 1 =yes 2 =No** | | |
| i. loss of job | | 72 |
| ii. Retirement | | 73 |
| iii. Loss of crop /bussiness failure | | 74 |
| iv. Household break in | | 75 |
| v. Marital Seperation/ divorce | | 76 |
| vi. Other major intra-family conflict . If yes specify | | 77 |
| vii. Major personal injury or illness | | 78 |
| viii. Voilence | | 79 |
| ix. Death of a spouse | | 80 |
| x. death or major illness of another family member | | 81 |
| xi. Wedding of family member | | 82 |
| xii. New job | | 83 |
| xiii. birth in the family | | 84 |
| xiv.separation from family | | 85 |
| xv unavailabilyt of food /food insecurity | | 86 |
| xvi. Other major stress …… If yes specify …….. | | 87 |
| **12. During the past 12 months, was there ever a time when you felt sad, blue ,or depressed** | | |
| for two weeks or more in a row? 1= yes 2= No | | 88 |
| **13. Are you willing to answer questions related to HIV/ AIDS 1= yes 2=no** | | 89 |
| b. if yes do you care for people with HIV/AIDS . 1= yes 2= No | | 90 |
| c. if yes which of these people | | |
| i. your children | | 91 |
| ii. Your grandchildren | | 92 |
| iii. Your spouse | | 93 |
| iv. Your family members | | 94 |
| v. your friends | | 95 |
| vi. People in the community | | 96 |

# Appendix 5:

## Dietary Diversity Questionnaire

(All information in this questionnaire is confidential).

| | | | |
|---|---|---|---|
| Area | _____ | | 1-2 |
| Respondents number : | | | 3-5 |
| Interviewer: | _____ | | 6-8 |
| Interview Date: | | D D M M Y Y Y Y | 9-16 |

**INSTRUCTIONS FILL IN THE BOX WITH THE APPROPRIATE ANSWERS**

Please describe the foods (meals and snacks) that you ate or drank yesterday during the day and night, whether at home or outside the home. Start with the first food or drink of the morning.
Write down all foods and drinks mentioned. When composite dishes are mentioned, ask for the list of ingredients.

When the respondent has finished, probe for meals and snacks not mentioned.

| Breakfast | Snack | Lunch | Snack | Dinner | Snack |
|---|---|---|---|---|---|
| | | | | | |

*When the respondent recall is complete, fill in the food groups based on the information recorded above. For any food groups not mentioned, ask the respondent if a food item from this group was consumed.*

| Question number | Food group | Examples | YES=1 NO=0 | |
|---|---|---|---|---|
| 1 | CEREALS | corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + *insert local foods e.g. ugali, nshima, porridge or paste,mabele,samp* | | ☐ 17 |
| 2 | WHITE ROOTS AND TUBERS | white potatoes, white yam, white cassava, or other foods made from roots | | ☐ 18 |
| 3 | VITAMIN A RICH VEGETABLES AND TUBERS | pumpkin, carrot, squash, or sweet potato that are orange inside + *other locally available vitamin A rich vegetables (e.g. red sweet pepper)* | | ☐ 19 |
| 4 | DARK GREEN LEAFY VEGETABLES | dark green leafy vegetables, including wild forms + *locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach* | | ☐ 20 |
| 5 | OTHER VEGETABLES | other vegetables (e.g. tomato, onion, eggplant) + *other locally available vegetables* | | ☐ 21 |
| 6 | VITAMIN A RICH FRUITS | ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + *other locally available vitamin A rich fruits* | | ☐ 22 |
| 7 | OTHER FRUITS | other fruits, including wild fruits and 100% fruit juice made from these | | ☐ 23 |
| 8 | ORGAN MEAT | liver, kidney, heart or other organ meats or blood-based foods | | ☐ 24 |
| 9 | FLESH MEATS | beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects | | ☐ 25 |
| 10 | EGGS | eggs from chicken, duck, guinea fowl or any other egg | | ☐ 26 |
| 11 | FISH AND SEAFOOD | fresh or dried fish or shellfish | | ☐ 27 |
| 12 | LEGUMES, NUTS AND SEEDS | dried beans, dried peas, lentils, nuts, seeds or foods made from these (e.g. hummus, peanut butter) | | ☐ 28 |
| 13 | MILK AND MILK PRODUCTS | milk, cheese, yogurt or other milk products | | ☐ 29 |

| | | | | |
|---|---|---|---|---|
| 14 | OILS AND FATS | oil, fats or butter added to food or used for cooking | | ☐30 |
| 15 | SWEETS | sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes anything (meal or snack) OUTSIDE the home yesterday? | | ☐31 |
| 16 | SPICES, CONDIMENTS, BEVERAGES | spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages<br>Household level only Individual level<br>Did you or anyone in your household eat anything (meal or snack)<br>Did you eat OUTSIDE the home yesterday? | | ☐32 |

## Appendix 6:

## Mini Nutritional Assessment Update

(All information in this questionnaire is confidential).

**Questionnaire**

For office use only: 1 - 4

*Mark the appropriate option with a* ***X or write your answer in the space provided:***

1 Today's date: d d m m y y — d d m m y y — 5 -10

2 Gender: — 11

1 Male

2 Female

3 Age: _____years — 12 - 13

4 Ethnicity — 14

1 Black

2 White

3 Coloured

4 Indian

5 Other Specify _____

5 Weight: _____Kg — 15 - 19

6 Height: _____cm — 20 - 22

7 Knee height: _____cm — 23 - 24

**THE MNA (MINI NUTRITIONAL ASSESSMENT): UPDATE**

**MINI NUTRITIONAL ASSESSMENT***© 1994 Nestec Ltd (Nestlé Research Centre)/Nestlé Clinical Nutrition*

**i. ANTHROPOMETRIC ASSESSMENT**

8 B.M.I (weight / height² in Kg/m²) — 25

0 BMI <19

1 19 ≤ BMI <21

2 21 ≤ BMI <23

3 BMI ≥23

9 Mid Arm Circumference _____cm — 26 - 28

0.0 MAC < 21

0.5 21 ≤ MAC ≤ 22

1.0 MAC > 22

| | | | |
|---|---|---|---|
| 10 | Calf Circumference _____cm | | 29 |
| | 0 CC <31 | | |
| | 1 CC ≥31 | | |
| 11 | Weight loss during last 3 months | | 30 |
| | 0 weight loss > 3Kg | | |
| | 1 does not know | | |
| | 2 weight loss between 1 and 3 Kg | | |
| | 3 no weight loss | | |
| **ii.** | **GLOBAL EVALUATION** | | |
| 12 | Does the participant live independently in contrast to a nursing home? | | 31 |
| | *Na oa iphelisa?* | | |
| | 0 no 0 CHE | | |
| | 1 yes 1 E | | |
| 13 | Does the participant take more than 3 prescription drugs (per day)? | | 32 |
| | *Na o noa lithlare ho feta makhetlo a mararo ka letsatsi?* | | |
| | 0 no 0 CHE | | |
| | 1 yes 1 E | | |
| 14 | In the past few months, has the participant suffered from psychological stress or acute disease? | | 33 |
| | *Likhoeling tse tharo tse fetileng, na u kile oa ba le:* | | |
| | *(bokulo bo potlakileng)? or (khatello ea maikutlo?)* | | |
| | 0 no 0 CHE | | |
| | 1 yes 1 E | | |
| 15 | Mobility | | 34 |
| | 0 bed or chair bound | | |
| | 1 able to get out of bed / chair, but does not go out | | |
| | 2 goes out | | |
| 16 | Neuropsychological problems | | 35 |
| | *Mathata a kello* | | |
| | 0 severe dementia or depression | | |
| | 1 mild dementia | | |
| | 2 no psychological problems | | |
| 17 | Pressure sore or skin ulcers | | 36 |
| | 0 yes 0 E | | |
| | 1 no 1 CHE | | |

| iii. | DIETARY ASSESSMENT | | | |
|---|---|---|---|---|
| 18 | How many full meals does the participant eat daily? | | | 37 |
| | *O ja ha kae ka letsatsi?* | | | |
| | 0 1 meal | 0 | | |
| | 1 2 meals | 1 | | |
| | 2 3 meals | 2 | | |
| 19 | Does he/she consume: | | | 38 - 40 |
| | At least one serving of dairy products (milk, cheese, yogurt) per day? | *Yes / No* | | |
| | *Na u ja bonyane e 'ngoe ea tse latelang ka letsatsi: lebese, cheese kapa yoghurt?* | | | |
| | Two or more servings of beans or eggs per week? | *Yes / No* | | |
| | *U ja linaoa kapa mahe ho feta habeli ka beke?* | | | |
| | Meat, fish or poultry every day? | *Yes / No* | | |
| | 0.0 if 0 or 1 yes | | | |
| | 0.5 if 2 yes | | | |
| | 1.0 if 3 yes | | | |
| 20 | Does he/she consume two or more servings of fruits or vegetables per day? | | | 41 |
| | *Na u ja ho feta mefuta e 'meli ea litholoana kappa meroho ka letsatsi?* | | | |
| | 0 no | 0 CHE | | |
| | 1 yes | 1 E | | |
| 21 | Has the participant food intake declined over the past 3 months due to a loss of appetite, digestive problems, chewing or swallowing difficulties? | | | 42 |
| | *Na mokhoa oa hao oa hoja o theohile nakong ea likhoeli tse tharo tse fetileng re shebile maemo a takatso ea lijo?* | | | |
| | 0 severe loss of appetite | | | |
| | 1 moderate loss of appetite | | | |
| | 2 no loss of appetite | | | |
| 22 | How many cups / glasses of beverages (water, juice, coffee, tea, milk, wine, beer,...) does the participant consume per day? | | | 43 - 45 |
| | *Ke lik'hapho/glass tse kae tsa lino tseo u li noang ka letsatsi?* | | | |
| | 0.0 less than 3 glasses | | | |
| | 0.5 3 to 5 glasses | | | |
| | 1.0 more than 5 glasses | | | |
| 23 | Mode of feeding | | | 46 |
| | *Bolela mokhoa o u sebelisang oa ho ja.* | | | |
| | 0 fed requires assistance | | | |
| | 1 self-fed with some difficulties | | | |
| | 2 self-fed without any problem | | | |

| iv. | SUBJECTIVE ASSESSMENT | |
|---|---|---|
| 24 | Does the participant consider to have any nutritional problems? | 47 |
| | *Na u kare u na le bothata ba hoja lijo tse nepahetseng?* | |
| 0 | major malnutrition | |
| 1 | does not know or moderate malnutrition | |
| 2 | no nutritional problems | |
| 25 | In comparison with other people of the same age, how would the participant consider his/her health status? | 48 - 50 |
| | *Papisong le batho ba bang ba lemo tsa hau, okare boemo ba hau ba bophelo bo joang?* | |
| 0.0 | not as good | |
| 0.5 | does not know | |
| 1.0 | as good | |
| 2.0 | better | |
| | **TOTAL (maxi 30 points):** *(question 8-25)* | 51 - 54 |

| **SCORE:** |
|---|
| ≥ 24 points: well-nourished |
| 17 to 23.5 points: at risk of malnutrition |
| < 17 points: undernutrition |

*Ref: Guigoz Y. Vellas B and Gary P.J. 1994. Mini Nutritional Assessment:*

*A practical assessment tool for grading the nutritional state of elderly patients.*

*Facts and Research in Gerontology . Supplement #2: 15-59*

**Appendix 7:**

**Physical Activity Scale For The Elderly ( P A S E )**

(All information in this questionnaire is confidential).

Area _____ (1-2)

Respondents number : (3-5)

Interviewer: _____ (6-8)

Interview Date: D D M M Y Y Y Y (9-16)

**INSTRUCTIONS FILL IN THE BOX WITH THE APPROPRIATE ANSWERS**

*Answer all items as accurately as possible.*

Please complete this questionnaire by either filling in the blank.

Here is an example: During the past 7 days, how often have you seen the sun?

[0.] NEVER [1.] SELDOM (1-2 DAYS)

[2.] SOMETIMES (3-4 DAYS) [3.] OFTEN (5-7 DAYS)

**LEISURE TIME ACTIVITY**

1. Over the past 7 days, how often did you participate in sitting activities such as reading, watching TV or doing handcrafts, washing, stretching eg. Standing from a chair?

0.] NEVER [1.] SELDOM (1-2 DAYS) [2.] SOMETIMES (3-4 DAYS) [3.] OFTEN (5-7 DAYS)

GO TO Q.#2

1a. What were these activities? _____

1b. On average, how many hours per day did you engage in these activities?

1.] LESS THAN 1 HOUR [2.] 1 BUT LESS THAN 2 HOURS

3. 2-4 HOURS [4.] MORE THAN 4 HOURS

2. Over the past 7 days, how often did you take a walk outside your home or yard for any reason? For example, for fun or exercise, walking to work, walking the dog, etc.?

0.] NEVER [1.] SELDOM (1-2 DAYS) [2.] SOMETIMES (3-4 DAYS) [3.] OFTEN (5-7 DAYS)

GO TO Q.#3 17

2a. On average, how many hours per day did you spend walking? 18

[1.] LESS THAN 1 HOUR [2.] 1 BUT LESS THAN 2 HOURS

[3.] 2-4 HOURS [4.] MORE THAN 4 HOURS

3. Over the past 7 days, how often did you engage in light sport or recreational activities such as bowling, golf with a cart, shuffleboard, fishing from a boat or pier or other similar activities?

(Casual walking, stretching, siting, light weight training, dancing slowly, light yard /house work)

0.] NEVER [1.] SELDOM (1-2 DAYS) [2.] SOMETIMES (3-4 DAYS) [3.] OFTEN (5-7 DAYS) 19

GO TO Q.#4

3a. What were these activities? _____ 20

3b. On average, how many hours per day did you engage in these light 21

[1.] LESS THAN 1 HOUR [2.] 1 BUT LESS THAN 2 HOURS

[3.] 2-4 HOURS [4.] MORE THAN 4 HOURS

4. Over the past 7 days, how often did you engage in moderate sport and recreational activities such as double tennis, dancing,hunting or other similar activities? (brisk walking,walking up hill, drawing water or carrying bucket of water, carrying a child weighing more than 2.5 kg etc.

0.] NEVER [1.] SELDOM (1-2 DAYS) [2.] SOMETIMES (3-4 DAYS) [3.] OFTEN (5-7 DAYS) ☐ 22

GO TO Q.#5

4a. What were these activities? _____

4b. On average, how many hours per day did you engage in these moderate sport and recreational activities? ☐ 23 ☐ 24

[1.] LESS THAN 1 [2.] 1 BUT LESS THAN 2 HOURS

[3.] 2-4 HOURS [4.] MORE THAN 4 HOURS

5. Over the past 7 days, how often did you engage in strenuous sport and recreational activities such as jogging, swimming, cycling, singles tennis, aerobic dance, skiing (downhill or cross-country) or other similar activities? ( jogging, running,most aerobics ,climbing stairs etc) ☐ 25

0.] NEVER [1.] SELDOM (1-2 DAYS) [2.] SOMETIMES (3-4 DAYS) [3.] OFTEN (5-7 DAYS)

GO TO Q.#6

5a. What were these activities? _____ ☐ 26

5b. On average, how many hours per day did you engage in these strenuous sport and recreational activities? ☐ 27

1.] LESS THAN 1 HOUR [2.] 1 BUT LESS THAN 2 HOURS

3. 2-4 HOURS [4.] MORE THAN 4 HOURS

6. Over the past 7 days, how often did you do any exercises specifically to increase muscle strength and endurance, such as lifting weights or pushups, etc.?

0.] NEVER [1.] SELDOM (1-2 DAYS) [2.] SOMETIMES (3-4 DAYS) [3.] OFTEN (5-7 DAYS) ☐ 28

GO TO Q.#7

6a. What were these activities? _____ ☐ 29

6b. On average, how many hours per day did you engage in exercises

1.] LESS THAN 1 HOUR [2.] 1 BUT LESS THAN 2 HOURS ☐ 30

3. 2-4 HOURS [4.] MORE THAN 4 HOURS

| | |
|---|---|
| **HOUSEHOLD ACTIVITY** | |
| 7. During the past 7 days, have you done any light housework, such as dusting or washing dishes? | |
| 1.] NO | 31 |
| 2]Yes | |
| 8. During the past 7 days, have you done any heavy housework or chores, such as vacuuming, scrubbing floors, washing windows, or carrying wood? | 32 |
| 1.] NO | |
| 2]Yes | |
| 9. During the past 7 days, did you engage in any of the following activities? | |
| Please answer **Yes** or **No** for each Item | |
| yes =1 No =2 | |
| a. Home repairs like painting,wallpapering,electrical work etc. | 33 |
| b. Lawn work or yard care,including snow or leaf removal, wood chopping,etc | 34 |
| c. Outdoor gardening | 35 |
| d. Caring for another person,such as children,dependent spouse. | 36 |
| **10. Work -Related Activity** | |
| During the past 7 days, did you work for pay or as a volunteer? | |
| No=1 yes =2 | 37 |
| 10 a How many hours per week did you work for pay and / as a volunter? ----------Hours | |
| 10b. Which of the following categories best describes the amount of physical activity required on your job/or volunteer work? | 38 |
| 1. Mainly siting with slight arm movement.[ eg. Office worker, watchmaker, seated assembly line worker bus driver etc.] | |
| 2. Sitting or standing with some walking [eg.cashier,general office worker, light tool and machinery worker]. | |
| 3. Walking , wit some handling of materials generally weighing less than 25kg [waiter/waitress,construction worker heavy tool and machinery worker] | |
| 4. Walking and heavy manual work often requiring handling of materials weighing over 25kg [eg. Stone mason farm of general labourer. | |
| Source: Neri (1993) | |
| 11. Apart from your dailly activities and what additional way of exercising would be acceptable to you? | |
| a. Walking in a group | |
| b. dancing | 41 |
| c. others specify …… | |

## Appendix 8:

## Frailty Scale Questionnaire

(A*ll information provided will be kept confidential)*

Area _____ 1-2

Respondents number : 3-5

Interviewer: _____ 6-8

Interview Date: 9-16

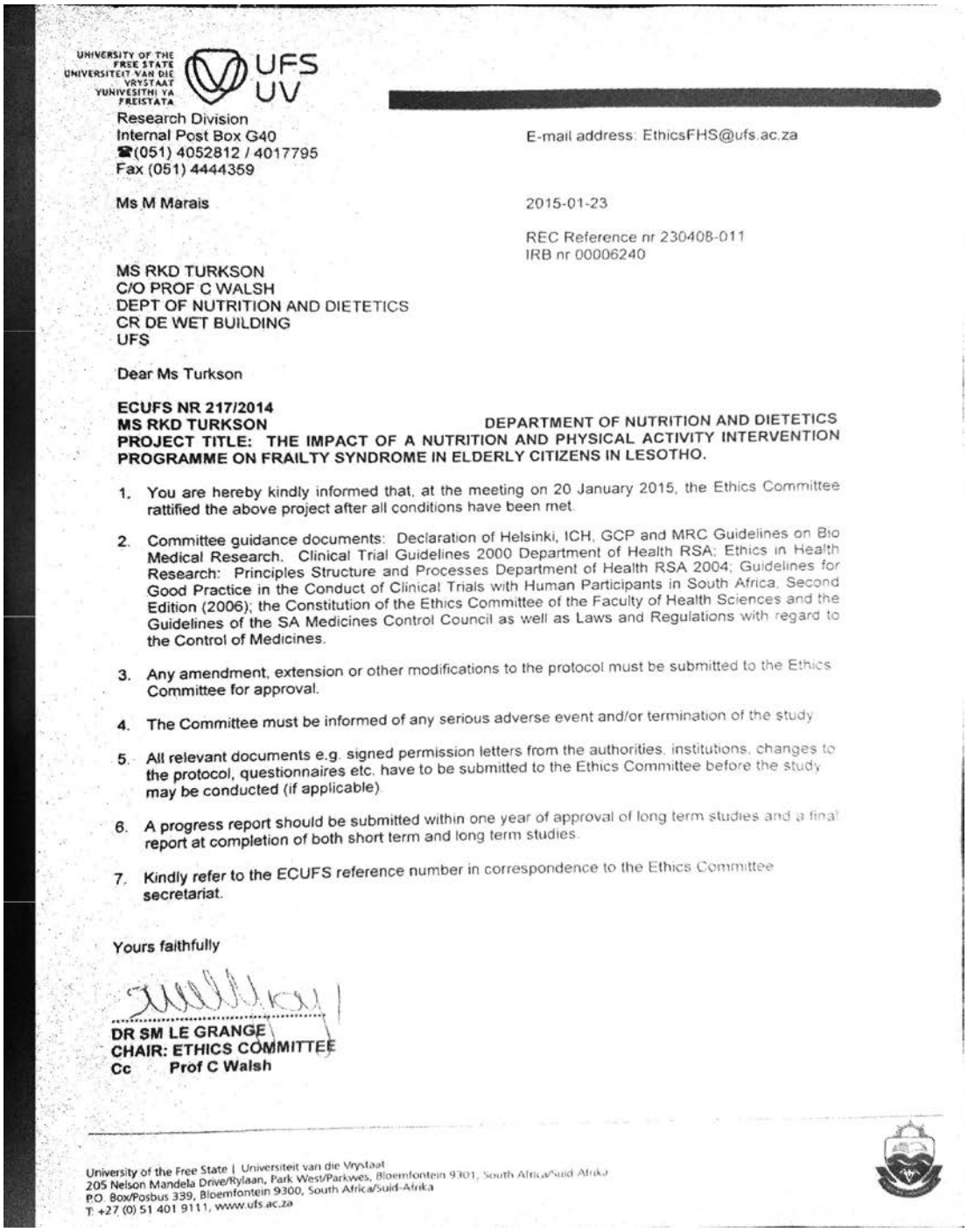
D D M M Y Y Y Y

**INSTRUCTIONS** **Complete the following for each particpant**

| Performance | No - 0<br>Yes -1 |
|---|---|
| **Participants are:**<br>Able to walk without assistance<br><br>Able to perform basic activities of daily living (eating, bathing, dressing, bed transfer)<br><br>Able to empty the content of your bowel<br><br>Able to empty the content of your bladder<br><br>Cognitively impaired (without dementia)<br><br>Cognitively impaired with dementia (exclude from study)<br><br>Need assistance with basic activities of daily living<br><br>Totally dependent on others for basic activities of daily living<br><br>Totally dependent on others for transfers | |

## Appendix 9:

## Approval Letter from Ethics Committee UFS



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E-mail address: EthicsFHS@ufs.ac.za

Ms M Marais

2015-01-23

REC Reference nr 230408-011
IRB nr 00006240

MS RKD TURKSON
C/O PROF C WALSH
DEPT OF NUTRITION AND DIETETICS
CR DE WET BUILDING
UFS

Dear Ms Turkson

**ECUFS NR 217/2014**
**MS RKD TURKSON** **DEPARTMENT OF NUTRITION AND DIETETICS**
**PROJECT TITLE: THE IMPACT OF A NUTRITION AND PHYSICAL ACTIVITY INTERVENTION PROGRAMME ON FRAILTY SYNDROME IN ELDERLY CITIZENS IN LESOTHO.**

1. You are hereby kindly informed that, at the meeting on 20 January 2015, the Ethics Committee rattified the above project after all conditions have been met.
2. Committee guidance documents: Declaration of Helsinki, ICH, GCP and MRC Guidelines on Bio Medical Research. Clinical Trial Guidelines 2000 Department of Health RSA; Ethics in Health Research: Principles Structure and Processes Department of Health RSA 2004; Guidelines for Good Practice in the Conduct of Clinical Trials with Human Participants in South Africa, Second Edition (2006); the Constitution of the Ethics Committee of the Faculty of Health Sciences and the Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines.
3. Any amendment, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.
4. The Committee must be informed of any serious adverse event and/or termination of the study.
5. All relevant documents e.g. signed permission letters from the authorities, institutions, changes to the protocol, questionnaires etc. have to be submitted to the Ethics Committee before the study may be conducted (if applicable).
6. A progress report should be submitted within one year of approval of long term studies and a final report at completion of both short term and long term studies.
7. Kindly refer to the ECUFS reference number in correspondence to the Ethics Committee secretariat.

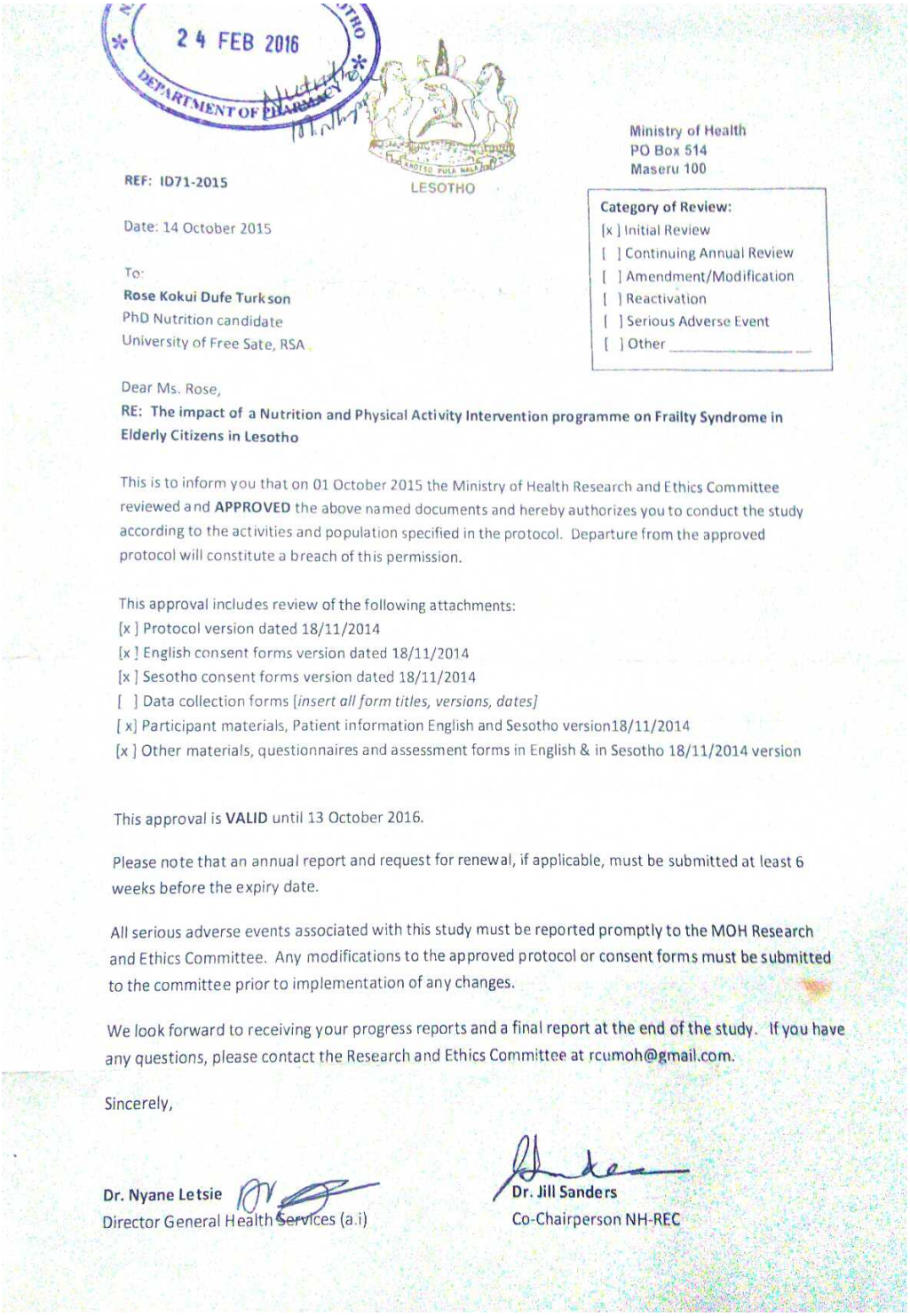
Yours faithfully

**DR SM LE GRANGE**
**CHAIR: ETHICS COMMITTEE**
**Cc Prof C Walsh**

University of the Free State | Universiteit van die Vrystaat
205 Nelson Mandela Drive/Rylaan, Park West/Parkwes, Bloemfontein 9301, South Africa/Suid-Afrika
P.O. Box/Posbus 339, Bloemfontein 9300, South Africa/Suid-Afrika
T: +27 (0) 51 401 9111, www.ufs.ac.za

# Appendix 10:

## Approval letters from Ministry of Health Lesotho



24 FEB 2016

DEPARTMENT OF PHARMACY

LESOTHO

Ministry of Health
PO Box 514
Maseru 100

REF: ID71-2015

Date: 14 October 2015

**Category of Review:**
[x ] Initial Review
[ ] Continuing Annual Review
[ ] Amendment/Modification
[ ] Reactivation
[ ] Serious Adverse Event
[ ] Other _____

To:
**Rose Kokui Dufe Turkson**
PhD Nutrition candidate
University of Free Sate, RSA

Dear Ms. Rose,

**RE: The impact of a Nutrition and Physical Activity Intervention programme on Frailty Syndrome in Elderly Citizens in Lesotho**

This is to inform you that on 01 October 2015 the Ministry of Health Research and Ethics Committee reviewed and **APPROVED** the above named documents and hereby authorizes you to conduct the study according to the activities and population specified in the protocol. Departure from the approved protocol will constitute a breach of this permission.

This approval includes review of the following attachments:
[x ] Protocol version dated 18/11/2014
[x ] English consent forms version dated 18/11/2014
[x ] Sesotho consent forms version dated 18/11/2014
[ ] Data collection forms *[insert all form titles, versions, dates]*
[ x] Participant materials, Patient information English and Sesotho version18/11/2014
[x ] Other materials, questionnaires and assessment forms in English & in Sesotho 18/11/2014 version

This approval is **VALID** until 13 October 2016.

Please note that an annual report and request for renewal, if applicable, must be submitted at least 6 weeks before the expiry date.

All serious adverse events associated with this study must be reported promptly to the MOH Research and Ethics Committee. Any modifications to the approved protocol or consent forms must be submitted to the committee prior to implementation of any changes.

We look forward to receiving your progress reports and a final report at the end of the study. If you have any questions, please contact the Research and Ethics Committee at rcumoh@gmail.com.

Sincerely,

**Dr. Nyane Letsie**
Director General Health Services (a.i)

**Dr. Jill Sanders**
Co-Chairperson NH-REC

# The National University Of Lesotho

## Institutional Review Board (NUL-IRB)

Telephone: Roma 22340601
Telegrams: Univer Roma, Lesotho
Telex: 4303 LO
Telefax: 22340000

P. O. Roma 180
Lesotho
Africa

## FACULTY OF HEALTH SCIENCES

December 9, 2014

Mrs Rose Dufe Turkson
NUL
PO Roma

Dear Sir/Madam,

**Re: The Impact Of A Nutrition And Physical Activity Intervention Programme On Frailty Syndrome In Elderly Citizens In Lesotho - (P 001/14)**

**National University of Lesotho (NUL), through its National University of Lesotho Institutional Review Board (NUL-IRB) under the Faculty of Health Sciences reviews and approves research proposals for NUL. The NUL-IRB operates with authorization for the National Review Board (NRB) of the Ministry of Health and follows Guidelines for submission of health research proposals. The purpose of NUL-IRB is to review research protocols and provide clearance letters.**

Thank you for submitting the above mentioned proposal. It has been reviewed and NUL – IRB hereby, approves your proposal. Authorization of this proposal is valid as long as the protocol is strictly followed. Departure from this will constitute a breach of this approval.

We look forward to having your progress reports and a final report at the end of your study.

Yours Sincerely,

Associate Professor S. AIYUK
Dean (FOHS)

Mrs. M. Ramathebane
Chairperson NUL-IRB

**Picture Gallery**

**Scenes from the field**

**Field assistant collecting data**

**Field assistant demonstrating exercises**

**Exercise intervention**

**Waiting for fermented milk with researcher standing behind them**

**Elderly consuming milk 15 minutes after intervention**