Changes in the food security status during the Covid-19 pandemic among the elderly within the Bethal District, Mpumalanga, South Africa

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Dissertation submitted in accordance with the requirements for the degree

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I can do all things through him who strengthens me.

PHILIPPIANS 4:13 ESV

DECLARATION

I declare that this thesis, titled **Changes in the food security status during the Covid-19 pandemic among the elderly within the Bethal District, Mpumalanga, South Africa**, hereby submitted for the qualification of Master of Science in Consumer Science at the University of the Free State, is my own independent work and that I have not previously submitted the same work for a qualification at/in another university/faculty.

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Aninka de Jager	28 July 2023
Name	Date

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ABSTRACT

South African households were established to be food insecure prior to the COVID-19 pandemic. However, hunger in Africa has only increased since the COVID-19 pandemic, due to its effects on economies and job losses. Moreover, the food security status of the elderly in the Bethal district, Mpumalanga, remained unknown for the time period prior to and during COVID-19. Therefore, this study focused on determining the food security status of the elderly with the use of HFIAS (Household Food Insecurity Access Scale) and HDDS (Household Dietary Diversity Score), also including food access and availability, health effects of COVID-19 and consumer food behaviour amongst the elderly in the Bethal district in Mpumalanga prior to and during COVID-19.

A mixed-method study with a total sample of 112 people, between the ages of 60 and 100 years, who live in the Bethal district (including: Amersfoort, Bethal, Ermelo, Kriel, Middelburg, Morgenzon, Secunda, Volksrust, Wakkerstroom, Witbank/eMalahleni, Devon, Brakpan, Lothair, and Perdekop). A structured questionnaire in the form of a survey was employed to obtain quantitative data. The qualitative component utilised semi-structured interviews that were conducted in person with the researcher in order to gain information of the participant's experience on the COVID-19 lockdown and it's effects on food security. Descriptive and inferential analysis to determine significance was done with SPSS version 26.

Only 21.6% of elderly respondents reported various levels of food insecurity during the COVID-19 pandemic. However, no significant differences were observed in the number of respondents that were severely food insecure prior to and during the COVID-19 pandemic. Furthermore, more than half (54.1%) respondents reported taking part in physical activity during lockdown; even though, the majority of the respondents did not meet the recommended physical activity guidelines of exercising at least 30 minutes per day. Very few (20.5%) of respondents reported weight gain during the COVID-19 lockdown period, as very few also reported being an emotional eater. A few participants (n=16) reported experiencing mental health difficulties due to social media content received during lockdown. More than half (69.9%) of respondents reported being

diagnosed with a chronic illness during the COVID-19 pandemic. The HDDS indicated that the elderly consumed more healthy foods during the COVID-19 pandemic compared to prior the pandemic, as very few respondents reported consuming more snacks during the lockdown, and very few reported lockdown as stressful or affecting their sleep negatively.

The findings suggest that food security prior to and during the COVID-19 pandemic remained high amongst the sampled population. However, mild to severe food insecurity percentages increased during the COVID-19 pandemic. Furthermore, the COVID-19 pandemic was observed to increase health difficulties experienced, which include chronic illnesses and mental health. No significant differences were reported in the elderly's physical activity during the COVID-19 pandemic. The majority of the elderly did not experience a change in income during the COVID-19 pandemic. For future research, more in-depth studies are necessary to explore the elderly's consumer behaviour, how provinces within South Africa's elderly food security differ after the COVID-19 pandemic, specifically focussing on the low-income elderly within South Africa and how food price increases since the COVID-19 pandemic has influenced the elderly's food security.

Keywords: elderly food security status; COVID-19 pandemic; Mpumalanga; South Africa; diet.

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LIST OF ABBREVIATIONS

AD	Alzheimer's disease
AF	Atrial fibrillation
AMD	Age-related macular degeneration
ASCVD	Arteriosclerotic heart disease
ASM	Appendicular skeletal muscle
BMD	Bone mineral density
BMI	Body mass index
CBOs	Community-based organisations
CHAP	Community health accreditation partner
CHD	Coronary heart disease
COVID-19	SARS-CoV-2
CVD	Cardiovascular disease
CV	Cardiovascular
DNA	Deoxyribonucleic acid
FAO	Food and Agriculture Organisation
FAP	Food assistance programmes
FT3	Free triiodothyronine mass
GDP	Gross Domestic Product
HDDS	Household dietary diversity score
HDL	High-density lipoprotein
HFIAS	Household food insecurity access scale
HIV/AIDS	Human immunodeficiency virus/acquired immunodeficiency syndrome
HRQoL	Health-related quality of life
HP	Highly palatable
IBD	Inflammatory bowel disease
IBS	Irritable bowel syndrome
kg	Kilogram
LDL	Low-density lipoprotein
LMICs	Low-and middle-income countries
MD	Mediterranean diet
MDR	Minimum dietary recommendation

MUFA	Mono-unsaturated fatty acid
NCDs	Non-communicable disease
NGOs	Non-governmental organisations
OA	Osteoarthritis
PA	Physical activity
PCOS	Polycystic ovary syndrome
PEM	Protein energy malnutrition
PUFA	Polyunsaturated fatty acid
SARS	Severe acute respiratory syndrome
SCD	Sickle cell disease
SDG	Sustainable Development Goals
SFA	Saturated fatty acids
SIBO	Small intestine bacterial overgrowth
SPSS	Statistical Package for the Social Sciences
SO	Sarcopenic obesity
T2D	Type 2 diabetes
TD	Thyroid dysfunction
TSH	Thyroid stimulating hormone
TT3	Total triiodothyronine
UN	United Nations
VC	Vascular calcification
WG	Whole grains
WHO	World Health Organisation

CHAPTER 1:
INTRODUCTION

1.1 GENERAL INTRODUCTION

An estimated 282 million people in Africa experienced hunger in 2020. Food insecurity is inevitable in situations where hunger, low income, and the inflated cost of healthy foods coexist, with conflict, climate change, economic slowdowns, and/or limited food access. Severe and prolonged food insecurity contributes to micronutrient deficiencies, malnutrition, obesity, and overweight, as well as non-communicable diseases (NCDs) (Food and Agriculture Organisation *et al.,* 2021). Although South Africa is considered food secure at the national level, it is food insecure at the household level (Statistics South Africa, 2019).

Globally, the COVID-19 pandemic caused economies to slow down and markets to close as exports and imports were brought to a standstill, which included disrupting global food systems in low- and middle-income countries (LMICs) (Headey & Ruel, 2020; Glauber *et al.,* 2020). As a result, global hunger increased by 9.8% since 2020, causing 828 million people globally to experience hunger during 2021 (WorldHealthOrgisation, 2022). In South Africa, the lockdown had a major impact on the local economy, causing the Gross Domestic Product (GDP) to decline, along with production, demand for goods and services, and a reduction in incomes and employment. The high prevalence of HIV/AIDS in South Africa made many individuals even more vulnerable to COVID-19, creating additional challenges for the public health system. Households in South Africa that depended on their monthly wages or incomes were most affected by the aftershocks of the economic slowdown, resulting in food insecurity (Khambule, 2022; Arndt *et al.,* 2020).

When financial stress is experienced and expenditure needs to be limited, people often resort to unhealthy coping strategies. These include consuming less nutritious foods and more energy-dense meals. In some instances, both maize and sugar are consumed excessively, while in other cases, sugar and fat will be consumed in considerable

amounts. In the worst cases, individuals will not consume any food for an entire day. Another contributor to malnourishment is the consumption of sugary drinks and ultra-processed foods, which are readily available and low in cost, contributing to diet-related diseases and obesity (Naicker *et al.,* 2021; Ledger, 2016).

Individually, a nutrient-deficient diet, which is often less expensive and high in calories, will cause nutrient deficiencies, severe acute malnutrition (Headey & Ruel, 2020), and weight gain (AlMughamis *et al.,* 2021). The COVID-19 pandemic has affected individuals in such a way that their lives became more sedentary (Sánchez *et al.,* 2021), including reduced physical exercise (Sooriyaarachchi *et al.,* 2021), adverse changes in diets, increased consumption of foods in between meals, reduced water intake, increased consumption of alcoholic beverages, increased screen time, reduced quality of sleep, and psychological effects (Bhutani & Cooper, 2021; Zachary *et al.,* 2021; Zeigler, 2021), compared to before the pandemic.

South Africans faced inequalities such as poverty, hunger, and low income before the COVID-19 pandemic, which were exacerbated during the pandemic, leading to increased food insecurity and vulnerability (Durão *et al.,* 2020). With the onset of the COVID-19 pandemic, many individuals either lost their jobs or experienced reduced income caused by the economic climate within South Africa (Mosiane *et al.,* 2020). Although many households were affected, food insecurity particularly affects elderly households due to singleness and lack of necessary finances, as found in a research study conducted in Sharpeville. Out of the 146 elderly persons who took part in the Sharpeville study, 33% reported being food insecure in terms of access, ranging from moderately to severely food insecure (Oldewage-Theron & Egal, 2021).

Thus, the purpose of this research was to ascertain the effect of the COVID-19 pandemic on elderly individuals within the Bethal district by evaluating their food security at the time of the study, compared to their food security status before the pandemic.

1.2 RESEARCH PROBLEM / PROBLEM STATEMENT

The COVID-19 pandemic caused severe disruption within various points of the world's food systems, including production, harvest, processing, transport, and consumption, leading to limited availability and increases in food prices. This situation made nutritious foods more expensive and unaffordable due to economic slowdowns, resulting in increases in unemployment, food insecurity (in terms of availability, accessibility, and stability), and malnutrition worldwide. Globally, around 828 million people experienced hunger during 2021 (WHO, 2022), and estimates showed that between 811 and 720 million people worldwide experienced undernourishment during 2020 (FAO *et al.,* 2021). Those who experienced severe food insecurity during the COVID-19 pandemic had an increased risk of contracting cardiovascular diseases, leading to reduced productivity and disrupted economic recovery (FAO *et al.,* 2021; Arndt *et al.,* 2020; Lugo-Morin, 2020; Swinnen, 2020).

Elderly individuals are particularly vulnerable to nutrient deficiencies due to poverty, which makes it challenging for them to maintain a healthy diet due to its expense. Poverty contributes to food insecurity in terms of restricted food availability, access, utilisation, and stability, malnutrition, declining productivity, and unemployment (FAO *et al.,* 2021; Lugo-Morin, 2020). The effects of poverty on adults manifest in various health issues such as anaemia, deficiencies, overweight, obesity, and protein energy malnutrition (PEM) (FAO *et al.,* 2021; Gibson, 2012). The prevalence of undernourishment increased from 5% in 2005 to 7.6% during 2019.

Causes of poverty include inequality in education, health, technology, information, and income, as well as socioeconomic factors such as marginalisation and social exclusion (FAO *et al.,* 2021). Moreover, elderly individuals' vulnerability is related to insufficient consumption of fruits and vegetables, which are essential for maintaining their health and providing necessary vitamins, minerals, and antioxidants. Oxidative stress caused by free radicals can compromise the immune system of older adults and lead to various illnesses, including chronic heart disease, cancer, atherosclerosis, diabetes, hypertension, inflammation, arthritis, and diabetes. Therefore, phytochemicals, beta-

carotene, vitamin C and E, zinc, copper, manganese, and selenium must be part of their daily food consumption (Whitney & Rolfes, 2016).

The vulnerable elderly faced both non-financial and financial limitations during the COVID-19 pandemic, further increasing their risk of contracting COVID-19 (Choi & Men, 2021). Within the South African context, there is a dearth of published articles on food security and the effects of the COVID-19 pandemic on food security, particularly concerning the elderly population. Therefore, research on the changes the COVID-19 pandemic caused in the food security of elderly individuals has not been conducted to date.

Improving health and food security in South Africa requires diet-related interventions (Hunter-Adams *et al.,* 2019). The prices of food and other essentials, such as water and electricity, increased during 2020, making it challenging for vulnerable individuals, including the elderly, to afford a healthy diet. Grants aimed at reducing poverty in South Africa were not sufficient to cover the costs of essential healthy foods for the beneficiaries (Misselhorn & Hendriks, 2017). The average income of individuals aged 55 to 64 years was estimated to be R3,500 per month in 2015 (Writer, 2016), while the cost of a basic food basket during April 2016 was R3,503 (Writer 2, 2016). The average cost of a food basket for November 2022 increased to R4,835.96, which was R563.52 more than the previous year (Govender, 2022). Minimum wages also saw an increase of 6.9% between 2015 and 2021 (Galal, 2022).

For this study, the time period of the COVID-19 restrictions to be researched is between 26 March and 17 August 2020, covering the initial hard lockdown from 26 March to 30 April 2020 (Alert level 5), alert level 4 from 1 May to 31 May 2020, and alert level 3 from 1 June to 17 August 2020 (SAGOV, 2023).

1.3 MAIN AIM OF THE STUDY

The purpose of this study was twofold:

1. To ascertain the extent to which the COVID-19 pandemic affected the food security of elderly individuals within the Bethal District, Mpumalanga.

2. To investigate the impact of the COVID-19 pandemic on the lives of the elderly, including changes in their food consumption and the contribution of other relevant lifestyle factors.

Subsequently, each objective will be discussed in detail.

1.4 OBJECTIVES

The following are the objectives of this research:

Primary Objectives:

I. To determine the influence of the COVID-19 lockdown on food availability for elderly individuals.
II. To assess the effect of the COVID-19 lockdown on the elderly's access to food.
III. To investigate the food utilisation patterns of elderly individuals during the COVID-19 lockdown.
IV. To ascertain the level of household food insecurity among the elderly before and during the COVID-19 lockdown.

Secondary Objectives:

a. To determine the availability of preferred foods for the elderly prior to the COVID-19 lockdown compared to during the COVID-19 lockdown.
b. To investigate the food purchasing behaviour of the elderly, including fresh produce, canned foods, meat, pre-prepared foods, and other dietary changes during the COVID-19 lockdown.
c. To assess the affordability of a balanced meal or diet for the elderly during the COVID-19 lockdown.
d. To determine the extent of hunger experienced by the elderly during the COVID-19 lockdown due to financial limitations.
e. To establish the elderly's experience of health difficulties during the COVID-19 lockdown.

f. To investigate the dietary diversity of the elderly prior to and during the COVID-19 lockdown in Mpumalanga.

g. To compare the food security status of the elderly before and during the COVID-19 lockdown and subsequent lockdown.

h. To assess the effects of the COVID-19 pandemic on smoking and alcohol consumption among the elderly, comparing data before and during the COVID-19 lockdown.

1.5 SIGNIFICANCE OF THE STUDY

This study holds significant importance due to the following reasons:

Unique Contribution: The study investigates the influence of the COVID-19 pandemic on food security among elderly individuals, particularly in the context of South Africa. As there is currently a lack of research on this specific topic, this study will contribute valuable insights to the existing literature and fill a crucial void.

Impact on Elderly Food Security: The findings of this research can have a positive impact on elderly individuals' food security by identifying the factors that influenced their access to food during the COVID-19 pandemic. Understanding these factors can help inform policymakers, organizations, and community members in implementing strategies to improve food security among the elderly.

Future Research and Entrepreneurial Opportunities: The study's results can serve as a foundation for future researchers who may wish to delve deeper into the subject of elderly food security during and beyond the pandemic. Additionally, entrepreneurs and organizations interested in addressing food security issues among the elderly population may find valuable insights and potential opportunities from this study's findings.

Empowering the Elderly: Through this research, elderly individuals themselves can gain a better understanding of how their lifestyle and circumstances during the pandemic may have affected their food security. This awareness can empower them to make informed choices and take proactive steps to enhance their food security in the future.

In conclusion, this study's significance lies in its potential to expand knowledge on elderly food security during the COVID-19 pandemic in South Africa, benefitting researchers, policymakers, organizations, and most importantly, the elderly population itself.

1.6 OUTLINE OF THE STUDY

The study is organised into several chapters, each serving a specific purpose in investigating elderly food security during the COVID-19 pandemic. The outline of the study is as follows:

Chapter 1: Introduction

- Explanation of the rationale for examining food security and its significance.
- Statement of the research aim and objectives.
- Justification for studying elderly food security during the COVID-19 pandemic in the South African context.
- Highlighting the significance of the research and the void it aims to fill.

Chapter 2: Literature Review

- A comprehensive review of existing literature on food insecurity and its determinants.
- Exploration of the impact of the COVID-19 pandemic on food security in the South African context, with a focus on the elderly.
- Discussion of the relationship between food insecurity and nutrition, illnesses contributing to weight gain, and the importance of vitamins and minerals during ageing.
- Examination of lifestyle factors affected by the COVID-19 pandemic.

Chapter 3: Methodology

- Description of the mixed-method approach used in the study.
- Explanation of the sample population, sampling procedure, and sample size.

- Detailed overview of the data collection instruments, including their reliability and validity.
- Discussion of the data analysis methods employed.
- Identification of potential limitations within the study.

Chapter 4: Results and Discussion

- Presentation of the research findings through graphs and tables.
- Analysis and interpretation of the results in relation to the existing literature.
- Discussion of the implications and significance of the findings for elderly food security during the COVID-19 pandemic.

Chapter 5: Conclusion and Recommendations

- Summary of the research objectives and the corresponding findings.
- Reflection on the research outcomes and their contribution to the field of study.
- Recommendations for future research directions.
- A conclusion that synthesises the study's key findings and their implications.

By following this outline, the study aims to provide valuable insights into the impact of the COVID-19 pandemic on food security among elderly individuals in the South African context and offer potential avenues for further research and interventions to improve elderly food security.

1.7 LIST OF DEFINITIONS

Balance	Providing foods in proportion to one another and in proportion (dietary) to the body's needs (Whitney & Robles, 2019).
Deficient	Inadequate; a nutrient amount that fails to meet the body's needs and eventually in deficiency symptoms (Whitney & Robles, 2019).
Elderly	Of advanced age; past middle age (dictionary.com, 2023).
Food Insecurity	A situation where people lack secure access to sufficient safe and nutritious food for normal growth and development coupled with an

	active and healthy life (Gibson, 2012).
Food Security	Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (Gibson, 2012).
Macronutrients	Carbohydrates, lipids (fats and oils), protein and water, which provide the necessary daily intake of energy (Gibson, 2012).
Malnutrition	A physiological condition caused by oversupply, deficiency and/or the imbalance in energy, protein and other nutrients, including vitamins and minerals (Gibson, 2012).
Micronutrients	Vitamins and minerals; the nutrients the body requires in relatively small amounts (milligrams or micrograms daily) (Whitney & Robles, 2019).
Nutrients	Any substance that contributes to the growth and healthy of a living organism (Gibson, 2012).
Nutrient Deficiency	Inadequate supply of essential nutrients in the diet resulting in malnutrition/disease (Gibson, 2012).
Nutrient Density	A measure of the nutrients a food provides relative to the energy it provides. The more nutrients and the fewer kcalories(kilojoules), the higher the Nutrient density (Whitney & Robles, 2019).
Nutrition	Related to the nutrients supplied by the food we eat to maintain a healthy functioning body. Inherent is the implication of quality fit for purpose. In this regard too, ‘adequate’ food does not necessarily equate with ‘good’ nutrition (Gibson, 2012).
Nutritional	Is the indication of a person’s nutritional health determined by the status quantity and quality of foods consumed and by the ability of the to use them (Gibson, 2012).

Participants	Individuals that took part in the qualitative section of this study.
Respondents	Individuals that took part in the quantitative section (Questionnaire) of this study.
Sustainable Diets	Patterns of eating that promotes health and provide food security for the present population while sustaining environmental resources for future generations (Whitney & Robles, 2019).
Quality of Life	A person's perceived physical and mental well-being (Whitney & Robles, 2019).

1.8 CONCLUSION

In conclusion, this chapter provided an overview of the research study. It began by discussing the widespread issue of food insecurity and its impact on nutrition and health, particularly in the context of the COVID-19 pandemic. The research problem and aim of the study were introduced, highlighting the importance of investigating the effects of the pandemic on elderly food security, a topic that has been largely understudied in South Africa.

The research objectives were clearly outlined, focusing on various aspects of elderly food security during the COVID-19 pandemic, including food availability, access, and utilization, as well as household food insecurity. Additionally, secondary objectives were set to explore specific elements related to food preferences, dietary behaviours, health difficulties, and lifestyle changes among the elderly.

The significance of the study was emphasized, as it aims to fill the existing void in research on the impact of the pandemic on elderly food security in South Africa. The findings from this study could potentially inform future research, policy interventions, and initiatives aimed at improving elderly food security and overall well-being.

Furthermore, the chapter provided an outline of the research study, indicating the structure and content of each subsequent chapter. Chapter 2 will delve into a comprehensive review of relevant literature, while Chapter 3 will discuss the research

methodology. Chapter 4 will present the results and discussions, and Chapter 5 will offer conclusions and recommendations for future research.

Overall, this chapter sets the foundation for the research study, establishing its significance, objectives, and scope, while paving the way for an in-depth investigation into the impact of the COVID-19 pandemic on elderly food security in the Bethal District, Mpumalanga.

CHAPTER 2:
LITERATURE REVIEW

2.1 INTRODUCTION

Food insecurity is a widespread issue that affects millions of people worldwide, especially in developing countries. The UN reported a significant increase in the number of people affected by hunger in 2021, reaching 828 million, compared to 782 million in 2020 and 678 million in 2019 (UN Report, 2022). Developing countries often face food insecurity due to factors such as reduced self-food production (Musemwa *et al.,* 2015; Habyarimana, 2015). In South Africa, research conducted in Sharpeville revealed that food insecurity is prevalent among elderly households, primarily due to financial constraints and singleness (Oldewage-Theron & Egal, 2021).

Elderly individuals who experience food insecurity are more likely to make poor food purchasing choices, leading to increased obesity rates (Souza & Marín-León, 2013). In South Africa, many households rely on government grants for financial support (Musemwa *et al.,* 2015). The elderly population in the country faces various challenges, including poor health, illness, grandparents being the heads of households, high levels of unemployment, HIV/AIDS, poverty, and dealing with substance abuse and crime among their grandchildren (Kasiram & Hölscher, 2015; Lombard & Kruger, 2009).

Elderly malnutrition has been associated with various health issues, including limited physical activity, diabetes, obesity, cancer, high blood pressure, heart disease, and dyslipidemia (Souza & Schreus, 2013). The World Health Organization (WHO) emphasizes the importance of a healthy diet to prevent malnutrition and non-communicable diseases (NCDs) and to meet the body's micro- and macro-nutrient requirements for maintaining physical activity and overall well-being (FAO *et al.,* 2020).

Furthermore, food insecurity has been linked to increased depression among elderly individuals in South Africa, particularly those between the ages of 60 and 69 (Bishwajit *et al.,* 2019). Depression can lead to poor self-rated health, sleep disturbances, and a diminished quality of life (Pourmotabbed *et al.,* 2020), as well as increased anxiety and

stress. The interplay between food insecurity, nutrition, and mental health is crucial in understanding the overall well-being of the elderly population during challenging times such as the COVID-19 pandemic.

2.2 FOOD INSECURITY AND ITS RELATIONSHIP WITH NUTRITION

Food insecurity is a situation where people lack secure access to sufficient safe and nutritious food for normal growth and development coupled with an active and healthy life (Hanmer *et al.,* 2021; Coleman-Jensen *et al.,* 2019; Gibson, 2012). Food insecurity was previously found to be affected by social isolation, location of residence, housing costs, economic status, living arrangements, health and its limitations, as well as the frequency of food purchases (Kim *et al.,* 2021; Cho, 2015; Yang, 2015; Kim & Frongillo, 2009; Kim *et al.,* 2008). Malnutrition is a key consequence of food insecurity. The WHO maintains that a healthy diet is essential to curb malnutrition and non-communicable diseases (NCD's), while ensuring that micro- and macro-nutrient requirements are met to maintain physical activity and physiological state (FAO *et al.,* 2020). Therefore, proper nutrition remains crucial for improving and/or maintaining quality of life (Fernandes *et al.,* 2018; Bernstein & Munoz, 2012).

The elderly have an increased vulnerability to health conditions, which could influence mobility, muscle strength, mental health, autonomy (Baptista *et al.,* 2018; Fernandes *et al.,* 2018; Gregório *et al.,* 2018; Hashemi, 2014), and feelings of loneliness (Kihlström *et al.,* 2019; Chung *et al.,* 2012; Brewer *et al.,* 2010). These factors subsequently affect their food security. Furthermore, processed foods that are high in energy, low in cost, and readily available contribute toward obesity (Wells *et al.,* 2021; Garcia *et al.,* 2009; Wamani *et al.,* 2007), as well as undernourishment (Wells *et al.,* 2021).

Roughly 23% of the global disease burden affects older individuals, consisting of chronic diseases (Fernandes *et al.,* 2018). Chronic diseases influence daily activities, quality of life, and food insecurity (Fernandes *et al.,* 2018; Russell *et al.,* 2016; Russell *et al.,* 2014). Furthermore, the direct cost of malnutrition includes treatment costs for nutritional diseases, comorbidities, and early mortality. Additionally, days of labour lost lead to decreased national workforce productivity, contributing to a reduction in national

income. Individuals and/or households have to carry the economic burden consequently. According to the World Bank report, financial losses due to malnutrition may be as much as 10% of lifetime income or equivalent to 2% - 3% of the Gross Domestic Product (GDP) (Gibson, 2012; World Bank, 2008).

2.2.1 Determinants of food insecurity

Food insecurity exists in both developed and developing countries (Pollard & Booth, 2019; Habyarimana, 2015; Musemwa *et al.,* 2015; Gerbe, 2012). According to the UN on 6 July 2022, 828 million people were affected by hunger during 2021, compared to 782 million during 2020 and 678 million in 2019. About 29.3% of people worldwide were moderately or severely food insecure during 2021, and 11.7% of people globally experienced severe food insecurity since 2020 (UN Report, 2022). The challenging nature of food insecurity is that it encompasses the economic status, public health, and social aspects of a country. Therefore, the root cause of food insecurity must be addressed to decrease inequality (Pollard & Booth, 2019).

Developing countries often experience food insecurity due to reduced self-food production (Musemwa *et al.,* 2015; Habyarimana, 2015) and unemployment. Previous reasons for food insecurity in developing countries included irregular and slow advancements in the production of food, problems with soil fertility, accelerated population growth, small household incomes, and insufficient rural infrastructure. For food security to be achieved in developing countries, both long- and short-term problems must be addressed (Maiangwa *et al.,* 2010). During the last two years, additional reasons were added by the United Nations, which include inflation and economic decline. The Russia-Ukraine war influenced the supply of oilseeds, staple cereals, and fertilizer, thereby increasing the costs of grains, and energy. It also impacted the economies of low-income countries by suppressing economic recovery after the COVID-19 pandemic (UN Report, 2022).

Determinants of food insecurity in households include households where the head is older than 45 years of age, illiterate households, the number of individuals in the

household, credit access, property possession (Gerbe, 2012), the number of household members employed, and women's higher education (Chinnakali *et al.,* 2014).

Undeniably, food insecurity has also been linked with domestic violence and the increase thereof (Abrahams *et al.,* 2020; Hatcher *et al.,* 2019; Lentz, 2017). The variables of food insecurity listed by Dudek and Myszkowska-Ryciak (2020) include age, education, gender, household composition, marital status, employment, and income status. They also found that younger individuals were less likely to be food insecure, females were likely to be more food insecure, individuals with tertiary education were less likely to suffer from food insecurity, and that income level correlated with the food insecurity level of an individual. Furthermore, food insecurity contributes to poor health, which also affects COVID-19 infection and recovery (Dudek & Myszkowska-Ryciak, 2020). Knowledge about food insecurity characteristics in the elderly is limited (Fernandes *et al.,* 2018; UN, 2015; Souza & Marín-León, 2013).

2.2.2 Current stance of food insecurity

In South Africa, most households are dependent on grants from the government. A study done in the Eastern Cape province of South Africa showed that 67.7% of its participants were experiencing severe food insecurity (Musemwa *et al.,* 2015). Research conducted in the Hammanskraal Township and Lebowakgomo village, in Gauteng, and Limpopo provinces, respectively, showed that weaned children between the ages of 7 and 12 months living in these areas were most severely food insecure and underweight. This was found to be due to malnourishment, as their diets lacked essential vitamins, minerals, and proteins while it primarily consisted of white maize meals and sugar. The diets of these children were found to be deficient in both quality and quantity (Ntila *et al.,* 2017). Malnutrition and food insecurity exist in many households that suffer from poverty; however, children under the age of 5 years are at an elevated risk of malnutrition. This was identified to be true in low agro-ecological locations in South Africa, where 35% of the children were stunted due to malnutrition, and 18% were wasted. A zone with agro-ecological potential holds a lower risk of food insecurity for children (Chakona & Shackleton, 2018).

Furthermore, the youths of both Ghana and South Africa were found to be severely food insecure, and young female food security was connected to the family's economic resources; however, the male counterparts were more likely to be food secure even if their families had fewer economic resources. Thus, in both countries, socioeconomic status was correlated with the food security of the households (Masa *et al.,* 2020). In Durban, South Africa, it was found that 96.2% of the black asylum-seeking or refugee women were food insecure. The coping strategies of these women or households included sending primary school children to local pre-schools to be fed, relying on community-based organizations (CBOs) and non-governmental organizations (NGOs) for food aid, only giving food to working household members, reducing food consumption of the mother/women, going an entire day without a meal, limiting food quantity intake, only consuming cheaper food that is not as in demand, and skipping meals. These coping strategies could over time lead to deficiencies and/or malnutrition (Napier *et al.,* 2018). Seasonal workers' food insecurity is a 'hidden crisis' amongst seasonal commercial farm workers in the Northern Cape, South Africa. The hunger that these workers experienced is mostly during the colder months, which lasts 5 to 7 months a year. Food insecurity was experienced due to low or temporary employment. During the winter, 88% of the participants experienced severe food insecurity, while the severity of food insecurity decreased to 49% during the summer months due to employment. The evidence also found that together with decreased food security, food diversity in diets also decreased during the winter months (Devereux & Tavener-Smith, 2019).

De Souza and Marín-León (2013) found in their study that elderly individuals suffering from food insecurity were more likely to experience obesity due to food purchasing choices. It was found that the elderly who frequently make use of soup kitchens were more likely to experience mild forms of food insecurity. According to Kim and Frongillo (2009), the food-insecure elderly were more likely to make use of food assistance programs (FAP) during a time of need, compared to times of food security. Park *et al*. (2019) found that the elderly aged 80 years and older were more likely to be food secure compared to those between the age of 60 and 69 years old, this was found to be the influence of loneliness, poor social support and poor community infrastructure.

According to Kim *et al*. (2021), the food environment within a community has effects on the health and eating behaviours of the elderly. The food-insecure elderly experienced difficulty with stocking up on food for the COVID-19 pandemic due to transportation and financial limitations, as well as food storage capacity. These limitations lead the already high-risk elderly to be even more exposed to the COVID-19 virus; furthermore, the elderly experienced complications in keeping to the recommended pandemic guidelines, such as purchasing food only once a week and more due to the above-mentioned limitations (Bridges *et al.,* 2022). Studies regarding food insecurity in the elderly are scarce (Gajda *et al.,* 2022; de Souza & Marín-León, 2013).

2.2.3 Effect of Covid-19 on nutrition and food security

COVID-19 has had negative effects on food security worldwide (Manfinato *et al.,* 2020; Mishra & Rampal, 2020; Zidouemba *et al.,* 2020). The pandemic led to individuals losing their jobs, inhibiting food access and increasing food insecurity. Challenges faced during the pandemic in terms of food access included food shortages, financial limitations, being forced not to adhere to regulations to get food, and limited information. Furthermore, individuals had concerns about the future costs of food products, reductions in income, relying on food programs for food access, and food shortages. These challenges and concerns led to the adoption of coping strategies, which included consuming less food, purchasing more affordable food, purchasing other foods than usual, making use of government feeding programs, welcoming foods received from family and friends, making use of food pantries, and credit at food stores. Households that were chronically food insecure were more likely to borrow money from family or friends as well. Another coping strategy that food-insecure individuals implemented was purchasing foods that could be stored for longer. Unfortunately, the coping strategies that food-insecure individuals or households implemented during COVID-19 could lead to decreased health, malnutrition, decreased mental health, and additional healthcare costs in the future (Niles *et al.,* 2020).

Food insecurity was found to be correlated with anxiety in Mexicans due to increased food insecurity as a result of the Covid-19 pandemic. Within the study, 57.1% of the

participants that lived in households experienced severe food insecurity. The study also found that households without children were more food secure. In Mexico, food insecurity increased as the pandemic progressed (Gaitán-Rossi *et al.,* 2020). In the United States of America, it is estimated that 54 million adults and 18 million children were food insecure during 2020 (Gunderson *et al.,* 2021). These households were characterized by children present in the household, Hispanic and non-Hispanic Black individuals, individuals with no tertiary education, no access to medical aid or health insurance, renting a property, and receiving food assistance. Furthermore, individuals with low food security experienced that the stores in their area were sold out of some household products, inhibiting them from purchasing food for more than a week ahead of time (Wolfson & Leung, 2020).

Additionally, it was found that 41.3% of the highly food-insecure individuals experienced that they did not have enough food for the household. Out of all the highly food-insecure individuals, 49.9% reported that they could not pay bills due to a lack of finances. Covid-19 caused already struggling households to find it even more challenging to meet their basic needs (Wolfson & Leung, 2020). The COVID-19 pandemic has led international trade to collapse due to decreases in demand and supply. The problematic nature of the collapse includes the reduction in economic activities, limited access to medical supplies, and decreases in both employment and incomes which lead to food insecurity. In contrast, the decreased global trade arising from the pandemic included benefits such as unhealthy food imports being ceased and environmental benefits such as a reduction in air pollution in Western Europe. Furthermore, the effects of the pandemic have influenced the progress made for the 2030 Sustainable Development Goals set by the UN (Barlow *et al.,* 2021).

Food insecurity was also experienced in 2020 in Belgium, and Germany. It was found that 10.4% of adults frequently or regularly experienced a fear of food deficit. The number of individuals that usually or frequently lacked money for healthy diets during the severe initial lockdown period was 10.3%, compared to those that regularly or occasionally experienced food shortages and lacked the money to purchase food, which was 5% (Wolfson & Leung, 2020).

In Belgium, most households that experienced a fear of food insecurity the most were single-parent-headed households, compared to the individuals that experienced the least fear of food insecurity, who had higher education. Major dietary behaviour adjustments in Belgium were experienced due to the strict initial lockdown period of the pandemic and the food insecurity that was induced, as more unhealthy foods were consumed; more soft drinks were consumed, fruit and vegetable consumption decreased (Vandevijvere *et al.,* 2021). In South Africa, the COVID-19 lockdown not only caused unemployment and food insecurity to increase but also led to increases in physical, psychological, and sexual abuse and increases in crime. Depressive, hopelessness, and psychological distress experiences also increased during the lockdown period (Abrahams *et al.,* 2021).

Food insecurity affects the elderly globally (Pirrie *et al.,* 2020; Park *et al.,* 2019). Research in Canada revealed that 24% of elderly individuals experienced severe to moderate food insecurity. The main cause of food insecurity for the elderly was financing, which led to coping strategies such as consuming fewer meals or limiting the size of meals and having to eat less due to finances lacking for more food. Furthermore, this led to the elderly experiencing symptoms of hunger and having to go more than a day without food. Results showed that food insecurity was mostly found or experienced in females, younger-elderly, non-white races, those with self-reported poor health, living by themselves or with others that are not their spouse, unmarried, and those that rented property rather than owning. In contrast to the previously mentioned research, the level of education did not have such a significant difference in food insecurity in the elderly that lived in Canada (Leroux *et al.,* 2018).

In Korea, 13% of the elderly were found to live in food-insecure households. The study found that food insecurity was correlated with alcohol consumption, thoughts of suicide, depression, and diets deficient in carbohydrates, iron, riboflavin, calcium, potassium, and niacin. In the USA, persistent food insecurity led the elderly to participate in food assistance programs, especially when help-seeking behaviours were present (Kim & Frongillo, 2009).

Elderly food insecurity prevails in South Africa (Oldewage-Theron & Egal, 2021; Kasiram & Hölscher, 2015; Medoua *et al.,* 2009). Recent research has shown that in one of South Africa's informal settlements (Sharpeville), food insecurity usually dominates elderly households due to singleness and lack of the necessary finances. Thirty-three percent (33%) reported themselves as being food insecure, which ranged from moderate to severe (Oldewage-Theron & Egal, 2021).

2.3 ILLNESSES THAT CONTRIBUTE TOWARD WEIGHT GAIN

2.3.1 Obesity

Obesity is identified in individuals with a body mass index (BMI) that is 30 or more (Apovian, 2016). Obesity is influenced by numerous factors, including genetics, behaviour, environment (Omer, 2020), cultural and socioeconomic factors (Apovian, 2016). Illnesses contributing to obesity include hypothyroidism, Cushing's disease, and polycystic ovary syndrome (PCOS). Medications with properties contributing to obesity include steroids, anti-diabetics, antipsychotics, antihypertensive, and anti-depressants. Other contributors that increase the risk of obesity consist of high energy intake such as energy-dense foods in combination with low energy expenditure, low physical activity, being sleep deprived; experiencing anxiety, stress, and/or depression, long working hours, and the environment within one's workplace, limited recreational facilities, food deserts, the absence of sidewalks, reduced socioeconomic status and lastly, restricted education (Omer, 2020; Hsieh *et al.,* 2020).

Stress was also found to be a cause of obesity, as it affects the body's energy regulation and appetite, causing an increase of highly palatable (HP) foods to be consumed. Stress has also been linked to the relapse or development of addictions and overeating of HP foods which lead to both weight gain and obesity (Sinha & Jastreboff, 2013). In South Africa, smoking was found to increase the risk of obesity, which was not dependent upon gender or race (Averett *et al.,* 2014). Furthermore, research done on township inhabitants within the Cape Town metropolitan area showed that women that lived there were more prone to obesity. Underlying reasons for this included that

women's income correlated to their obesity or weight level, the higher their socioeconomic status, the higher their odds to be obese; and women who were deprived of food as children were more likely to be obese. The evidence also found that South African women's idea of an 'ideal' female body was bigger than when it was compared to the male's 'ideal'. The study found that participants who were deprived of food, as children, either went to bed or school whilst experiencing hunger, otherwise these individuals would eat food at another home due to the lack of food in their own home (Case & Mendez, 2009). Evidence of obesity and malnutrition was found in the Free State province of South Africa. Participants included individuals from both rural and urban areas within the province. In both urban and rural cases, consumption of salt, sugar, and fats took place daily; unfortunately, fruit, vegetables, and milk were not consumed in adequate amounts (Tydeman-Edwards *et al.,* 2018).

Unhealthy and low-cost foods that are easily available in the market should be avoided, due to their contribution to obesity (Beltrán-Carrillo *et al.,* 2022; Distel *et al.,* 2019; Ruhlman, 2017; Konttinen *et al.,* 2013; Scott *et al.,* 2012; Rolls *et al.,* 2007). It has been found that elderly individuals with obesity experience an increased risk of contracting influenza. However, it was also found that immune system responses improved and inflammation was reduced when weight loss was experienced (Frasca & McElhaney, 2019). Furthermore, abdominal obesity has been associated with an elevated risk of cognitive impairment among the elderly of China (Hou *et al.,* 2019). Lastly, evidence shows that elderly individuals that experienced difficulty in physical mobility had a considerable risk of being obese, regardless if these individuals took part in physical activity (Asp *et al.,* 2017). Obese individuals are more prone to a higher risk of chronic kidney disease, coronary microvascular angina, pulmonary hypertension, microvascular dementia, and heart failure due to microvascular dysfunction (Sorop *et al.,* 2017). In contrast to prior studies, it was found that cardiovascular disease, atherosclerotic (ASCVD), and type 2 diabetes (T2D) in combination with obesity do not withhold an increased risk of CV-related events, including mortality (Pagidipati *et al.,* 2020).

2.3.2 Cardiovascular disease

According to the World Health Organisation, Cardiovascular Diseases (CVD) consist of a set of diseases including cerebrovascular disease, coronary heart disease, rheumatic heart disease, and others. CVD is one of the main contributors to mortality, globally. Causes of strokes and heart diseases include smoking, excessive alcohol consumption, an unhealthy diet, and lack of physical activity. These factors are presented in increased levels of blood lipids, high blood pressure, elevated blood glucose, obesity, and overweight. Efforts that reduce or prevent the risk of contracting cardiovascular disease include increasing salt intake, ceasing smoking, refraining from excessive alcohol consumption, consuming more fruits and vegetables, and participating in regular physical activity (WHO, 2021). Furthermore, even moderate (400g) or modest (800g) consumption of fruit, vegetables, and legumes was found to reduce the risk of cardiovascular disease, cardiovascular mortality, and other forms of mortality (Miller *et al.,* 2017).

However, for cardiovascular (CV) mortality to decrease, remodelling and dysfunction of the left ventricle of the heart to decrease, weight loss is advised, bariatric surgery is also an option due to its benefits (Koliaki *et al.,* 2019). Research indicates that stress contributes to inflammatory responses and other cardiovascular effects (Kivimäki & Steptoe, 2018). International increased blood pressure levels, due to smoking, dietary influences, lipid abnormalities, reduced physical activity, sodium intake, age-related factors, and others, have been found to contribute to CVD (Fuchs & Whelton, 2020). Evidence was found that statins, used for elevated cholesterol levels, could reduce the risk of chronic obstructive pulmonary disease exacerbation in elderly individuals with CVD (Rea *et al.,* 2018). Women were found to have a higher risk of CVD due to obesity, insulin resistance, and the effects of menopause on sexual hormones (Manrique-Acevedo *et al.,* 2020). Individuals with CVD were found to have increased vulnerability to developing COVID-19, cardiac dysfunction, or one of the long-term effects of COVID-19 such as Severe Acute Respiratory Syndrome (SARS), abnormal glucose, and lipid metabolisms (Bansal, 2020).

2.3.3 Diabetes

Food insecurity could be associated with insulin resistance, caused by inflammation and stress hormones in Latin Americans with type 2 diabetes (T2D) (Bermúdez-Millán *et al.,* 2019). Insulin resistance has also been found to change cellular metabolism, leading to alterations in gene expression, dyslipidemia and hyperglycemia, increased oxidative stress and inflammation, endothelial functioning, and lipid build-up which causes metabolic deregulation to be maintained (Koliaki *et al.,* 2019; Ormazabal *et al.,* 2018).

2.3.4 Hypothyroidism

Hypothyroidism has been found to occur when there is insufficient stimulation of thyroid hormone by the thyroid gland, causing various health difficulties if left untreated (Gaitonde *et al.,* 2012). The importance of thyroid hormones is evident in their impact on many organs, as well as bodily temperature and heart rate regulation (Brix *et al.,* 2011). With ageing, the thyroid gland is affected, particularly the endocrine system and related organs (Gesing *et al.,* 2012). However, Roberts *et al*. (2018) found that the elderly who have recently been diagnosed with renal disease or atrial fibrillation (AF) were more likely to develop hypothyroidism. As age increases, so does the risk of fluctuations in Thyroid Stimulating Hormone (TSH). Conversely, mild hyperthyroidism was found to increase cardiovascular morbidity (Barbesino, 2019). Hypothyroidism was found to be especially common in ageing women, and treatment for subclinical hypothyroidism led to improvements in lipid profiles (Bensenor *et al.,* 2012). Sheng *et al*. (2019) found that Appendicular Skeletal Muscle Mass (ASM), physical function, and muscle strength are age-dependent, decreasing with age. However, Sarcopenia was also found to correlate with reduced free triiodothyronine (FT3) thyroid hormone levels. In their study, elderly Chinese individuals with euthyroidism experienced decreased muscle function and mass, along with reduced FT3 levels.

Moreover, fluctuations in thyroid hormone levels contribute to reduced cognitive functioning, visuospatial organization, memory, reaction time, and attention. Even mild changes in thyroid functioning were found to influence cognitive functioning, and treatment may not fully restore cognitive impairments (Bégin *et al.,* 2008; Ceresini *et al.,*

2009). Thyroid hormones play a vital role in bodily metabolism, and any dysfunction may lead to reduced immune response, especially when combined with additional co-morbidities. These factors render individuals with thyroid dysfunctions vulnerable to contracting SARS-CoV-2, viral, or bacterial infections due to oxidative stress that compromises the immune system (Kumari *et al.,* 2020; Lui *et al.,* 2021). Zhang *et al*. (2021) found that patients with thyroid dysfunction (TD) who were infected by COVID-19 experienced increased levels of inflammation and cardiac injury during the illness. This led to an increase in symptom severity, longer hospitalization times, and higher mortality rates (Scappaticcio *et al.,* 2020; Lui *et al.,* 2021; Zhang *et al.,* 2021). Chen *et al*. (2021) found that COVID-19 patients with TD underwent reduced levels of total triiodothyronine (TT3) and TSH, depending on the severity of COVID-19 symptoms experienced (Chen *et al.,* 2021; Lui *et al.,* 2021).

2.4 THE COVID-19 PANDEMIC AND NUTRITION

During the COVID-19 pandemic, several studies conducted in different countries showed that weight gain became a concerning issue. In Kuwait, research revealed that COVID-19 contributed to significant weight gain in Kuwaitis. This was attributed to decreased physical activity, increased food consumption during the day and night, and heightened anxiety levels. Interestingly, participants perceived their food consumption patterns as healthy, but the statistics showed otherwise, with only 7.3% reporting that they did not snack between meals (AlMughamis *et al.,* 2021).

Similar findings were observed in Spain, where adults gained between 1 and 3 kg during the COVID-19 lockdown period. Weight gain was more prominent in females, those who were overweight or obese before COVID-19, individuals experiencing hunger, and those with increased snacking, sugar-sweetened beverages, and alcohol consumption (Sánchez *et al.,* 2021). In Sri Lanka, young adults gained an average of 2.35 kg during the lockdown period, coupled with decreased physical activity, increased screen time, and sedentary behaviour (Sooriyaarachichi *et al.,* 2021). The US also reported weight gain in adults ranging from 0.62 to 1 kg. Contributing factors included increased consumption of energy-dense and processed foods, low fruit intake, reduced

physical activity, and difficulties in craving control, along with elevated levels of stress, boredom, and prolonged TV watching (Bhutani *et al.,* 2021).

However, not all studies reported weight gain during the pandemic. An online study found that for many participants, their weight remained stable, although below-average sleeping hours and increased time spent watching TV and playing video games were reported. Physical activity decreased, but computer usage hours were increased (Zachary *et al.,* 2020).

Various factors were found to contribute to weight gain risks during the pandemic. These included low physical activity, increased alcohol consumption, emotional eating, being overweight or obese, sedentary behaviour, increased snacking, reduced water intake, and degraded sleep quality (Zeigler, 2021). The COVID-19 pandemic had a significant impact on people's lifestyles, influencing their dietary habits, physical activity levels, and overall well-being.

2.5 MICRO AND MACRO NUTRIENTS

As humans, we are unable to synthesize the vitamins and minerals necessary to maintain health; hence, these nutrients must be obtained through diet. Nutrient deficiencies can lead to diseases and impaired biological functions. However, it is essential to be cautious about excessive mineral consumption, as it can also be harmful (Lee, 2015).

For the elderly, a chronic deficiency of vitamins and minerals can increase their vulnerability to various health risks (Beto, 2015; Bethesda, 2013; Pasiakos, 2012; Peik *et al.,* 2008). Adequate intake of vitamins and minerals is crucial for maintaining overall health and well-being during the ageing process.

2.5.1 B Vitamins

Vitamin B_1/ Thiamine is essential for energy production (Peterson *et al.,* 2020; Frank *et al.,* 2007) and metabolism, including the conversion of amino acids and fatty acids. It also plays a role in immune cell function and serves as an antioxidant. Thiamine

deficiencies can lead to the death of neurons in specific brain regions (Peterson *et al.,* 2020).

Vitamin B*3*/ Niacin regulates enzymes and is involved in fatty acid synthesis (Peterson *et al.,* 2020; Wanders *et al.,* 2013). It has been found to reduce the effects of Parkinson's Disease and repair DNA damage. Niacin also reduces immunosuppression caused by ultraviolet irradiation. Deficiency in Niacin, known as Pellagra, can cause symptoms like diarrhoea, inflamed skin, and dementia (Peterson *et al.,* 2020; Wanders *et al.,* 2013).

Vitamin B*5*/ Pantothenic acid is crucial for fatty acid metabolism and the transportation of Vitamin *B7* (biotin) (Peterson *et al.,* 2020; Wanders *et al.,* 2013).

Vitamin B*6*/ Pyridoxine is involved in carbohydrate, fatty acid, and amino acid metabolism, as well as the production of neurotransmitters (Peterson *et al.,* 2020). Deficiency or reduced intake of vitamin B6 has been associated with an increased risk of cancer development (Peterson *et al.,* 2020; Fania *et al.,* 2019).

Vitamin B*9*/ Folate deficiency can lead to neural tube defects, compromise some immune functions, increase DNA strand breakage, and raise the risk of cancer (Peterson *et al.,* 2020; Su *et al.,* 2016; Wang *et al.,* 2012). However, like many B vitamins, B9 also exhibits anti-inflammatory properties (Peterson *et al.,* 2020; Wu *et al.,* 2017).

Vitamin B*12*/ Cobalamin plays a significant role in regulating certain immune cells, but its absorption can be inhibited by certain medications (Peterson *et al.,* 2020). Vitamin B*12* deficiency has been associated with poor memory and delayed information processing (Morris, 2012). Deficiencies in Vitamins B*6*, B*9*, and B*12* have been linked to psychological, neurological, and cognitive dysfunction (Selhub *et al.,* 2010).

2.5.2 Calcium

Calcium is absorbed in three sites within the human body. The first site is the kidneys, where most of the absorption and release take place. The second site is the intestines,

where additional absorption occurs. The final site is the bones, where calcium can move freely in and out of stores (Beto, 2015; Bethesda, 2013; Goodman & Quarles, 2008). The elderly, lactose intolerant individuals and women are at risk of calcium deficiency. Post-menopausal women and those who are lactose intolerant may be at a greater risk of deficiency due to dietary restrictions and reduced calcium absorption caused by medications or osteoporosis (Beto, 2015; Bethesda, 2013; Choi *et al.,* 2013; Wu *et al.,* 2010).

Research has found that individuals who consume vegetables, fruits, and calcium, along with engaging in mild exercise, are less likely to develop osteoporosis (Beto, 2015; Crandall *et al.,* 2012). Long-term calcium deficiencies can contribute to chronic disease risk (Beto, 2015; Goodman & Quarles, 2008; Peterlik *et al.,* 2009; Hong *et al.,* 2013; Yang & Kim, 2014). Therefore, a diet containing calcium, vitamin D, phosphorous, and protein is beneficial for decreasing the risk of bone fractures, improving muscle strength and mass, and enhancing bone mineralization. Adequate calcium consumption also reduces the risk of obesity and helps maintain a healthy body weight (Beto, 2015; Lee *et al.,* 2014; Yang & Kim, 2014; Shin *et al.,* 2013; Fogelholm *et al.,* 2012; Peik *et al.,* 2008).

2.5.3 Carbohydrates

Carbohydrates consist of whole grains (WG), cereals, wheat, rye, spelt, oats, maize (corn), barley, white flour, and whole wheat flour. Complex carbohydrates include pasta, rice, bread, and related items (Capurso, 2021). Most carbohydrates are derived from plants, while some come from animals and microbes (Cheng *et al.,* 2020; Porter & Martens, 2017). Complex carbohydrates are more difficult to digest, and these non-digestible carbohydrates are broken down in the colon, proving to be beneficial for the bacterial ecosystem in the gut (Cheng *et al.,* 2020; Verspreet *et al.,* 2016).

Carbohydrates provide energy, and during digestion, they are converted into glucose. However, elevated levels of stored glucose (fat) contribute to obesity, cardiovascular diseases, hypertension, diabetes, insulin resistance, glucose intolerance, fatty liver, and dyslipidemia (Cheng *et al.,* 2020).

Lifestyle and diet factors can impact the gut microbiota. An imbalance in gut microbiota has been found to negatively affect conditions such as irritable bowel syndrome (IBS), Small Intestine Bacterial Overgrowth (SIBO), inflammatory bowel disease (IBD), and constipation (Cheng *et al.,* 2020). Ageing decreases multiple physiological functions and metabolism, which also influences the diversity of gut microbiota (Cheng *et al.,* 2020).

With ageing, harmful bacteria increase while beneficial bacteria decrease within the gut, leading to mild inflammation within the nervous system. This, in turn, can lead to a reduction in cognitive abilities and contribute to conditions like Alzheimer's disease or Parkinson's. Prebiotics have been shown to reduce these consequences of ageing and age-related diseases (Cheng *et al.,* 2020).

On the other hand, reducing carbohydrate intake for several months has been proven to benefit weight loss, improve risk factors for heart disease, enhance insulin sensitivity (Lee *et al.,* 2017; Rosedale *et al.,* 2009), improve overall health, prevent metabolic diseases, and delay the ageing process (Lee, 2015). However, high consumption of whole wheat and insoluble fibre has been found to decrease the risk of conditions such as strokes, coronary heart disease (CHD), mortality, and type 2 diabetes (Capurso, 2021; Aune, 2016; AHA, 2016).

2.5.4 Carotenoids

Carotenoids, which are derived from fruits and vegetables, contain antioxidant properties (Semba *et al.,* 2009). Low levels of carotenoids can lead to diminished physical performance and muscle strength, a condition known as sarcopenia, as carotenoids contribute to balancing out oxidation (Semba *et al.,* 2009). Reduced carotenoid intake has been associated with decreased knee, hip strength, and grip (Semba *et al.,* 2009). Furthermore, low carotenoid levels have been found to be negatively associated with the risk of developing insulin resistance and diabetes (Semba *et al.,* 2009).

2.5.5 Copper

Elevated copper concentrations have been found to negatively influence cognition (Brewer, 2010; Squitti *et al.,* 2009). Interactions between copper and the amino acid homocysteine have been shown to cause oxidation, leading to the development of Alzheimer's disease (AD) (Brewer, 2010). Additionally, elevated copper levels have been linked to other diseases, including Tourette's syndrome, Parkinson's disease, macular degeneration, autism (Brewer & Newsome, 2009; Brewer, 2010), prostate cancer (Brewer, 2010; Zhang *et al.,* 2009), and atherosclerosis in cases of copper toxicity (Brewer, 2010). Zinc has been found to reduce copper toxicity, known as Wilson's disease, by inhibiting copper absorption (Brewer, 2010).

Copper can be found in multivitamin supplements (Brewer, 2010), but its bioavailability is much higher in meat compared to other foods (Juárez *et al.,* 2021; Menezes *et al.,* 2018; Bohrer, 2017; Brewer, 2010). Shellfish and liver have been found to contain elevated concentrations of copper (Brewer, 2010; Liebman, 2009; Sinha *et al.,* 2009). Additionally, copper can be found in water if copper pipes are used (Brewer, 2010).

2.5.6 Fats and types of fats

Fats/lipids can be divided into triglycerides, fatty acids, sterols, phospholipids, and saturated, unsaturated, and trans-fatty acids, monounsaturated (MUFA) and polyunsaturated fatty acids (PUFA). Both plant and animal food sources were found to contain fatty acids. However, the two polyunsaturated fatty acids α-linolenic acid and α-linolenic acid, found in vegetable and seed oils, are classified as essential fatty acids, as the human body is unable to synthesise these fatty acids (Tvrzicka *et al.,* 2011) .

Moreover, fatty acids also play a role in the absorption of vitamins A, E, D, and K, which are fat-soluble, as well as carotenoids. Furthermore, vegetables and fruit contain unsaturated fatty acids, were as dairy and meat were found to contain considerable amounts of saturated fatty acids (Tvrzicka *et al.,* 2011).

Trans fatty acids contribute to the decrease of high-density lipoprotein (HDL) – cholesterol, as well as the increase of low-density lipoprotein (LDL) – cholesterol

(Tvrzicka *et al.,* 2011). Furthermore, fatty acid present within the diet was found to contribute negatively toward blood cholesterol, as well as AD (Morris & Tangney, 2014).

Moreover, diseases such as diabetes, cardiovascular disease, and illnesses that increase the risk of dementia are treatable and preventable by dietary fat intake (Furtado *et al.,* 2008; Gadgil *et al.,* 2013; Morris *et al.,* 2014). A previous CHAP study confirmed that increased intake of trans and saturated fatty acids, in combination with reduced intake of monounsaturated (MUFA) - and polyunsaturated (PUFA) - fatty acids increased the risk of contracting Alzheimer's disease (Morris & Tangney, 2014).

By replacing saturated fatty acids (SFA) with PUFA's the risk of CHD can be decreased in middle-aged men and women, as well as the elderly (Jakobsen *et al.,* 2009). In contrast, certain fats have been found to contribute positively toward longer living and health; however, reduced levels of polyunsaturated Fatty Acids (PUFAs) will also be beneficial (Lee, 2015).

2.5.7 Fibre

Dietary fibre can be categorized into soluble and insoluble fibre. Soluble fibre is highly fermentable and easily utilized by gut microbiota (Cheng *et al.,* 2020; Holscher, 2017). On the other hand, insoluble fibre consists of fibre containing the plant cell walls and cellulose. These forms of fibre are less effective during fermentation, but they increase the rate of transit within the gut, thus reducing fermentation time (Cheng *et al.,* 2020).

2.5.7.1 Soluble fibre

Barley, oats, and rye are sources of soluble fiber. Barley is beneficial for dietary requirements as it contains B vitamins, iron, manganese, selenium, copper, magnesium, phosphorus, and zinc (Capurso, 2021).

Oats also provide dietary benefits due to their protein, fiber, fat, manganese, and B vitamins content (Capurso, 2021), as well as their positive effects on glycemic control (Capurso, 2021; Åberg *et al.,* 2020; Augustin *et al.,* 2020; Bączek *et al.,* 2020; Sievenpiper, 2020; Tosh & Bordenave, 2020; Wolever *et al.,* 2018).

Rye contains pantothenic acid, niacin, thiamine, vitamin B*6*, and minerals. Rye is a good carbohydrate alternative for weight loss due to the feeling of satiety that it provides and its water-binding capabilities. According to Nordlund *et al.,* rye bread reduces the risk of contracting diabetes due to its whole grain and fibre content (Capurso, 2021; Nordlund *et al.,* 2016).

2.5.7.2 Insoluble fibre

Dietary insoluble fibre includes whole grains and spelt. Increased intake of whole grains (WG) has been shown to reduce the risk of mortality (Capurso, 2021; Fung *et al.,* 2009). Whole-grain consumption positively influences blood lipid profile, postprandial insulin, intestinal microbiome (Capurso *et al.,* 2021; Giacco *et al.,* 2010; Costabile *et al.,* 2007), blood pressure, and body weight (Capurso, 2021; Kelly *et al.,* 2017).

Spelt provides B vitamins, manganese, phosphorus, fibre, and protein to the diet (Capurso, 2021). Maize/corn in its raw state contains beneficial nutrients such as thiamine, riboflavin, vitamin B6, niacin, iron, manganese, potassium, selenium, copper, magnesium, phosphorus, zinc, and sodium (Capurso, 2021).

Furthermore, dietary fibre intake has been found to increase calcium absorption (Dai *et al.,* 2018; Jakeman *et al.,* 2016; Holloway *et al.,* 2007). Another study found that these results were gender-specific, as calcium absorption was increased with increased fibre intake, yet this was only found to be so in elderly men and not in the women that took part in the study. Thus, the effect of dietary fibre on calcium absorption is affected by hormones (Dai *et al.,* 2018).

2.5.8 Fluoride

Fluoride is beneficial for osteoporosis (Ciosek *et al.,* 2021; Vestergaard *et al.,* 2008), as well as for steroid therapy, as it inhibits bone loss and vertebral fractures (Ciosek *et al.,* 2021; Vestergaard *et al.,* 2008). Fluoride has also exhibited beneficial qualities for bone development (Ciosek *et al.,* 2021; Everett, 2011) and health (Ciosek *et al.,* 2021; Weivoda *et al.,* 2020; Everett, 2011).

Excessive intake of fluoride has shown to cause radiographic changes within the bone, leading to conditions such as fluorosis, which can manifest as osteoporosis or osteosclerosis (Ciosek *et al.,* 2021; Gupta *et al.,* 2016; Kurdi, 2016; Simon *et al.,* 2016). Bones contain the majority of fluoride in the body (93 to 97%), while the remainder has been found in the kidneys and liver (Ciosek *et al.,* 2021).

Furthermore, the concentrations of fluoride in bones are dependent upon gender, the period of exposure, age, and bone-related diseases (Ciosek *et al.,* 2021; Palczewska-Komsa *et al.,* 2016; Fordyce *et al.,* 2007). Research has found that females are prone to higher fluoride concentrations compared to men (Ciosek *et al.,* 2021). Lastly, countries such as America and other European countries, which supply fluoridated water, have shown to positively impact residents' bone health (Ciosek *et al.,* 2021).

2.5.9 Iodine

Iodine is of immense importance for the brain and thyroid, as it assists in the quantity of thyroid hormone produced and has significance in brain function, development, and maintenance (Redman *et al.,* 2016). Research has found that severely iodine-deficient pregnant women are more likely to give birth to infants with untreatable mental damage (Redman *et al.,* 2016). Similar effects have been reported for hypothyroxinemia, a condition where there are lower levels of thyroid hormones during pregnancy (Redman *et al.,* 2016; Henrichs *et al.,* 2010).

For the elderly, it is essential to consume iodine as recommended by the WHO to reduce the risk of thyroid autoimmune diseases or disorders (Andersen *et al.,* 2012; Andersen *et al.,* 2009; Andersen *et al.,* 2008; WHO, 2007), such as goitre (Ikromjonovna, 2021).

2.5.10 Iron

Iron is important for neurotransmitter metabolism and synthesis, as well as the transportation of oxygen within the human body. However, unbalanced iron content can contribute to the oxidation of various substances. Certain regions within the brain

contain iron; however, with ageing, the concentrations of iron within the brain alter, causing neurodegeneration and inflammation (Ward *et al.,* 2014), and sarcopenia (Xu *et al.,* 2010; Altun *et al.,* 2008 Hofer *et al.,* 2008; Seo *et al.,* 2008; Jung *et al.,* 2008; Xu *et al.,* 2008).

Neurodegenerative diseases affected by iron include AD (Daugherty & Raz, 2015; Ward *et al.,* 2014; Qin *et al.,* 2011; Xu *et al.,* 2010; Altamura & Muckenthaler, 2009), Parkinson's disease (Daugherty & Raz, 2015; Ward *et al.,* 2014; Ulla *et al.,* 2013; Xu *et al.,* 2010; Lee *et al.,* 2010), Friedreich's ataxia (Ward *et al.,* 2014; Xu *et al.,* 2010; Pandolfo & Pastore, 2009), Multiple sclerosis (Daugherty & Raz, 2015; Khali *et al.,* 2015; Pinter *et al.,* 2015; Rudko *et al.,* 2014; Walsh *et al.,* 2014; Ceccorelli *et al.,* 2009), Huntington's disease (Ward *et al.,* 2014; Xu *et al.,* 2010; Bartzokis *et al.,* 2007; Simmons *et al.,* 2007; Walker, 2007), and Restless legs syndrome (Ward *et al.,* 2014; Allen & Earley, 2007).

2.5.11 Magnesium

Magnesium supplementation has been found beneficial for elderly individuals suffering from insomnia (Abbasi *et al.,* 2012). Insomnia, which negatively affects the quality and quantity of sleep, is characterized by difficulties in falling asleep, remaining asleep, early waking, and is often persistent over time. Unfortunately, insomnia tends to increase with age and can be exacerbated by age-related conditions. Insomnia can lead to various adverse effects, including prolonged reaction time, memory problems (especially short-term memory), impaired brain functioning, increased risk of injuries, and reduced performance in daily activities. Additionally, insomnia has been associated with higher mortality rates (Abbasi *et al.,* 2012; Stone *et al.,* 2009; Dam *et al.,* 2008). Sleep deprivation due to insomnia can also result in decreased overall health quality and increased levels of depression and stress (Abbasi *et al.,* 2012).

In contrast, magnesium supplementation has been shown to increase physical activity in the elderly (Abbasi *et al.,* 2012; Chasens & Yang, 2012; Stamatakis & Brownson, 2008). Magnesium is naturally present in various dietary sources, including dark green

leafy vegetables, beans, nuts, seeds, whole grains, fish, and seafood (Abbasi *et al.,* 2012).

It is essential to be cautious about magnesium intake, as excessive levels of magnesium, known as hypermagnesemia, can be associated with conditions such as hypothyroidism, lithium therapy, and Addison's disease (Musso, 2009).

2.5.12 Vitamin A

Vitamin A contributes to vision, cellular differentiation, and immunity. It plays a significant role in wound healing (Polcz & Barbul, 2019) and functions as an antioxidant, making it beneficial to the elderly diet as a preventative for illnesses (Dao *et al.,* 2017).

2.5.13 Vitamin C

Vitamin C, otherwise known as ascorbic acid, serves as an antioxidant and thus holds preventative properties against diseases such as cancer and sarcopenia. Vitamin C was also found to be beneficial for reducing oxidized Low-Density Lipoprotein (LDL). In addition, ascorbic acid was found to be beneficial for diseases such as Werner's syndrome, Huntington's disease, Alzheimer's disease, and dementia (Monacelli *et al.,* 2017). Additionally, vitamin C plays a significant role in collagen cross-linking (Camarena & Wang, 2016).

2.5.14 Vitamin D

Vitamin D is derived from sunlight exposure and diet (Brouwer-Brolsma *et al.,* 2016). However, the efficient intake of vitamin D is dependent upon season, latitude, skin pigment, pollution, age, sunscreen use, medication use, effective absorption of the gut, and any kidney or liver disease (Brouwer-Brolsma *et al.,* 2016; Holick, 2007). It is also influenced by genetics (Brouwer-Brolsma *et al.,* 2016; Palacios & Gonzalez, 2014; Hilger *et al.,* 2014; Brouwer-Brolsma *et al.,* 2012; Wang *et al.,* 2010; Mithal *et al.,* 2009). Vitamin D has been found to prove beneficial for bone health, endocrine, immune, and central nervous systems, as well as CVD, autoimmune disease and cancer (Bruyère *et al*., 2014).

2.5.15 Vitamin E

A lifestyle consisting of physical activity and antioxidant-containing foods was found to be beneficial in the prevention of cognitive decline, which, if left untreated, could develop into dementia and Alzheimer's disease (Casati *et al.,* 2020; Marseglia *et al.,* 2018). Various forms of vitamin E were found to be beneficial in reducing the risk of Alzheimer's disease (Casati *et al.,* 2020). Furthermore, the risk of contracting pneumonia was found to be decreased by as much as 35% with the use of vitamin E supplementation (Hemilä, 2016).

2.5.16 Vitamin K

Research has established that vitamin K supplementation or intake might prevent diseases and conditions, such as cardiovascular diseases, inflammation, and osteoarthritis (Harshmen & Shea, 2016). Vitamin K is mostly derived from foods and vegetables such as dark green leafy vegetables, dried prunes, nuts (Popa *et al.,* 2021; Turck *et al.,* 2017), as well as animal-derived foods (Popa *et al.,* 2021; Melse-Boonstra, 2020). However, vitamins K in fruits and vegetables consist of low bioavailability compared to animal-derived foods (Popa *et al.,* 2021; Margier *et al.,* 2019; Schwalfenberg, 2017; Booth, 2012). Vitamin K aids in blood clot formation (Popa *et al.,* 2021), contains anti-inflammatory and antioxidant qualities, contributes toward bone health quality, otherwise known as bone mineral density (BMD), and reduces the risk of bone fractures (Popa *et al.,* 2021; Sim *et al.,* 2020). Furthermore, vitamin K was also found to be beneficial in reducing the risk of contracting age-related illnesses and syndromes such as sarcopenia, osteoarthritis (OA), osteoporosis (Popa *et al.,* 2021; Shea *et al.,* 2015), CVD (Popa *et al.,* 2021; Jaminon *et al.,* 2020), coronary heart disease (CHD), and vascular calcification (VC) (Popa *et al.,* 2021; Gast *et al.,* 2009).

2.5.17 Zinc

Zinc plays a vital role in immune function, thereby influencing oxidative stress and inflammatory responses (Prasad, 2014; Prasad *et al.,* 2007; Bao *et al.,* 2010), Wilson's disease (Prasad, 2014), and macular degeneration (AMD) (Prasad, 2014; Chew *et al.,*

2013). Zinc is also beneficial for leprosy, hepatitis C, leishmaniasis, colds, and shigellosis (Hui & Tang, 2012; Prasad, 2009). Zinc in combination with antidepressants was found to be a more beneficial treatment (Cebrera, 2015; Ranjbar *et al.,* 2013). Zinc is also beneficial for sickle cell anaemia, otherwise known as sickle cell disease (SCD) (Cebrera, 2015; Bao *et al.,* 2008) and for improved cognitive performance (Haase & Rink, 2009). In individuals with normal zinc concentrations, the risk of contracting pneumonia is less, as well as reports of decreased recovery time required from pneumonia (Cabrera, 2015; Haase & Rink, 2009; Meydani *et al.,* 2007). Zinc has also been found to contribute positively to individuals with diabetes, as it provided glycemic control (Nuttall & Oteiza, 2014; Jayawardena *et al.,* 2012). Additional benefits of zinc include improved mood, inflammation, memory, and oxidative stress (Lai *et al.,* 2012; Bao *et al.,* 2010; Beletate *et al.,* 2007).

A zinc deficiency may contribute to many chronic illnesses such as cancer, diseases that degenerate the nervous system, atherosclerosis (Cabrera, 2015; Chasapis *et al.,* 2012), difficulty with memory and learning due to neurodegenerative disorders (Cabrera, 2015; Szewczyk, 2013; Brewer, 2010; Plum *et al.,* 2010), cognitive decline (Cabrera, 2015; Kosaka *et al.,* 2013); lung infections, congestive cardiopathy, depression, and GIT diseases (Haase & Rink, 2009). Numerous factors contribute to elderly zinc deficiency such as diet (Cabrera, 2015; Vasto *et al.,* 2007); malabsorption and medication (Cabrera, 2015; Mocchegiani *et al.,* 2013; Roohani *et al.,* 2013), diseases (Haase & Rink, 2009) and lifestyle (Haase & Rink, 2009). Zinc deficiency in severe form causes wound healing to take more time, skin lesions, impaired vision, and diarrhoea (Haase & Rink, 2009). The most severe form of zinc deficiency was found in the chronically ill that are housebound (Haase & Rink, 2009).

Multiple studies have shown that zinc concentrations decrease during ageing, especially with reduced dietary zinc intake (Haase & Rink, 2009). In contrast, zinc toxicity was found to cause vomiting, macrocytic anaemia, reduced immune responses, sideroblastic anaemia, neutropenia, lethargy, nausea, fatigue, and epigastric pain (Cabrera, 2015; Sheqwara & Alkhatib, 2013; Trinch, 2007). Zinc toxicity can also inhibit copper absorption, causing copper deficiency with some of its symptoms to exist, such

as neutropenia and anaemia in a severe form (Haase & Rink, 2009; Hodkinson *et al.,* 2007). Furthermore, elevated zinc concentrations have been found to contribute to AD (Nuttall & Oteiza, 2014; Duce *et al.,* 2010), although decreased zinc levels have shown the same results (Nuttall, 2014).

2.6 LIFESTYLE FACTORS AFFECTED BY COVID-19

2.6.1 Diets

Pandemic-related events increased stress, which has been linked to altered eating patterns (Yau & Potenza, 2013; Sidor & Rzymski, 2020), and weight as well (Sidor & Rzymski, 2020; Maniscalco & Rinaman, 2017; Razzoli & Bartdomucci, 2016; Maniscalco *et al.,* 2013). Pandemic events where individuals were required to stay home for prolonged periods have also been linked to alterations in purchases of prepared foods or cooking more often (Gasmi *et al.,* 2020; Sidor & Rzymski, 2020).

Sidor *et al*. (2020) found in Poland that during the COVID-19 restrictions, individuals were more prone to snacking, consuming more meals per day, and cooking more often, leading to individuals consuming greater amounts of dairy, meat, and fast foods. Individuals older than 45 years of age reported that they consumed less fruit and vegetables, dairy, sweets, and legumes, while consuming more coffee and meat.

2.6.1.1 Different diets, their benefits and disadvantages

Lo *et al*. (2017) discovered that the risk of pre-frailty and frailty can be reduced by consuming a diet containing considerable amounts of seeds and nuts, fruits and vegetables, tea, whole grains, milk, and omega-3 rich deep-sea fish (Capurso, 2021; Lo *et al.,* 2017). Evidence has also found that following the Mediterranean diet (MD) can reduce the risk of cardiovascular diseases (CVD) from high to a reduced risk of strokes, acute myocardial infarction, and death due to CVD (Capurso, 2021; Estruch *et al.,* 2018; Estruch *et al.,* 2013; Buckland *et al.,* 2009).

Furthermore, following the MD has shown benefits in improved quality of life and health, reduction in the risk of cancer, death due to congenital heart disease, and overall

mortality (Capurso, 2021; Sofi *et al.,* 2010). Moreover, adherence to the MD was also found to directly increase lifespan (Capurso, 2021; Buckland *et al.,* 2009). Evidence has found that the MD, mostly consisting of whole grains, fruits, and vegetables, has a reducing impact on inflammation (Semba *et al.,* 2009).

The positive effects of the MD were found to correlate with its reducing levels of oxidative stress, lipids, gut microbiota problems, inflammation, alteration of hormones, and growth of cancer pathogenesis. Since the MD diet was found to include considerable amounts of dietary fibre and restricted intake of saturated fatty acids, branch-chain amino acids, and sulfur, the additional benefits found include improved effects on HDL cholesterol, which was attributed to the intake of legumes, nuts, and fish (Capurso, 2021; Estruch *et al.,* 2018; Estruch *et al.,* 2013).

Indeed, the MD or the Okinawa diet was found to be more beneficial when followed as a lifestyle, rather than as a diet for a limited time (Capurso, 2021).

A diet consisting of vast amounts of processed and red meat and fast food was found to increase inflammation (Sidor & Rzymski, 2020; Christ *et al.,* 2018; Montonen *et al.,* 2013). Furthermore, processed meats and meat products are said to contain increased amounts of sodium (Wyness *et al.,* 2011). On the other hand, vegetarian diets have been linked to reduced carbohydrate intake and high fibre intake, which was found to be beneficial for increased satiety properties. Vegetarians were found to have a lower body weight when compared to meat-eating individuals (Wyness *et al.,* 2011).

High protein diets have been found to create increased satiety feelings (Wyness *et al.,* 2011; Paddon-Jones *et al.,* 2008). A high protein diet that coincides with reduced carbohydrate content in the diet causes ketogenesis. Ketogenic diets are beneficial for weight loss (Johnstone *et al.,* 2008; Wyness *et al.,* 2011). However, caution has been advised when participating in this diet, as safety concerns were noted (Wyness *et al.,* 2011). Lastly, cardiovascular diseases such as obesity, high blood cholesterol, hypertension, high blood triglycerides, and diabetes were found to be influenced by lifestyle factors such as diet, smoking, and physical activity (Wyness *et al.,* 2011).

Sarcopenia is known for the loss of both skeletal muscle function and mass (Santilli *et al.,* 2014) and can also be experienced in the form of obesity, known as sarcopenic obesity (SO), which is experienced when body fat is increased while muscle mass decreases, causing the normal weight to persist but weakness to be experienced. Lifestyle changes that can be made to prevent Sarcopenia include physical activity, as increased inactivity contributes to the loss of both strength and muscle mass, and sufficient and healthy nutritional interventions (Santilli *et al.,* 2014).

Furthermore, it was found that SO contributes to both an increase in muscle mass reduction and a risk of developing metabolic syndrome (Narici & Maffulli, 2010). Metabolic syndrome was identified as a key factor that leads to increased cardiovascular disease risk (Troxel *et al.,* 2010). Metabolic syndrome exists when multiple illnesses exist at once, including obesity, atherogenic dyslipidemia, insulin resistance, and hypertension (Huang, 2009). Individuals diagnosed with metabolic syndrome were found to be twice as likely to develop cardiovascular disease and five times as likely to contract type 2 diabetes. Research indicated that the two main habits that cause worldwide metabolic syndrome to prevail include a sedentary lifestyle and obesity (Grundy, 2008).

2.6.2 Physical activity

Even low to moderate levels of physical activity (PA) are beneficial to the health of elderly individuals, as PA decreases the risk of contracting CVD (Lachman *et al.,* 2018), premature mortality, ischemic stroke, ischemic heart disease, and all-cause heart failure (Kraus *et al.,* 2020), and prevents infectious diseases (Scartoni *et al.,* 2020; Walsh *et al.,* 2011) and inflammation (Scartoni *et al.,* 2020). Reduced PA was also found to increase the risk of cardiac arrest and long-term coronary artery disease (Woods *et al.,* 2020).

Furthermore, PA is beneficial for mental health as well, providing relief or prevention of depression (Scartoni *et al.,* 2020; Schuch *et al.,* 2016), anxiety (Scartoni *et al.,* 2020; Stubbs *et al.,* 2017), and contributing to the recovery of elderly cognitive functioning (Scartoni *et al.,* 2020; Bangsbo *et al.,* 2019; Condello *et al.,* 2017; Diamond, 2013).

Moderate PA also contributes to anti-influenza benefits, including increased efficacy of vaccines and reduced risk of contracting influenza (Nogueira *et al.,* 2020; Scartoni *et al.,* 2020), as well as acting as a therapy for type 2 diabetes, counteracting the effects of the disease on the body (Condello *et al.,* 2017). Unfortunately, with age-related decline, PA levels decrease (Condello *et al.,* 2017), as the elderly might find PA more difficult due to comorbidities and frailty (Lachman *et al.,* 2018; Sattelmair *et al.,* 2011).

Due to COVID-19 regulations, many individuals were forced to stay at home, and gymnasiums and parks were closed. This caused physical activity to reduce, and increased sedentary behaviour (including the use of screens) was found to influence physical health negatively (Colley *et al.,* 2020; Patterson *et al.,* 2018; Biswas *et al.,* 2015), as well as decreased mental health (Colley *et al.,* 2020; Hamer *et al.,* 2010) and depression (Colley *et al.,* 2020; Wang *et al.,* 2019). Amongst the elderly, PA was found to show antidepressant and anxiolytic effects (Callow *et al.,* 2020; Mumba *et al.,* 2020; Mura & Carta, 2013). PA positively impacts the elderly's health (Lachman *et al.,* 2018; Sattelmair *et al.,* 2011) and CVD (Lachman *et al.,* 2018; Piepoli *et al.,* 2016; SSWHA, 2013; Smith *et al.,* 2012; Smith *et al.,* 2011).

However, PA during COVID-19 infection was found to increase the risk of contracting cardiac damage, as well as cardiac death during PA and after the infection (Woods *et al.,* 2020; Inciardi *et al.,* 2020; Yang & Jin, 2020). Recommendations for PA during signs of COVID-19 symptoms suggested that PA should be ceased, and following recovery, PA should be resumed gradually (Woods *et al.,* 2020; Bloeken *et al.,* 2020).

Moderate-intensity PA lasting for at least 30 minutes is recommended for the elderly 2-3 times a week (Woods *et al.,* 2020; Li *et al.,* 2020; Lachman *et al.,* 2018; Liguori, 2017; Huang *et al.,* 2016). Colley *et al*. (2020) found that reduced exercise and increased screen or internet habits impacted self-perceived mental health during COVID-19. Lastly, 37.3% of adults older than 50 years of age indicated a reduction in PA due to COVID-19 social distancing guidelines (SDG) (Callow *et al.,* 2020).

Sarcopenia is known for the loss of both skeletal muscle function and mass (Santilli *et al.,* 2014), which causes muscle function to decline (Granic *et al.,* 2019) in a correlated

manner as physical disability (Santilli *et al.,* 2014). Furthermore, Sarcopenia leads the elderly individual to experience frailty, which increases with time, ending in death (Granic *et al.,* 2019; Santilli *et al.,* 2014). Additional factors that were found to contribute to sarcopenia include increased inflammation, poor nutritional status, the loss of muscle fibres, changes in hormone levels, changes in renin (Burton & Sumukadas, 2010), physical activity, immunological- and neuropathic functioning (Narici & Maffulli, 2010). It was suggested that resistance training would be more effective to prevent sarcopenia compared to other physical exercises (Burton & Sumukadas, 2010).

2.6.3 Mental health

Chronic reduction of food intake contributes to ill mental health (Bishwajit *et al.,* 2019; Pérez-Escamilla, 2017; Jebena *et al.,* 2016; Tesfaye *et al.,* 2016; Popa & Ladeu, 2012; Rao *et al.,* 2008). Bishwajit *et al*. (2019) found that men were more likely to experience depression if they smoked tobacco. In contrast, the likelihood of depression decreased in women who smoked (Bishwajit *et al.,* 2019; Fluharty *et al.,* 2017; Mathew *et al.,* 2017).

Furthermore, HIV has also been linked with ill mental health and food insecurity (Bishwajit *et al.,* 2019; Palar *et al.,* 2012; Weiser *et al.,* 2012). The WHO found that the elderly are at a higher risk of experiencing mental distress and food insecurity at moderate to severe levels, compared to younger people (Gyasi *et al.,* 2020; WHO, 2019; Leung *et al.,* 2015; Carter *et al.,* 2011). Hatcher *et al*. (2019) found that high food insecurity was associated with high domestic violence caused by men in South Africa (Hatcher *et al.,* 2019).

The treatment of depression in individuals that were also diagnosed with HIV is challenging in South Africa (Tomita *et al.,* 2019; Peterson *et al.,* 2013), although it can also be linked to micronutrient deficiencies (Weaver & Hadley, 2009; Kaplan *et al.,* 2007).

Measures such as quarantine, social distancing, and isolation during pandemics have been shown to influence individuals emotionally and psychologically (Talevi *et al.,* 2020; Rubin, 2020; Brooks *et al.,* 2020; Taylor *et al.,* 2019). Pandemics were found to cause

psychological reactions such as emotional distress, maladaptive and defensive behaviours (Talevi *et al.,* 2020; Taylor *et al.,* 2020), frustration, fear, anxiety, anger, loneliness, depression, boredom, avoidance, and stress, as well as "headline stress disorder" which causes emotional responses to exist from media reports (Talevi *et al.,* 2020; Moreno *et al.,* 2020; Li *et al.,* 2020; Lei *et al.,* 2020; Qiu *et al.,* 2020). Psychological distress was also present in individuals during the Ebola virus (Lee *et al.,* 2020; Shultz *et al.,* 2016).

During the COVID-19 pandemic, an increase in activities such as online gambling (Moreno *et al.,* 2020; Brooks *et al.,* 2020; King *et al.,* 2020), as well as increased alcohol consumption was noted during quarantine (Moreno *et al.,* 2020; Clay & Parker, 2020). Social isolation caused exhaustion, irritability, acute stress disorder, detachment from others, insomnia, indecisiveness, poor concentration, anxiety, and fear (Woods *et al.,* 2020; Dowlati *et al.,* 2010).

Amongst the list of physical health conditions that had an increased risk of severe COVID-19 illness or death was obesity (Flint, 2020). Media reports increased the weight stigma of obese patients by reporting the numbers of deaths and ICU admissions of such individuals (Flint *et al.,* 2016; Flint & Tahrani, 2020; Wilcock, 2020; Saguy & Almeling, 2008; Hilbert & Ried, 2009; Heuer *et al.,* 2011). In contrast, literature has shown other results with obesity and illnesses (Hayward *et al.,* 2018). However, the weight stigma has been shown to influence the behaviour of the obese (Campbell *et al.,* 2020). Consequently, obese individuals experienced higher anxiety due to their perceived increased risk of contracting the illness in a severe form or of death (Sulway, 2020).

The elderly experienced increased loneliness early on during the pandemic, which increased with time (Applebaum *et al.,* 2021; Luchett *et al.,* 2020; Kotwal *et al.,* 2020). Pets reduced loneliness by providing comfort, tactile needs (Applebaum *et al.,* 2021; Young *et al.,* 2020), as well as emotional support and companionship (Applebaum *et al.,* 2021; Gee & Mueller, 2019). Pets have been found to provide psychological help during times of isolation for the elderly(Applebaum & Zsembik, 2020; Applebaum *et al.,* 2021; Matijczak *et al.,* 2020; Zilcha-Mano *et al.,* 2012; Herzog, 2011).

However, Lee *et al*. (2020) found that certain factors could serve as beneficial in the protection of mental health during COVID-19, these include stress coping strategies, ego-integrity, self-efficacy (Lee *et al.,* 2020; Cho Seongja, 2014), and resilience (Lee, 2020).

2.6.4 Finances

The elderly who experienced multiple chronic illnesses were forced to choose between needs and necessities, such as food and medication, due to financial limitations (Bhargava *et al.,* 2012; Bengle *et al.,* 2010; Seligman & Schillinger, 2010; Sullivan *et al.,* 2010; Jih *et al.,* 2018; Vogeli *et al.,* 2007; Fried *et al.,* 2012). Again, food insecurity has been found to contribute to multiple health problems (Bhargava *et al.,* 2012; Ziliak *et al.,* 2008; Kim & Frongilo, 2007).

Therefore, the South African government started implementing social grants to increase food security and decrease poverty (Chakona & Shackleton, 2019; Labadarios *et al.,* 2011; Altman *et al.,* 2009; Thornton, 2008), as well as raising SASSA grants for the elderly which was implemented prior to the COVID-19 pandemic (SASSA, 2023); and Social Relief of Distress (SRD) grants during the COVID-19 pandemic which consisted of R350 per month and was only available to those who fit the criteria (SAGOV, 2023).

2.7 CONCLUSION

The challenging nature of food insecurity is that it encompasses the economic status, public health, and social aspects of a country (Pollard & Booth, 2019). Achieving food security in developing countries requires addressing both long- and short-term challenges (Maiangwa *et al.,* 2010). However, in recent years, the global economy has been impacted by events such as the COVID-19 pandemic and the Russia-Ukraine war (UN Report, 2022). The pandemic led to food access challenges, including food shortages, financial limitations, difficulties in adhering to regulations to obtain food, and limited information. These challenges resulted in coping strategies, such as consuming less food, purchasing more affordable options, trying different foods, and utilizing government feeding programs, support from family and friends, food pantries, and credit

at food stores. These factors negatively affected food security. Food-insecure individuals or households are at risk of experiencing decreased health and mental well-being, malnutrition, and increased future healthcare costs (Niles *et al.,* 2020). Therefore, maintaining proper nutrition remains crucial for improving and preserving food security and overall quality of life (Fernandes *et al.,* 2018; Bernstein & Munoz, 2012). This chapter focused on reviewing the existing relevant literature.

CHAPTER 3:
RESEARCH METHODOLOGY

3.1 INTRODUCTION

Research methodology is a systematic approach used to solve research problems (Patel & Patel, 2019). It involves studying the various steps a researcher takes to investigate a research problem, along with the underlying logic behind those steps. Understanding both the research methods and the methodology is essential for conducting a scientifically sound study. This chapter will provide an overview of the research design, target population, data collection methods, data analysis techniques, reliability and validity measures, as well as the limitations of this study.

3.2 RESEARCH DESIGN

Research design is the plan or blueprint for conducting a research project (Akhtar, 2016). It outlines the methods and procedures that will be used to collect and analyze data. There are different types of research designs, including quantitative and qualitative approaches.

For this study, an exploratory and descriptive mixed-method design was employed. The study used both quantitative and qualitative data collection methods to gain a comprehensive understanding of the impact of the COVID-19 pandemic on the food security, lives, and food consumption of the elderly, thus including individuals that are 60 years and older.

The quantitative component of the study involved the use of a questionnaire to gather data from a larger sample of elderly individuals. The questionnaire provided structured data that could be statistically analyzed to determine the extent of the pandemic's impact on food security and other related factors.

The qualitative component of the study involved conducting semi-structured interviews with a smaller sample of elderly individuals. These interviews allowed for in-depth

exploration and understanding of the experiences and perspectives of the elderly during the pandemic. Qualitative data provided insights into the nuances and complexities of the impact of the pandemic on their lives and food consumption.

The mixed-method design was chosen because it allows for a more comprehensive and enriched understanding of the research topic (Crause, 2015). By combining both quantitative and qualitative approaches, the study could triangulate the findings and validate the results from multiple perspectives.

The convergent parallel mixed-method design was used, which involves collecting both quantitative and qualitative data simultaneously and analyzing them separately before merging the findings for a comprehensive interpretation (Morse & Niehaus, 2009). This approach enables a more robust and holistic exploration of the research questions and enhances the overall validity and reliability of the study's findings (Green *et al*. 2015).

Using a mixed-method design was particularly suitable for this study as it allowed for a deeper exploration of the impacts of the COVID-19 pandemic on the elderly's food security and well-being, incorporating both statistical data and rich narrative insights from interviews. This approach provided a more nuanced understanding of the complexities and challenges faced by the elderly during the pandemic and its effect on their food-related experiences.

3.3 TARGET POPULATION AND SAMPLING

3.3.1 Population

Elderly individuals living independently and in old age homes in the Bethal district, including the Bethal town and surrounding towns within the area in Mpumalanga were included for diverse responses while selecting individuals representing the average elderly. The study area comprised of Bethal, Ermelo, Middelburg, Kriel, Secunda, Wakkerstroom, and other smaller rural towns within the rural area of the Bethal district. Thus, towns within a 143 km radius were included. Most working individuals in this area work in the mining industry, electricity generation industry, or in the chemical industry at Sasol. The mining industry within Mpumalanga contributes to more than 20% of the

provincial GDP, and significant amounts of Mpumalanga's coal are exported to other countries, including China, India, South Korea, and Japan. Mpumalanga houses 11 of South Africa's 13 coal-fired power stations, contributing to 70% of Eskom's capacity. Manufacturing and beneficiation provide about 15% of the provincial GDP. The Highveld area produces more than 50% of South Africa's soya bean crops. Around 14% of the land area is used for poultry, mutton, beef, dairy, and wool production (MERRP, 2022). The average basic mining salary is R 119,908 per year and could be as high as R 431,932 per year (Za.indeed.com, 2022), the average basic salary for Eskom employees is R 462,000 per year (payscale.com, 2022), for Sasol workers', salaries vary between R 4,759 per month and R 25,000 per month depending on the post and qualification (Za.indded.com, 2022). An estimated amount of 382,004 people older than 60 years of age live within this area (Stats SA, 2021). Due to the industry and salaries found in the Highveld, some of the elderly in this region receive a pension from pension funds or from savings, whilst others receive SASSA grants. The researcher is familiar with this area, and limited previous research has been done on population food insecurity within this area. The only recent study on food insecurity in the area was on understanding the factors which contribute towards household food insecurity and poverty within the Gert Sibande Municipal area (Agboola, 2021), local food security/food production within this area is negatively influenced by mining activity taking up much land previously used for farming practices (Simpson *et al.,* 2019).

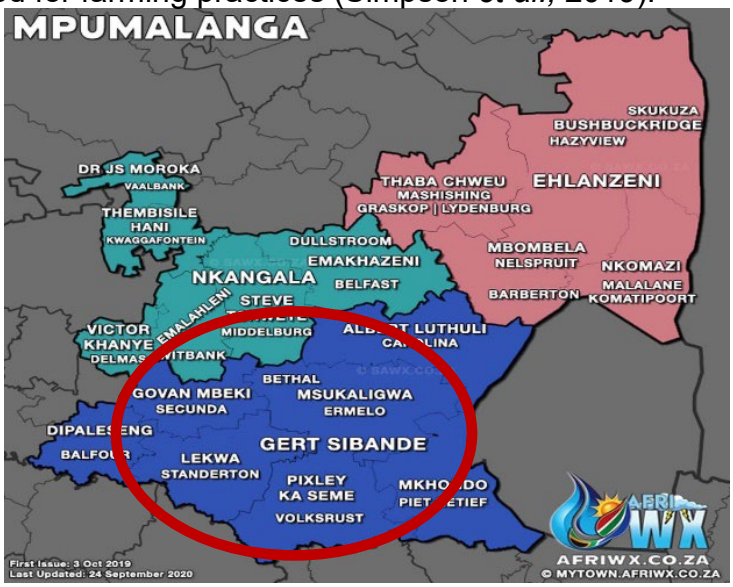

Figure 3.1: Map of study area within Mpumalanga

3.3.2 Quota sampling

Quota sampling was used for the sample selection of the quantitative component. Quota sampling is the classification of characteristics within the population, such as age and location of residence in this study, from which sampling units are selected to complete each characteristic (Martínez-Mesa *et al.,* 2016; Davis, 2005). The aim of quota sampling is to have a sample of the groups that are being studied, which are proportional to the population studied and representative of the population being studied. This form of sampling improves representations of particular groups in the population and ensures that they are not over-represented (Sharma, 2017).

The sample size was determined by using the estimated population of 60 years and older within this region together with the following formula:

n = NC^2 / [C^2 + (N-1)]

= 223 * 0.32 / [0.32 + (223-1) * 0.022] = 112

Where: n = sample size N = population size C = Coefficient of variation which is ≤ 30% e = margin of error which is fixed between 2-5%

The study sample was calculated at a 30% coefficient of variation and a 2% margin of error for low variability and minimizing error (Covid-19 statistics SA, 2022; Bradshaw 1 *et al.,* 2022; Bradshaw 2 *et al.,* 2022 ;Statistical Release 2018, 2021; Pillay-van Wyk *et al.,* 2020; Statistical Release 2017, 2020; Statistical Release 2016, 2018; Community Survey, 2016; Nassiuma, 2000).

3.3.3 Purposive sampling

Purposive sampling was used for the sample selection of the qualitative component. Judgmental (purposive) sampling is applied when individuals are deliberately selected

to provide valuable information that cannot be obtained through other sampling strategies (Maxwell, 1996). Purposive sampling is used when a diverse sample is necessary for data gathering (Martínez-Mesa *et al.,* 2016). According to Sharma (2017), purposive sampling techniques include maximum variation sampling, homogeneous sampling, typical case sampling, extreme case sampling, total population sampling, and expert sampling.

In this study, maximum variation sampling was used to gather a variety of experiences related to the COVID-19 pandemic. Therefore, a variety of living conditions were included, such as individuals living on their own, living at an old age home, living with their spouses, living with family, and family living with them. This approach allowed for a diverse range of perspectives and experiences to be captured, enriching the qualitative data and providing a deeper understanding of the impacts of the pandemic on food security and well-being among the elderly population. Participants and respondents were selected based on their ability to meet the criteria mentioned above as well as their willingness to take part in the study.

3.4 DATA COLLECTION INSTRUMENTS

For the purpose of data collection, questionnaires were distributed to the management at old age homes within the area, as well as other individuals that meet the criteria set for this study. This approach was mostly due to the restrictions and safety measures set in place during the COVID-19 pandemic. The researcher was allowed to enter one of Bethal's old age homes to conduct data gathering, and in this case, one respondent was willing to take part in an interview as a participant. The other interview participants were selected using purposive sampling and were asked if they would participate via telephonic conversations or in person. In total, data was collected from 112 people using both paper-based and online platforms.

Additionally, a total of 25 interviews were conducted for the purpose of this study, as saturation was reached at this point, these individuals also took part in the questionnaire section of data gathering. The combination of questionnaire responses and interviews allowed for a comprehensive and multi-dimensional understanding of the impacts of the

COVID-19 pandemic on food security and well-being among the elderly population in the Bethal district.

3.4.1 Questionnaires

Survey methods are cost-effective and used to represent populations of interest when large amounts of data need to be collected, making them suitable for mixed methods studies (Fowler, 2009; Beatty & Willis, 2007). According to Couper *et al*. (1998), surveys are typically conducted using a questionnaire, which includes a set of questions related to a specific topic and attributes or behaviours regarding this topic. Questionnaires can be administered via telephone, in person, or through web-based platforms. For this study, the questionnaire was translated from English to Afrikaans and back to English to ensure the accuracy of the translation and clarity of understanding within the target population.

The survey addressed questions on household food security, food diversity, and the influence of COVID-19 on general health. Respondents were also asked for their year of birth, demographics, level of education, household size, the number of household members older and younger than 60 years of age, the amount of money spent monthly on food, and their monthly income. Frongillo *et al*. (1997) found questionnaires to be valid for identifying hunger and food security within rural households (Frongillo *et al.,* 1997), and more recent studies by Rafiei *et al*. (2013), Abbasi *et al*. (2016), and Tutunchi *et al*. (2020) have also shown questionnaires to be effective in assessing food security.

A questionnaire was created specifically for this research study, which consists of five sections (Appendix B). Table 3.1 provides a summary of the questionnaire composition, indicating the types of questions used and the sections they belong to.

Table 3.1: Summary of questionnaire composition

Section	Question content	Question type
Section 1 Demographics	Year born (age)	Categorical close-ended (ordinal)
	Gender associated with	Categorical close-ended (nominal)
	Home language (Mother tongue)	Categorical close-ended (nominal)
	Marital status	Categorical close-ended (nominal)
	Town of residence	Categorical close-ended (nominal)
	Additional residence information if not included in previous options	Categorical open-ended (nominal)
	Employment status	Categorical close-ended (nominal)
	Change in working hours if applicable	Categorical close-ended (nominal)
	Highest qualification	Categorical close-ended (nominal)
	Accommodation set-up	Categorical close-ended (ordinal)
	Number of individuals living in household	Categorical close-ended (ordinal)
	Household members older the 60 years	Categorical close-ended (ordinal)
	Household members younger than 60 years	Categorical close-ended (ordinal)
	Main source of income	Categorical close-ended (nominal)
	Declaration of additional source of income	Categorical close-ended (nominal)
	Declaration of type of additional income	Categorical close-ended (nominal)
	Amount spent on food per month	Categorical open-ended (ordinal)
	Income affected by COVID-19 pandemic	Categorical close-ended (nominal)
	How was income affected	Categorical close-ended (nominal)
	Why did it change	Categorical close-ended (nominal)
	Total monthly household income	Categorical open-ended (ordinal)
Section 2 Impact of COVID-19 on health	Diagnosis of chronic illnesses since COVID-19	Categorical close-ended (nominal)
	Effect of alcohol on health	Categorical close-ended (nominal)
	Effect of cigarettes on health	Categorical close-ended (nominal)
	Diagnosis of nutrient deficiency since COVID-19	Categorical close-ended (nominal)
	If applicable indicate which deficiency	Categorical open-ended (nominal)
	Weight gain during COVID-19	Categorical close-ended (nominal)
	How much weight gained	Categorical close-ended (nominal)
	How much weight lost during COVID-19	Categorical close-ended (nominal)
	Participation in physical exercise	Categorical close-ended (nominal)
	If applicable how often do you exercise	Categorical close-ended
	Changes in exercise program	Categorical close-ended (nominal)

	due to COVID-19	
	Changes in screen and sitting time due to COVID-19	Categorical close-ended (nominal)
	Experienced more stress/anxiety/sleep of lesser quality during COVID-19	Categorical close-ended (nominal)
	Emotional eater during COVID-19	5-point Likert scale* Begin always and end Never
	Scared to leave your house during COVID-19	5-point Likert scale* Begin always and end Never
	Tested positive for COVID-19	Categorical close-ended (nominal)
	Has a sense of smell/taste recovered	Categorical close-ended (nominal)
	Has diet changed since having COVID-19	Categorical close-ended (nominal)
	How has diet changed since having COVID-19	Categorical open-ended (nominal)
Section 3 Impact of COVID-19 on food consumption and behaviour	Time lap between grocery shopping influenced by COVID-19	Categorical close-ended (nominal)
	Increase in snacking since COVID-19	Categorical close-ended (nominal)
	Influence of COVID-19 on fresh produce consumption	Categorical close-ended (nominal)
	Influence of COVID-19 on canned/ pre-prepared meals	Categorical close-ended (nominal)
	Influence of COVID-19 on meat consumption	Categorical close-ended (nominal)
	Influence of COVID-19 on plant-based purchases	Categorical close-ended (nominal)
	Influence of COVID-19 on less expensive foods	Categorical close-ended (nominal)
	Influence of COVID-19 on restaurant visits	Categorical close-ended (nominal)
	Influence of COVID-19 on “take away” consumption	Categorical close-ended (nominal)
	Start planting own food	Categorical close-ended (nominal)
	Started shopping online	Categorical close-ended (nominal)
	Someone else bought my food	Categorical close-ended (nominal)
Section 4 Food security during COVID-19 restriction	Found food looking for	Categorical close-ended (nominal)
	Afford eating balanced meals during COVID-19	Categorical close-ended (nominal)
	Afford to purchase food during COVID-19	Categorical close-ended (nominal)
	9 Food security questions during COVID-19	Categorical close-ended (nominal)
	12 Dietary diversity questions during COVID-19	Categorical close-ended (nominal)
Section 5 Food security prior to COVID-19	Found food looking for	Categorical close-ended (nominal)
	Afford eating balanced meals	Categorical close-ended (nominal)
	Afford to purchase food	Categorical close-ended (nominal)
	9 Food security questions before COVID-19	Categorical close-ended (nominal)
	12 Dietary diversity questions	Categorical close-ended (nominal)

	before COVID-19	

**Likert scale is aimed at gaining opinions/perceptions of participants relating to a 'latent' variable in research (Joshi et al., 2015; Boone & Boone, 2012). According to Joshi et al. (2015), the construct of a Likert scale instrument can be derived from the objectives of study and objectives are the operational form of theoretical construct of phenomenon under inquiry. The Likert scales used in this study's questionnaire are interval measures*.

For the purpose of data collection, questionnaires were distributed to management at old age homes within the area, primarily due to restrictions and safety measures set in place during the COVID-19 pandemic. The researcher was granted access to one of Bethal's old age homes for data gathering, and one respondent from this facility participated in an in-person interview. Other interview participants were selected using purposive sampling and were asked if they would participate via telephonic conversations or in person, most chose in person conversations. In total, 112 people were included in the data collection using both paper-based and online platforms, and 25 interviews were conducted.

The questionnaire consisted of five sections. Section 1 focused on demographic information, including the year of birth, gender, home language, marital status, town of residence, employment status, level of education, accommodation set-up, number of individuals living in the household, number of individuals older and younger than 60 years of age in the household, main source of income, any additional sources of income, monthly expenditure on food, and how the participant's income was affected by the COVID-19 pandemic, if applicable. Participants were also asked to provide their household's total income per month.

Section 2 contained health-related questions that could be influenced by the COVID-19 pandemic. This section included a list of chronic illnesses that participants were diagnosed with during the pandemic, questions about the influence of alcohol and smoking on health, the presence of nutrient deficiencies during the pandemic, weight changes, exercise participation, screen time changes, stress/anxiety/sleep experiences, emotional eating habits, and fear of leaving home during the pandemic. Participants

who tested positive for COVID-19 were also asked about their sense of smell/taste recovery and changes in their diet since testing positive.

Section 3 focused on the impact of COVID-19 on food consumption and behaviour. It included questions on changes in grocery shopping frequency, increased snacking, and changes in the consumption of fresh produce, canned/pre-prepared meals, meat, plant-based products, less expensive food, restaurant visits, and take-away purchases or consumption. Other purchasing behaviours, such as starting to grow one's own food or using online shopping, were also addressed.

Section 4 assessed food security during COVID-19 restriction times (27 March until 17 August 2020). Participants were asked about the availability of food during this period, the affordability of balanced meals, and whether they had enough money for the food they wanted. Additionally, the section included the Household Food Insecurity Assess Scale (HFIAS) questions and Dietary Diversity questions.

Section 5 focused on food security prior to the COVID-19 pandemic (before 27 March 2020). The questions were the same as those in Section 4, but referred to pre-COVID times.

The questionnaire was designed to ensure that the statements and questions were easily understandable to all participants, with simple wording and a straightforward layout. A pilot test was conducted with 10 randomly selected individuals of younger age with knowledge in regional language use, residing within the areas where data was gathered to identify and correct any spelling or sentence errors, ensuring better quality and clarity in both English and Afrikaans versions.

Participants' personal information, such as names, was not asked, and data gathered were handled with confidentiality. The questionnaires were self-administered, and all respondents and participants voluntarily and anonymously took part in the study, none withdraws were experienced. Only the researcher had access to all the information gathered during the study. The average time to complete the questionnaire was approximately 20 minutes.

3.4.2 Reliability and Validity

All measuring instruments used in the study were carefully reviewed and assessed by the study leaders and the researcher to ensure that they effectively measured all the objectives of the study. The questionnaire incorporated the Household Food Insecurity Access Scale (HFIAS) (Gebreyesus *et al.,* 2015; Deitchler *et al.,* 2010; Knueppel *et al.,* 2010) and FAO Dietary Diversity, along with other questions from recent studies related to the topic. This approach provided the questions with reliability and multiple forms of validity, including content and face validity.

The questions used in the semi-structured interviews were also drawn from recent studies related to the topic, further contributing to their face and content validity.

To assess the questionnaire's internal consistency and reliability, a Cronbach's Alpha test was conducted, and the calculated value was 0.742. This value falls within the acceptable range for a questionnaire's variance validity. Cronbach's Alpha values between 0.6 and 0.8 are considered acceptable, while values below 0.6 may be considered questionable. Therefore, the Cronbach's Alpha value obtained in this study indicates good internal consistency and reliability for the questionnaire.

3.4.3 Semi-structured interviews

According to Dunn (2005), interviews are verbal exchanges where the interviewer attempts to gather information from another person. Semi-structured interviews, used in this study, allow participants to respond in their own words rather than providing short 'yes or no' answers, thereby providing a more in-depth understanding of their experiences. Semi-structured interviews are considered an excellent method of data gathering (Longhurst, 2016).

In this study, semi-structured interviews were used to determine how the COVID-19 pandemic influenced lifestyle factors of the elderly within Mpumalanga, as narrated by the participants themselves. Prior to the interviews, participants gave written consent to take part, and they were informed that the interviews would be recorded for later

documentation. All participants were thanked for their willingness to participate in the study and were treated with respect.

Semi-structured interviews offer both a predetermined order of questions and the flexibility to allow participants to address topics in their own way (Dunn, 2005). According to McIntosh and Morse (2015), semi-structured interviews make use of an interview guide or schedule, containing open-ended questions, which place the focus on the participant's responses. The interview questions used in this study were predetermined open-ended questions, which allowed for probing of answers to seek clarifications and gather detailed information (see Appendix C). The interviews were conducted in either English or Afrikaans on a one-on-one basis, mostly in person, with the researcher, as the researcher is fluent in both languages, and the participants were fluent in either English or Afrikaans.

3.5 DATA ANALYSIS

Data analysis requires the researcher to adopt a reflective attitude, a methodological and rational approach in research (Bergin, 2018). According to Silverman (2010), the separation of data analysis techniques into quantitative and qualitative methods is a useful way of organizing a body of knowledge into something digestible. The sections below provide detailed explanations of how the data analysis for both quantitative and qualitative components was executed.

3.5.1 Statistical analysis of survey data

The data collected from the questionnaire-based survey was analyzed using various forms of descriptive data (univariate), tabs (bi- and multi-variate). For this purpose, SPSS version 26 was employed to conduct data analysis, including the qualitative open-ended questions within the survey. Frequencies, means, and standard deviations were calculated from the gathered data. The processed data from SPSS was then used to create tables and graphs to represent significant findings.

Univariate analysis was utilized for presenting demographics, the impact of COVID-19 on health, food consumption, and behaviour, as well as food security. Bi-variate

analysis was employed to determine food security before and during the COVID-19 pandemic and to compare the food security of different towns. Multi-variate and univariate data were combined to determine the influence of the COVID-19 pandemic on elderly food security.

Cross-tabulation was employed to examine the relationship between categorical variables in greater detail compared to individual variables (Greasley, 2008).

To evaluate the statistical significance and probability of observed changes between data sets, the Chi-squared statistical test was applied to cross-tabulations. Thus, Chi-squared tests were used to assess possible significant associations among variables.

A significance level of 0.05 was used in this study, meaning that results with a p-value less than 0.05 ($p<0.05$) were considered significant, while values larger than 0.05 implied no change in variance (Andrade, 2019).

3.5.2 Analysis of interview data

The semi-structured interview audio recordings were transcribed by the researcher by hand, and where applicable, arithmetic calculations were used to analyze the data. The findings from these calculations were used to create graphs and tables. Trends in the qualitative data were identified through phenomenological analysis. Each of the verbatim transcripts was labelled using pseudonyms (A-Y). The data was then analyzed thematically, according to the questions asked, in order to be reported alongside the quantitative data

3.6 ETHICAL CONSIDERATIONS

Research ethics are crucial in the course of conducting research, as they involve the responsible publication of researched information and the protection of the subjects' dignity (Akaranga & Makau, 2016; Fouka & Mantzorou, 2011). Individuals involved in this study participated as research participants for data gathering purposes. Therefore, ethics approval was necessary and obtained through the General/Human Research Ethics Committee (GHREC) [Ethical Clearance number: UFS-HSD2021/0764/21]

(Appendix A), which approved the research proposal, outline, and protocol before fieldwork commenced.

The ethical review process was implemented to ensure that the human rights of the participants were not violated and that they were not negatively harmed during the data gathering process. To maintain anonymity and confidentiality, participants' identities were kept undisclosed and unidentifiable to anyone reading the final dissertation. The research instruments used in this study may have contained information that was potentially emotionally harmful or degrading for the participant.

All respondents who participated in the study did so voluntarily, and no incentives were given.

Participants who responded to the hard copy-based survey and those who took part in the semi-structured interviews provided written consent (Appendix D). Consent was also obtained from participants who participated via the online-based survey. For the interviews, a voice recorder was used, and participants were informed of this. Participants were assured that their identity would remain anonymous. They were also assured that only the researcher and research team would have access to the results gathered by the different research instruments used in this study. Appointments were made with participants, especially for interviews, to maintain professionalism during the data gathering process. The researcher remained objective and punctual throughout the study. After questionnaires were collected, they were placed in a locked cupboard, with only the researcher having access to these documents. Each questionnaire was separated from the consent form, which contains the participant’s name; the completed questionnaire was given a number. Qualitative data was also given numbers, and no names were linked to the data gathered.

3.7 CONCLUSION

The conclusion of Chapter 3 highlights that it presented a comprehensive overview of the research methodology employed in this study. The subsequent chapter will delve into an in-depth discussion of the results obtained from the research study.

CHAPTER 4:
RESULTS AND DISCUSSIONS

4.1 INTRODUCTION

In this chapter, the findings of the current research are presented, with a particular focus on the main aim, which was to assess the impact of the COVID-19 pandemic on the food security of the elderly in the Bethal District, Mpumalanga. The data gathered from the study is analyzed and discussed in five key categories, namely demographic information, food availability results, food access results, food utilization results, household food security results, and secondary objectives. The qualitative and quantitative data are combined and analyzed within each category to provide a comprehensive and integrated overview of the research findings.

4.2 DEMOGRAPHIC INFORMATION

Table 4.1 provides a representation of the demographic characteristics of the participants who took part in this research. The average age of the sample was 70.16 years, with 69.8% of the respondents being female. The majority of the participants (85.7%) were identified as Afrikaans speakers, followed by English (8.9%), Zulu (3.6%), and Swati (1.8%). These percentages were calculated using arithmetic calculations.

Regarding marital status, 55.9% of the respondents were married, and 62.2% were retired. In terms of education, 52.7% of the participants had some level of school education. Notably, the majority of respondents (80%) stated that their working hours did not change due to the COVID-19 pandemic, which may be attributed to a significant proportion of retired participants. Only 14.3% reported a decrease in working hours as a result of the pandemic.

Table 4.1: Demographic Information

	Frequency (%)	n
Age		
82-90	9.8	10
72-81	29.4	30
62-71	52.9	54
60-61	7.8	8
	100	**102**
Gender		
Female	69.8	74
Male	30.2	32
	100	**106**
Home Language		
Afrikaans	85.7	96
English	8.9	10
Siswati	1.8	2
Zulu	3.6	4
	100	**112**
Marital status		
Divorced	9.9	11
Married	55.9	62
Single	7.2	8
Widowed	24.3	27
Widower	2.7	3
	100	**111**
Residence		
Amerfoort	2.7	3
Bethal	58.9	66
Ermelo	6.3	7
Kriel	2.7	3
Middelburg	6.3	7
Morgenzon	0.9	1
Other	14.3	16
Secunda	0.9	1
Volksrust	4.5	5
Wakkerstroom	2.7	3
	100	**112**
Current employment status		
Employed	18.9	21
Part-time	0.9	1
Retired	62.2	69
Self-employed	14.4	16
Unemployed	3.6	4
	100	**111**
Change in working hours due to COVID-19		
Decrease	14.3	5
Increase	5.7	2
No change	80	28
	100	**35**

Level of education		
Schooled	52.7	58
Diploma/Higher certificate	29.1	32
Undergraduate	6.4	7
Post grad	11.8	13
	100	**110**
Main source of income		
Annuity	5.4	6
Pension	55.4	62
Salary	30.4	34
Spouse	8.9	10
	100	**112**
Income affected due to COVID-19		
No	78.2	86
Yes	21.8	24
	100	**110**
Income changes during COVID-19		
Decrease	57.9	22
Increase	0	0
No response	42.1	16
	100	**38**

The sample included respondents from various towns, including Witbank/eMalahleni, Devon, Brakpan, Lothair, and Perdekop, in addition to Bethal. The majority (55.9%) of the respondents were married, 44.1% were single. Among the participants, 23.2% lived on their own, 13.4% lived in an old age home, and 22.4% lived with family.

Interestingly, the majority of respondents (65.3%) did not have household members younger than 60 years of age.

In terms of income sources, the majority of the respondents (63.1%) relied on a pension, either their own or that of their spouse, as their main source of income. Additionally, 72.1% of the respondents stated that they did not have an additional source of income. For those with an additional source of income, 16% reported receiving financial support from their children.

On average, these households spent ZAR 3,596 monthly on food. The majority of respondents (78.2%) reported that the COVID-19 pandemic did not affect their income. Among those who stated that their income was impacted (21.8%), they indicated that it decreased.

The mean±SD amount of total household income was calculated at ZAR 16,888.54±17,511.947. A third (33%) of respondents reported that the reason for a decreased income during the COVID-19 pandemic was the government-imposed restrictions, which led to non-essential workers not being able to work and, therefore, not receiving a salary. Notably, none of the participants reported a salary increase during the time of COVID.

4.3 FOOD AVAILABILITY RESULTS

In the context of food availability, the majority of respondents (72.5%) reported that they were always able to find the foods they were looking for in stores prior to the COVID-19 pandemic, and this percentage slightly decreased to 63.1% during the pandemic (Table 4.2). However, there was a notable increase in respondents who reported never being able to find the foods they were looking for during COVID-19 (1.8% to 4.5%), as well as those who sometimes found the foods they were looking for (25.7% to 32.1%), indicating a significant ($p<0.001$) increase in food unavailability during the COVID-19 pandemic.

Some participants mentioned in the interviews that they experienced specific challenges with food availability during the pandemic. For instance, four participants reported that certain foods, such as fresh produce and certain spices, were not always available in stores. Additionally, one participant noted that the town of Emzinoni experienced a total lack of food supply after two weeks of the initial lockdown, and residents had to travel to Bethal to purchase food. This indicates that Bethal experienced shortages of certain foods, while Emzinoni faced a more severe food supply issue.

Comparing these findings with other studies, Brucker, Stott & Phillips (2021) found that consumers in the USA were able to find the foods they were looking for both prior to and during the COVID-19 pandemic. However, Shahzad, Qing, Rizwan, Razzaq & Faisel (2021) reported that 83.7% of households in Punjab, Pakistan experienced medium-to-high difficulty in accessing essential supplies due to the government's response to COVID-19. Similarly, Rivan *et al*. (2021) observed that as many as 18.9% of middle-aged and elderly respondents in Peninsular Malaysia experienced insufficient

quantity of food. In contrast, Giroux *et al*. (2022) found that 85% of the elderly in their sample in the United States experienced food stores running out of food.

These findings highlight the challenges faced by the elderly in accessing adequate and diverse food supplies during the COVID-19 pandemic, with significant variations observed in different regions.

Table 4.2: Summary of food security prior to and during COVID-19 restrictions

		Prior to the COVID-19 pandemic				During the COVID-19 pandemic				
		Never	Sometimes	Always		Never	Sometimes	Always		P-value
Availability of foods	(%)	1.8	25.7	72.5	**100**	4.5	32.1	63.1	**100**	**<.001***
	N	2	28	79	**109**	5	36	70	**111**	
Affordability of balanced meals	(%)	1.8	19.1	79.1	**100**	6.3	23.4	70.3	**100**	**<.001***
	N	2	21	87	**110**	7	26	78	**111**	
Always had enough money to purchase wanted food	(%)	2.8	24.8	72.5	**100**	2.8	24.8	72.5	**100**	**<.001***
	N	3	27	79	**109**	3	27	79	**109**	

*Significant as p-value=<0.05

4.4 FOOD ACCESS RESULTS

Table 4.2 reveals that a majority of respondents (79.1% and 70.3%, respectively) stated that they were always able to afford balanced meals before and during the COVID-19 pandemic. However, a notable increase in respondents who could never or sometimes afford balanced meals during the pandemic was observed compared to before. This difference was found to be statistically significant ($p<0.001$). Additionally, five participants specifically mentioned that foods were more expensive during the pandemic than before.

The increase in food prices during 2020, with the highest increase observed in fruit at 13.9% and the lowest in dairy products at 6.5%, along with other essential items such as water and electricity becoming more expensive from July 2020 onwards with a 6% increase (Stats SA, 2020), likely contributed to the financial strain experienced by elderly consumers. The combination of increased food prices and reduced income or no income increase during the pandemic could have impacted the food consumption patterns of the elderly.

On the other hand, reports on the monetary availability for foods that respondents wanted to purchase remained unchanged from before to during COVID-19, and as a result, no significant differences were observed in this aspect.

These findings highlight the financial challenges faced by the elderly in accessing balanced meals during the COVID-19 pandemic, especially with the increase in food prices and potential changes in income.

4.5 FOOD UTILISATION RESULTS

A small minority of the respondents (5.4%) reported being diagnosed with a nutrient deficiency. The reported deficiencies included iron deficiency (anaemia) (1.8%), magnesium (0.9%), and vitamin C (0.9%). Iron is crucial for neurotransmitter metabolism and synthesis, as well as the transportation of oxygen within the human body. However, an imbalanced iron content can contribute to the oxidation of various substances. Additionally, certain regions within the brain contain iron, and as individuals age, the concentrations of iron within the brain may change, leading to neurodegeneration and inflammation (Ward *et al.,* 2014).

Regarding magnesium, Abbasi *et al*. (2012) found that magnesium supplementation is beneficial for elderly individuals experiencing insomnia. In the current study, approximately a quarter of the respondents (25%) reported experiencing more stress, anxiety, or sleep disturbances of lesser quality during the COVID-19 pandemic. Participant G mentioned experiencing a panic attack during the lockdown, which was triggered by uncertainty and alarming predictions on social media. Insomnia, characterized by difficulties falling asleep, remaining asleep, early waking, and experiencing sleep disturbances for an extended period, can be exacerbated as individuals age due to various age-related conditions. Sleep deprivation can contribute to reduced overall health and an increase in depression and stress. Two participants in this study also struggled with depression during the lockdown.

As for vitamin C, it serves as an antioxidant and provides preventive properties against diseases such as cancer and sarcopenia. It is also beneficial for reducing oxidized Low-

Density Lipoprotein (LDL) (Camarena & Wang, 2016). The COVID-19 infection can directly and indirectly worsen a person's nutritional status, particularly among the elderly, as symptoms of the infection can impact food intake and nutrient absorption (Spolidoro *et al.,* 2021; Bedock *et al.,* 2020).

4.6 HOUSEHOLD FOOD SECURITY RESULTS

Figure 4.1 presents the food security categories of the elderly prior and during to the pandemic. The percentage of food secure elderly decreased during the COVID-19 pandemic, from 90% to 87%. In contrast, the percentage of mildly food insecure individuals increased from 9.1% prior to the pandemic to 15.3% during the COVID-19 pandemic. Similarly, the percentage of severely food insecure individuals also increased, rising from 1.8% prior to COVID-19 to 7.2% during COVID-19. These findings suggest that the COVID-19 pandemic had a significant impact on the food security of the elderly population in the Bethal District, Mpumalanga.

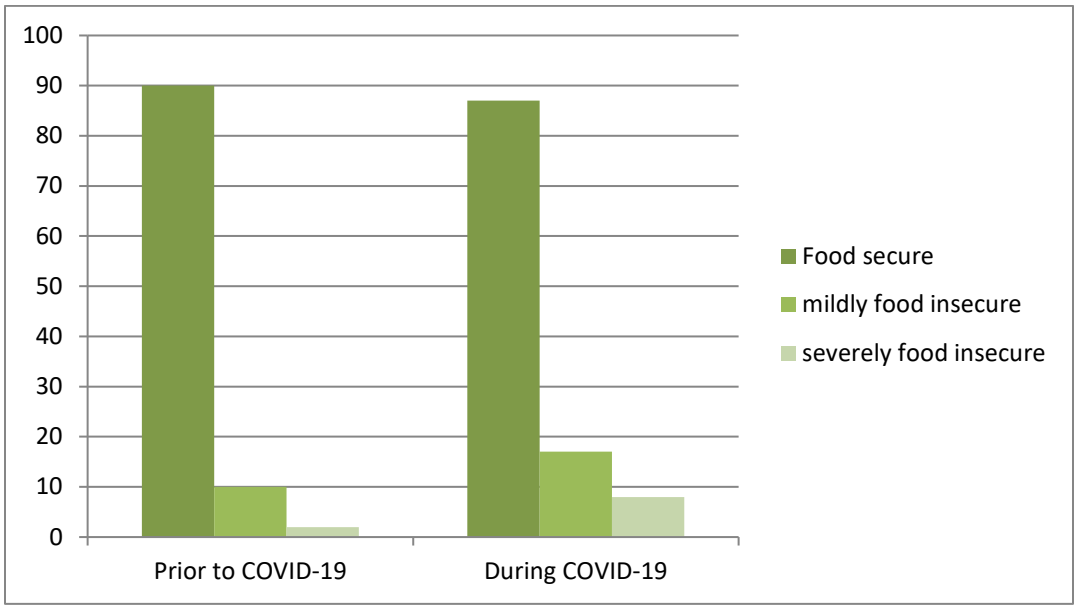

Figure 4.1: Food security prior to and during COVID-19

Prior to the COVID-19 pandemic, more than a third (34%) of respondents experienced an insufficient quality of food, due to shortages of certain foods. However, during the COVID-19 pandemic, this number increased to less than half (46%) of the respondents

facing the same problem. The results of this study show a high statistical significance ($p<0.001$), indicating that the pandemic had a notable impact on the quality of food available to the elderly population in the Bethal District, Mpumalanga. These findings align with a study conducted in Peninsular Malaysia, where 18.9% of middle-aged and elderly respondents reported experiencing an insufficient quantity of food (Rivan *et al.,* 2021).

Table 4.3: Summary of HFIAS prior to and during the COVID-19 pandemic

		Prior to the Covid-19 pandemic			During the Covid-19 pandemic			P-value
		Yes	No		Yes	No		
Worried about enough food for a household	(%) N	17.4 19	82.6 90	**100** **109**	21.6 24	78.4 87	**100** **111**	**<.001***
Not eating foods preferred due to a lack of resources (access)	(%) N	12.7 14	87.3 96	**100** **110**	12.6 14	87.4 97	**100** **111**	**.001***
Forced to eat a limited variety of food due to a lack of resources (limited diversity)	(%) N	14.7 16	85.3 93	**100** **109**	19.3 21	80.7 88	**100** **109**	**<.001***
Forced to eat foods you/they did not want to because of a lack of resources	(%) N	9.1 10	90.9 100	**100** **110**	15.3 17	84.7 94	**100** **111**	**<.001***
Forced to eat a smaller meal than you felt necessary	(%) N	5.6 6	94.4 102	**100** **108**	6.4 7	93.6 103	**100** **110**	**<.001***
Had to eat less meals per day, due to limited amounts of food in the house	(%) N	4.5 5	95.5 105	**100** **110**	5.5 6	94.5 104	**100** **110**	**<.001***
Had no food of any kind to eat due to a lack of resources to find food	(%) N	1.8 2	98.2 107	**100** **109**	7.2 8	92.8 103	**100** **111**	**.067**
Went to bed hungry due to a lack of food	(%) N	1.8 2	98.2 108	**100** **110**	1.8 2	98.2 109	**100** **111**	**.0098**
Went an entire day/night without food, due to a lack of food	(%) N	1.8 2	98.2 108	**100** **110**	0.9 1	99.1 109	**100** **110**	**.286**

*Significant as p-value=<0.05

Prior to the COVID-19 pandemic, a tenth (10%) of the respondents experienced insufficient food intake, compared to more than a tenth (19%) of respondents that faced the same problem during the COVID-19 pandemic.

During the initial COVID-19 restrictions, 21.6% of respondents felt worried about having enough food for the household, while only 17.4% felt the same prior to the pandemic.

These findings show high statistical significance ($p<0.001$) and are consistent with studies conducted in Pakistan and Iran.

Food security strategies practised by a minority of respondents prior to the COVID-19 pandemic included not eating preferred foods (12.7%) and limited food variety (14.7%). However, during COVID-19, a significantly higher proportion (19.3%) of respondents practised eating a limited variety of food ($p<0.001$). Similar results were observed in Peninsular Malaysia, where 18.9% of elderly respondents consumed an insufficient food variety during COVID-19.

The proportion of respondents reporting no food of any kind in their household due to a lack of resources increased from 1.8% prior to the COVID-19 pandemic to 7.2% during the pandemic ($p<0.001$). Similar observations were made in Iran, where 10.2% and 8.2% of respondents rarely had any food to eat prior to and during COVID-19.

Going to sleep while hungry at night due to a lack of food was reported by only 1.8% of respondents both prior to and during the pandemic. However, significantly fewer respondents (0.9%) experienced this situation during COVID-19. The number was half compared to the pre-pandemic period, possibly due to soup kitchens, financial aid, or changes in food consumption. In Iran, 4.4% and 6.5% of respondents rarely had to go a whole day and night without eating prior to and during COVID-19.

In the HFIAS, three domains were indicated based on the responses to individual occurrence questions: 1) anxiety and uncertainty about the household food supply, 2) insufficient quality, and 3) insufficient food intake and its physical consequences. Less than a quarter (15%) of the respondents experienced anxiety and uncertainty about the household food supply prior to the COVID-19 pandemic, compared to less than a quarter (21%) during COVID-19.

When comparing the food-secure elderly prior to and during the COVID-19 pandemic, many HFIAS indicators showed high statistical significance ($p<0.001$), with only two indicators not reaching statistical significance ($p>0.05$).

Table 4.5: Correlations between food security during and before COVID

Correlations			
		FS During	**FS Before**
FS During	Pearson Correlation	1	.727**
	Sig. (2-tailed)		0.000
	N	107	106
FS Before	Pearson Correlation	.727**	1
	Sig. (2-tailed)	0.000	
	N	106	106

*Significant as p-value=<0.05

There is a significant positive correlation (r=.727, p=0.000) between the food security prior to and during the COVID-19 pandemic. Thus indicating that the elderly's food security was not negatively influenced by the COVID-19 pandemic.

Table 4.6: Analysis of Food Security Before COVID and Main Income Source

Analysis of variance Food Security Before COVID					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	0.343	5	0.069	2.786	0.021
Within Groups	2.464	100	0.025		
Total	2.807	105			

*Significant as p-value=<0.05

A statistical significance (p-value=0.021) was found between the elderly's food security before COVID and the main income source, thus indicating that food security before the COVID-19 pandemic was not influenced by the main income source.

Table 4.7: Analysis of Food Security During COVID and Location

Analysis of variance Food Security During COVID					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	0.685	7	0.098	3.650	0.002*
Within Groups	2.653	99	0.027		
Total	3.337	106			

*Significant as p-value=<0.05

A statistical significance (p-value=0.002) was found between the elderly's food security during COVID and location, therefore indicating that food security during the COVID-19 pandemic was not influenced by the location where respondents reside.

Table 4.8: Analysis of Food Security Before COVID and Main Income Sources

Main income 1	Main income 2	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Grant/ Staatstoelaag	Pension/Pensioen	.16315*	0.04942	0.016*	0.0195	0.3068
	Spouse/Eggenoot	.19402*	0.06602	0.046*	0.0022	0.3859

*Significant as p-value=<0.05

A statistical significance (p-value=0.016) was found between the two different income sources of social/government grant, pension, and spouse's income, indicating that these two income sources did not influence the elderly's food security prior to the COVID-19 pandemic. This means that there was no significant difference in food security levels between those who relied on a grant as their main income source and those who relied on a pension or a spouse's income. Both groups had similar food security levels before the pandemic.

Table 4.9: Analysis of Food Security During COVID and Locations

Location 1	Location 2	Mean Difference (I-J)	Std.Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Bethal	Kriel	-.30331*	0.09670	0.045*	-0.6028	-0.0039
	Wakkerstroom	-.34035*	0.09670	0.015*	-0.6398	-0.0409
Ermelo	Wakkerstroom	-.35979*	0.11296	0.039*	-0.7096	-0.0100
Volksrust	Wakkerstroom	-.38519*	0.11955	0.035*	-0.7554	-0.0150

*Significant as p-value=<0.05

Statistical significance (p-value=<0.05) was found among the towns of Wakkerstroom and Bethal, Ermelo and Volksrust, as well as Bethal and Kriel, indicating that the elderly's food security during the COVID-19 pandemic was not influenced in these

towns respectively. This means that there was no significant difference in food security levels among the elderly in these towns during the pandemic.

Table 4.10: Analysis of Food Security Before COVID and Location

Analysis of variance Food Security Before COVID					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	1.015	7	0.145	7.926	0.000*
Within Groups	1.792	98	0.018		
Total	2.807	105			

*Significant as p-value=<0.05

A statistical significance (p-value=0.000) was found between food security prior to the COVID-19 pandemic and location, indicating that the elderly's food security prior to the pandemic was not influenced by location. This means that there was no significant difference in food security levels among the elderly in different locations before the COVID-19 pandemic.

Table 4.11: Analysis of Food Security Before COVID and Locations

Location 1	Location 2	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Amersfoort	Kriel	-.66667*	0.12345	0.000*	-1.0490	-0.2843
Bethal	Kriel	-.62500*	0.09711	0.000*	-0.9258	-0.3242
	Wakkerstroom	-.25463*	0.07989	0.039*	-0.5021	-0.0072
Ermelo	Kriel	-.61905*	0.10843	0.000*	-0.9549	-0.2832
Kriel	Amerfoort	.66667*	0.12345	0.000*	0.2843	1.0490
	Bethal	.62500*	0.09711	0.000*	0.3242	0.9258
	Ermelo	.61905*	0.10843	0.000*	0.2832	0.9549
	Middelburg	.65079*	0.10843	0.000*	0.2832	0.9866
	Volksrust	.66667*	0.11314	0.000*	0.3162	1.0171
	Other/Ander	.54815*	0.10180	0.000*	0.2328	0.8635
Middelurg	Kriel	-.65079*	0.10843	0.000*	-0.9866	-0.3149
Wakkerstroom	Bethal	.25463*	0.07989	0.039*	0.002	0.5.21

*Significant as p-value=<0.05

No correlation was found between towns and food security before the COVID-19 pandemic (p-value=0.000), indicating that the elderly's food security in different towns was not significantly related prior to the pandemic.

However, between Bethal and Wakkerstroom (and vice versa), a positive correlation was found (p-value=0.039), indicating that the elderly's food security in these towns was positively related prior to the pandemic. This means that there was a similar pattern of food security levels between Bethal and Wakkerstroom before the COVID-19 pandemic.

4.6.1 Secondary objectives

4.6.1.1 Availability of Preferred Foods

As mentioned in the food availability results, a significant difference ($p<0.001$) was identified between the availability of foods that the elderly were looking for in stores prior to and during COVID-19 (Table 4.2, p.65). This indicates that there was a significant increase in the unavailability of certain foods during the COVID-19 pandemic compared to before the pandemic. The qualitative and quantitative data gathered both supported this finding.

During COVID-19, - Bethal and other towns experienced a lack in certain foods, while Emzinoni experienced a total lack of food supply. This suggests that the COVID-19 pandemic had a substantial impact on food availability in these areas, leading to difficulties in finding the foods that elderly respondents were looking for in stores.

4.6.1.2 Food Consumption

In this section, respondents had to indicate how the COVID-19 pandemic influenced their food consumption and purchasing behaviour.

Table 4.12: Summary of Food Consumption Behaviour During COVID-19

		Decrease	Increase	No change	
Fresh produce	(%) n	15.2 17	15.2 17	69.6 78	**100** **112**
Canned/ pre-prepared meals	(%) n	9.0 10	10.8 12	80.2 89	**100** **111**
Meat	(%) n	10.7 12	4.5 5	84.8 95	**100** **112**
Plant-based	(%)	9.9	6.3	83.8	**100**

products	n	11	7	93	**111**
Less expensive foods	(%) n	6.3 7	22.3 25	71.4 80	**100** **112**
Visits to restaurants	(%) n	66.1 74	0.9 1	33 37	**100** **112**
"Take away"	(%) n	47.3 53	3.6 4	49.1 55	**100** **112**
Started planting own food	(%) n	6.9 7	17.6 18	75.5 77	**100** **102**
Started shopping online	(%) n	7.9 8	12.9 13	79.2 80	**100** **101**
Someone else purchased my food for me	(%) n	10.4 11	19.8 21	69.8 74	**100** **106**

The majority (63.3%) of respondents reported that more time elapsed between their shopping trips during the COVID-19 pandemic. Shopping during the COVID-19 restrictions included limited hours (Schrack *et al.,* 2020 and Portney *et al.,* 2020) as well as limited items that were for sale, keeping to social distancing, and other safety regulations (DMA, 2020). Participant B stated, "Since COVID-19 started, I go to stores less often."

The majority (75%) of the respondents reported not taking part in more snacking since COVID-19. However, four participants reported experiencing an increase in hunger, mostly due to changed work environments and habits. In contrast, emotional eating has been found to result due to increases in stress and the hormone cortisol created thereby (Avena *et al.,* 2021; American Psychological Association, 2013), as well as a form of distraction from pandemic-related situations (Avena *et al.,* 2021; Harvard Health, 2021; Centers for Disease Control and Prevention, 2020). According to Cancello *et al*. (2020), 41.5% of individuals in Northern Italy consumed more snacks during the COVID-19 pandemic than prior to the pandemic. One participant stated, "Due to changed circumstances and routine during the lockdown, I was close to food the whole time, I started snacking more often," whilst another participant stated, "I experienced an increase in hunger due to limitations in movements such as visiting friends." However, 20.5% of respondents reported weight gain between 1 and 10 kg, and furthermore, the

majority of the respondents did not meet the recommended physical activity guidelines of exercising at least 30 minutes per day, as 15.7% reported never doing any exercise, and a further 50% exercised less than 5 days per week.

The majority (69.6%) of the respondents reported that their consumption of fresh produce did not change due to the COVID-19 pandemic. A similar trend was identified for canned or pre-prepared meals (80.2%), meat consumption (84.8%), plant-based products (83.8%), and purchases of less expensive foods (71.4%). The potential unavailability of fresh foods during the COVID-19 pandemic could lead to increased purchases of unhealthy foods, such as non-perishable and processed foods, , which could contain reduced levels of potassium and increased levels of sodium, thus affecting blood pressure (Schrack *et al.,* 2020 and Portney *et al.,* 2020). However, this did not seem to happen in the majority of respondents as 69.6% did not change their consumption of fresh produce and meat, and 15.2% even consumed more fresh produce.

Only 17.6% of the respondents started planting their food. The “grow-your-own-food" movement was implemented due to the wide variety of benefits provided, including health, psychological, productivity, economic, and sustainability for both urban and suburban areas (Filimonau, 2022; Sofo & Sofo, 2020). Similar results were observed by Cancello, Soranna, Zambra, Zambon & Invitti (2020), residents in Northern Italy consumed more healthy foods during the COVID-19 pandemic compared to before COVID-19, which included consuming more plant-based items instead of meat. The prices of food and tea increased during 2020, with the highest increase on fruit at 13.9% and the lowest increase being 6.5% in dairy products. Other necessities such as water and electricity were also more expensive from July 2020 onward, with a 6% increase (Stats SA, 2020). Participant G stated, “Foods were more affordable than now (2022), but the food prices did certainly go up during the initial lockdown.”

The majority (66.1%) of respondents reported that their visits to restaurants decreased due to the COVID-19 pandemic. The purchases of ready-made foods were prohibited from grocery stores as well as other non-essential goods during the initial level 5 lockdown (DMA, 2020).

A large percentage (49.1%) of respondents reported that their "takeaway" consumption remained unchanged during COVID-19; however, 47.3% showed decreased consumption of takeaway food, which is a good health-related indication. In contrast, evidence from Brazil showed similar results, as the meal purchases of Brazilians have increased since the COVID-19 pandemic, including both takeaways and restaurant dining (Hakim *et al.,* 2021).

Very few (12.9%) of the respondents started shopping online. Younger consumers living in larger cities were found to be more likely to purchase items online, rather than in-store during the COVID-19 pandemic (Gao *et al.,* 2020).

Almost one in five (19.8%) of the respondents had someone else purchase their food during the COVID-19 pandemic. Due to, the WHO-China Joint Mission reported that the death rate escalated with age, from 3.6% for 60-69-year-olds to 14.8% for those ages 80 years and older. The elderly and those with co-morbidities were possibly even more scared to go outside due to possibly being unable to keep a social distance of six feet (1.8 meter) from others or getting the COVID-19 virus via surface contact (Schrack *et al.,* 2020 & WHO-China Report, 2020). However, 10.4% of the respondents indicated that other people assisting them with food shopping did not do so anymore. This could have led to more elderly being hungry if they could not access their food through restrictions on shopping hours and mobility.

4.6.1.3 Affordability of Balanced Meals

As shown in Table 4.2, the majority (79.1% and 70.3% respectively) of respondents stated that they were always able to afford balanced meals before and during the COVID-19 pandemic; however, more respondents reported that they could never or sometimes not afford balanced meals during the COVID-19 pandemic compared to before. Additionally, five participants mentioned that "Foods were more expensive than previous." The prices of food and tea increased during 2020, with the highest increase in fruit at 13.9% and the lowest increase in dairy products at 6.5%. Other necessities, such as water and electricity, also became more expensive from July 2020 onward, with a 6% increase (Stats SA, 2020). Consequently, the combination of increased food

prices and reduced income or no salary increase resulted in financial strain on the elderly consumers, impacting their food consumption.

4.6.1.4 Hunger due to Financial Limitation

Only 1.8% and 7.2% respectively reported that there was no food of any kind in their household due to a lack of resources prior to and during the COVID-19 pandemic, indicating a significantly higher percentage of respondents reporting experiencing these conditions during the COVID-19 pandemic. However, results indicate that financial limitations to the availability of food are statistically highly significant ($p<0.001$), referring to Table 4.2. Thus, the probability of the elderly experiencing hunger due to financial reasons was very slim.

Results on individuals that had to go to sleep whilst hungry at night due to a lack of food prior to and during the pandemic indicated no significant difference.

Only 1.8% of respondents reported that they went an entire day or night without a meal due to a lack of food prior to the COVID-19 pandemic. Interestingly, fewer (0.9%) respondents experienced the same circumstances during the COVID-19 pandemic. However, this was significant as the amount was half compared to prior COVID-19; however, statistical results showed no significance. This could be due to soup kitchens, financial aid (by the government or other individuals), or changes in foods consumed. However, the number of individuals that had to go to sleep whilst hungry did not change, and even fewer went an entire day or night without a meal. These results could be influenced by factors such as food price increases, job loss, and limited availability of food or access to food stores due to mobility or fear. In contrast, a study conducted in Iran by Pakravan-Charvadeh, Mohammadi-Nasrabadi, Gholamrezai, Vatanparast, Flora & Nabavi-Pelesaraei (2021) found that 4.4% and 6.5%, respectively of respondents rarely had to go a whole day and night without eating prior to and during COVID-19.

4.6.1.5 Health Difficulties

This section's questions were designed to gather information on how the COVID-19 pandemic influenced the elderly's health. This included recently diagnosed chronic illnesses, nutrient deficiencies, weight gain or loss, experiences of stress/loss of sleep, emotional eating, dietary changes, physical exercise participation, and alterations. Respondents were requested to report their own experiences relating to these topics during the COVID-19 pandemic (Table 4.13).

The majority of the respondents (69.9%) reported being diagnosed with a chronic illness since the COVID-19 pandemic started. Participant P stated, "I experienced a mini-stroke during the initial restriction". Participant Y reported, "I had higher high blood pressure, anxiety, and stress due to the influence of social media". According to Bambra *et al*. (2020) and Moreno *et al*. (2020), the actions taken for COVID-19 lockdowns had various unequal health implications, such as experiences of income/job loss, the effects of lockdown on health care (limited access to non-COVID related health care due to an overwhelmed health care system), and inequalities in effects of lockdown on health such as mental health. According to Zhao and Zhou (2020) and Moreno *et al*. (2020), social media had a negative impact on mental health during the COVID-19 pandemic. Thus, the COVID-19 pandemic had a significant impact on the elderly's health. In contrast, Choi and Men found that the food insecure are more likely to have poor health and are more likely to be infected by COVID-19 (Choi & Men, 2021).

Table 4.13: Summary of COVID-19's Impact on Health

	Frequency (%)	n
Chronic illnesses diagnosis since COVID-19		
Arthritis	6.3	7
Depression	5.4	6
Heart disease	8	9
High blood pressure	17.9	20
High cholesterol	9.8	11
HIV	1.8	2
Osteoporosis	3.6	4
Other cancers	1.8	2
Type 2 diabetes	4.5	5
Stroke	0.9	1
No response	40	45
	100	**112**
Weight gain during COVID-19		

No	83.8	93
Yes	16.2	18
	100	**111**
Reported weight gained during COVID-19		
1-2 kg	26.1	6
2.1-3 kg	30.4	7
3.1-10 kg	39	9
More than 10 kg	4.3	1
	100	**23**
Reported weight lost during COVID-19		
1-2 kg	5.4	6
2.1-3 kg	6.3	7
3.1-4 kg	1.8	2
4.1-5 kg	2.7	3
5.1-8 kg	0	0
8.1-10 kg	0.9	1
More than 10 kg	2.7	3
Unchanged	52.7	59
No response	27.5	31
	100	**112**
Participation in physical exercise		
Yes	45.9	50
No	54.1	59
	100	**109**
Frequency of physical activity		
Never	15.7	11
Occasionally	11.4	8
Once in 2 weeks	2.9	2
Once a month	1.4	1
1-2 times per week	14.3	10
3 times per week	11.4	8
4 times per week	8.6	6
5 times per week	11.4	8
6 times per week	5.7	4
7 times per week	17.1	12
	100	**70**
Changes in exercise program due to COVID-19		
Decrease	17.4	16
Increase	3.3	3
No change	79.3	73
	100	**92**
Screen and sitting time during COVID-19		
Decrease	1.9	2
Increased	26.9	29
No change	71.3	77
	100	**108**
Increase of stress/anxiety/sleep of lesser quality during COVID-19		
No	60.4	67
Sometimes	17.1	19
Yes	22.5	25
	100	**111**
Emotional eating during the COVID-19 pandemic		

Always	1.8	2
Often	9.1	10
Sometimes	21.8	24
Rarely	15.5	17
Never	51.8	57
	100	**110**

Feeling scared to leave home during the COVID-19 pandemic		
Always	12.7	14
Often	11.8	13
Sometimes	22.7	25
Rarely	11.8	13
Never	40.9	45
	100	**110**
Respondents that tested positive for COVID-19		
No	61.6	69
Yes	38.4	43
	100	**112**
Recovery of smell/taste after testing positive for COVID-19		
No	11.6	5
Yes	88.4	38
	100	**43**
Experience of dietary changes since testing positive for COVID-19		
No	76.7	33
Yes	23.3	10
	100	**43**

Only 20.5% of the respondents reported that they gained weight during the COVID-19 pandemic, with 26.1% and 30.4% gaining 1-2 kg and 2.1-3 kg, respectively. The majority of the respondents did not meet the recommended physical activity guidelines of exercising at least 30 minutes per day, as 15.7% reported never doing any exercise, and a further 50% exercised less than 5 days per week. However, it seems that this was their usual exercise routine, as 79.3% reported no change in their physical activity pattern.

On the other hand, only 19.6% of the respondents reported weight loss during the COVID-19 pandemic, while 20.5% stated that they gained between 1 and 10 kg of weight. Moreover, 52.7% stated that their weight remained unchanged. In contrast, research done in Kuwait found that COVID-19 contributed to significant weight gain in Kuwaitis. This was due to decreased physical activity, increased food consumption day

and night, and increased anxiety (AlMughamis *et al.,* 2021). Prolonged quarantine and increased stress levels were found to cause "food cravings" or yearning for "comfort foods," which could be behavioural, cognitive, emotional, or physiological. Moreover, carbohydrate-rich foods were found to improve mood during stressful times (Muscogiuri *et al.,* 2020; Yilmaz & Gökmen, 2020; Wu *et al.,* 2020; Rodríguez-Martín & Meule, 2015). Participant B stated, "Due to changed circumstances and routine during the lockdown, I was close to food the whole time, I started snacking more often."

The majority (54.1%) of the respondents reported that they participate in physical exercise, of which 17.1% stated that they partake in physical activity seven times per week. The majority (79.3%) reported that the COVID-19 pandemic did not cause their exercise program to change. Even low to moderate levels of physical activity (PA) were found to be beneficial to elderly individuals, as PA decreases the risk of contracting cardiovascular diseases (CVD) (Lachman *et al.,* 2018), premature mortality, ischemic stroke, ischemic heart disease, and all-cause heart failure (Kraus *et al.,* 2020). PA is beneficial for health (Scartoni *et al.,* 2020; Schroeder *et al.,* 2019), as prevention for infectious diseases (Scartoni *et al.,* 2020; Walsh *et al.,* 2011), and inflammation (Callao *et al.,* 2020; Scartoni *et al.,* 2020). Furthermore, PA was found to be beneficial for mental health as well, relieving or preventing depression (Scartoni *et al.,* 2020; Schuch *et al.,* 2016), anxiety (Scartoni *et al.,* 2020; Stubbs *et al.,* 2017), and aiding in the recovery of elderly cognitive functioning (Scartoni *et al.,* 2020; Bangsbo *et al.,* 2019; Condello *et al.,* 2017; Diamond, 2013). Moderate PA is also found to contribute to anti-influenza benefits (Nogueira *et al.,* 2020; Scartoni *et al.,* 2020).

The majority (71.3%) of the respondents reported that the COVID-19 pandemic did not cause their screen and sitting time to change. However, only 7 participants reported sitting more than usual. Participant S stated, “I might have watched more TV during the initial weeks of lockdown”, whereas participant V stated, “I used my phone and computer more in order to send the school children work to do at home”. According to King *et al*. (2020), Javed (2020), and Perez (2020), digital entertainment consumption has increased due to the COVID-19 restrictions and quarantines.

The majority (60.4%) of respondents reported that they did not experience more stress/anxiety or have lower-quality sleep during the COVID-19 pandemic. One participant experienced a panic attack due to social media messages and living alone. Another stated, “I was diagnosed with depression during the restriction”. According to Bambra *et al*. (2020) and Moreno *et al*. (2020), the actions taken for COVID-19 lockdowns had various unequal health implications, such as experiences of income/job loss, the effects of lockdown on health care (limited access to non-COVID related health care due to an overwhelmed health care system, etc.), and inequalities in effects of lockdown on health, such as mental health. According to Zhao and Zhou (2020) and Moreno *et al*. (2020), social media had a negative impact on mental health during the COVID-19 pandemic. Increased levels of stress induced by the COVID-19 pandemic's uncertainty about the future, perceived health risks, and financial concerns are likely to trigger sleep problems, depression, fatigue, and low-grade inflammation (Larkin & Chantler, 2020; Schrack *et al.,* 2020; Grandner *et al.,* 2013).

The majority (51.8%) of the respondents stated that they never took part in emotional eating during the pandemic. Emotional eating has been found to result from increases in stress and the hormone cortisol created thereby (Avena *et al.,* 2021; American Psychological Association, 2021), as well as a form of distraction from pandemic-related situations (Avena *et al.,* 2021; Harvard Health, 2021; Centers of Disease, Control, Prevention, 2020). Participant B stated, “Due to changed circumstances and routine during the lockdown, I was close to food the whole time, I started snacking more often,” and participant A stated, “I experienced an increase in hunger due to limitations in movements such as visiting friends”. In contrast, Jackson, Weaver, Iniguez & Lanigan (2022) observed that the frequency of unhealthy snacking had a negative correlation with living alone and dietary quality in middle-aged adults and decreased with age in the food secure.

A large percentage (40.9%) of respondents stated that they were not scared to leave their homes during the pandemic. In contrast, the WHO-China Joint Mission reported that the death rate escalated with age, from 3.6% for 60-69-year-olds to 14.8% for those ages 80 years and older. The elderly and those with co-morbidities were possibly even

more scared to go outside due to possibly being unable to keep a social distance of six feet (1.8 meter) from others or getting the COVID-19 virus via surface contact (Schrack *et al.,* 2020 & WHO-China Report, 2020).

Only 23.3% of respondents reported testing positive for COVID-19, with the majority (88.4%) of these respondents reported that they have recovered their sense of smell or taste. Of those that reported testing positive for COVID-19, the majority (76.7%) stated that their diet did not change due to the virus; the remaining respondents stated that they ate less or nothing during the illness due to an altered sense of taste, and others reported consuming healthier food afterwards. The symptoms and severity of the COVID-19 virus were found to vary in patients, ranging from multi-organ dysfunction, acute respiratory distress syndrome to asymptomatic symptoms (Mohseni *et al.,* 2021& Zu *et al.,* 2020).

Table 4.14: Correlations between Insufficient Food Intake and Its Physical Consequences

Correlations			
		Insuff Food Intake During	**Insuff Food Intake Before**
Insuff Food Intake During	Pearson Correlation	1	.801**
	Sig. (2-tailed)		0.000
	N	107	106
Insuff Food Intake Before	Pearson Correlation	.801**	1
	Sig. (2-tailed)	0.000	
	N	106	106

*Significant as p-value=<0.05

There is a significant positive correlation (r=.801, p-value=0.000) between insufficient food intake during and before the COVID-19 pandemic, thus indicating that insufficient food intake was not influenced by the COVID-19 pandemic.

4.6.1.6 Dietary diversity

Table 4.15 summarises the number of food categories consumed prior to and during the COVID-19 pandemic.

Table 4.15: Summary of Number of Food Categories Selected Prior to and During COVID-19

Food categories selected	Prior to COVID-19		During COVID-19	
	Frequency (%)	N	Frequency (%)	N
6	0.9	1	0.9	1
7	0.9	1	0	0
8	0.9	1	2.8	3
9	4.6	5	11.1	12
10	12	13	14.8	16
11	31.5	34	25.9	28
12	46.3	50	43.5	47
0	2.8	3	0.9	1
	100	**108**	**100**	**108**

The results indicate the following changes in dietary diversity during the COVID-19 pandemic:

- A slight increase (1.9%) in the consumption of legumes compared to before COVID-19.
- An increase (6.5%) in the consumption of tree nuts reported by respondents during the COVID-19 pandemic.
- Milk and milk product consumption increased slightly (2.8%) during COVID-19.
- The consumption of sweets decreased during COVID-19 by as much as 5.6%.
- The consumption of spices, condiments, and beverages decreased (2.8%) compared to before COVID-19.

These changes in dietary diversity could be attributed to various factors, including limited availability of certain foods, changes in shopping habits, and government restrictions on certain items during the COVID-19 lockdown. Overall, the dietary diversity increased in the high dietary diversity classification group (food group 6-9) during COVID-19 (7.3% to 14.8% respectively), while food groups 10-12 decreased during COVID-19 (89.8% to 84.2% respectively).

These findings suggest that dietary diversity was adequate among the elderly respondents, and their food consumption seemed to be healthier than prior to the COVID-19 pandemic.

Table 4.16: Mean and Std. deviation in Household Dietary Diversity Score

	N	Mean	Std. Deviation	P-value
HDDS During	108	10.7593	1.63987	<.001
HDDS Before	108	10.7407	2.19332	

*Significant as p-value=<0.05

The mean HDDS of both prior to and during the COVID-19 pandemic is above the score of 4.5, which is an indicator of high dietary diversity and food security. HDDS was also found to be highly statistically significant (p<0.001), indicating that the probability of low dietary diversity is very small.

Table 4.17: Correlations between Insufficient Quality of Food During and Before COVID

Correlations			
		Insiff Quality During	**Insuff Quality Before**
Insuff Quality During	Pearson Correlation	1	.598**
	Sig. (2-tailed)		0.000
	N	107	106
Insuff Quality Before	Pearson Correlation	.598**	1
	Sig. (2-tailed)	0.00	
	N	106	106

*Significant as p-value=<0.05

There is a significant positive correlation (r=.598, p-value=0.000) between insufficient food quality during and prior to the COVID-19 pandemic, indicating that COVID-19 did not influence insufficient food quality intake.

Table 4.18: Correlations between HDDS During and Prior to COVID-19

Correlations			
		HDDS During	**HDDS Prior**
HDDS During	Pearson Correlation	1	.562**
	Sig. (2-tailed)		0.000
	N	108	108
HDDS Prior	Pearson Correlation	.562**	1
	Sig. (2-tailed)	0.000	

	N	108	108

*Significant as p-value=<0.05

There is a significant positive correlation (r=.562, p=0.000) between food security prior to and dietary diversity during the COVID-19 pandemic. According to the guidelines provided by Pallant (2016), this relationship can be interpreted as a large relationship. Thus, in this case Covid-19 did not influence household dietary diversity of the elderly when a correlation was made between HDDS and COVID.

4.6.1.7 Smoking and alcohol consumption

The majority of respondents (68.5%) knew that consuming alcohol and cigarette smoking would affect their health, respectively. This is a positive outcome. However, none of the qualitative participants reported consuming more alcoholic substances or cigarettes during the COVID-19 restrictions. Participant B stated, "We drank our wine until it was done, but we didn't consume more than usual."

According to Avena *et al*. (2021) and Compton (2014), pandemic-related mental health consequences, such as anxiety, isolation, and stress, contribute to addiction, substance misuse, and relapse. However, addiction also places these individuals at an increased risk of contracting COVID-19 (Dubey *et al.,* 2020; Columb *et al.,* 2020; Ornell *et al.,* 2020).

4.7 ADDITIONAL INFLUENCES OF THE COVID-19 PANDEMIC (QUALITATIVE DATA)

Nine participants felt that the restrictions did not influence their lives much; however, 16 participants felt that the restrictions greatly influenced their lives. Effects varied from decreased social interactions, church gatherings, shopping, and work, to struggles in businesses within the initial lockdown. Some participants experienced the deaths of family members or friends, feelings of isolation, and the need to adjust and search for more information on the COVID-19 pandemic. Overall, participants had varied experiences during the COVID-19 restrictions.

Participant B stated, "Social media in combination with restrictions and deaths increased stress." Participant C mentioned, "The uncertainty of the future caused stress." Four participants experienced anxiety due to uncertainty about the COVID-19 virus. Participant L experienced stress due to financial concerns, while Participant W experienced stress due to having diabetes. Participant X felt scared of causing other family members to contract COVID-19, leading to stress. Increased levels of stress induced by the COVID-19 pandemic's uncertainty about the future, perceived health risk, and financial concerns are likely to trigger sleep problems, depression, fatigue, and low-grade inflammation (Larkin & Chantler, 2020; Schrack *et al.,* 2020; Grandner *et al.,* 2013).

Participant C stated, "I was able to get more things done at home due to the pandemic." Participant D struggled to manage depression during the restrictions. Participant E remarked, "The country only now realizes the economic effect of the COVID-19 pandemic." Participant F mentioned the problematic electricity situation in Bethal during the pandemic, which worsened the effects on small businesses in the town. Participant G added, "We got wiser in handling COVID-19, contributing towards less anxiety and more peace." Participant J appreciated the convenience of virtual meetings and not having to visit stores, but expressed worry about people living in old age homes. Participant P felt isolated during the restriction, as close family members died due to COVID-19, and community members could not provide support or emotional comfort during tough times. Participant Y expressed concern about the impact of the initial lockdown on children's education and the potential long-term effects in subjects like math.

According to Bambra *et al*. (2020) and Moreno *et al*. (2020), the actions taken for COVID-19 lockdowns had various unequal health implications, such as experiences of income/job loss and limited access to non-COVID related health care due to an overwhelmed system, affecting mental health unequally. Zhao and Zhou (2020) and Moreno *et al*. (2020) also noted the negative impact of social media on mental health during the COVID-19 pandemic. Morgado *et al*. (2021) suggested that individuals have

different coping mechanisms during a crisis, and individual factors affect how the crisis is experienced and acted upon.

Women in Portugal found confinement to reduce their quality of life more than men, and single and younger individuals found the COVID-19 pandemic to be traumatic (Morgado *et al*. 2021). Brooks *et al*. (2020) emphasized the importance of transparency and clear communication from the government during quarantine to avoid negative experiences and long-term consequences for the healthcare system and those quarantined.

4.8 CONCLUSION

This research study utilized a mixed methods approach, combining both qualitative and quantitative methods to gather primary data. Various research instruments, such as questionnaires and semi-structured interviews, were employed to collect data from the participants. Additionally, regression analysis was used to analyze and interpret the quantitative data.

In Chapter 5, the findings from the research study are discussed, and their implications are interpreted. The chapter serves as the conclusion of the study, summarizing the key results and insights gained from the data analysis.

Furthermore, Chapter 5 also provides recommendations for future researchers in the field. These recommendations may suggest potential areas for further investigation and exploration, based on the gaps and limitations identified in the current study. By offering suggestions for future research, the study contributes to the ongoing development of knowledge in the subject area.

Overall, this research study makes use of a comprehensive approach to explore the topic, and the insights gained from the data collected can potentially have implications for policy-making, healthcare interventions, or other relevant fields. The mixed methods approach allows for a deeper understanding of the subject matter, complementing and enriching the overall research findings.

CHAPTER 5:
CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

Chapter 5 concludes the dissertation by discussing the main findings in relation to the objectives and providing recommendations for future research.

Limited research has been done in South Africa on the impact of the COVID-19 pandemic on the elderly's food security. Diet-related interventions are necessary for health and food security in order to improve the situation in South Africa (Hunter-Adams *et al.,* 2019). Food insecurity in the vulnerable elderly was brought on by both non-financial and financial limitations during the COVID-19 pandemic while also increasing their risk of contracting COVID-19 (Choi & Men, 2021). Traditional food system knowledge and agrobiodiversity are being lost due to lifestyle changes, imported foods, urbanization, and deforestation, hindering progress towards Sustainable Development Goal (SDG) 2: Zero Hunger (Vogliano *et al.,* 2021).

This chapter takes the structure of discussing each objective individually and if it has been met, as well as sharing recommendations concluded by the researcher and explaining the limitations that the researcher acknowledges.

5.2 SUMMARY OF KEY FINDINGS

This study aimed to determine the extent to which the COVID-19 pandemic and various aspects of the pandemic influenced the food security of the elderly within the Bethal District, Mpumalanga. Additionally, the research aimed to investigate the impact of the COVID-19 pandemic on the lives of the elderly, including changes in their food consumption and the contribution of other relevant lifestyle factors. Each objective will be discussed in the following sections.

5.2.1 Primary Objectives

5.2.1.1 Determining the COVID-19 pandemic's influence on food availability for the elderly

Based on the findings of the study, it was determined that the COVID-19 pandemic had no significant effect on the availability of food for the elderly ($p<0.001$). Therefore, the probability of food unavailability was found to be very low.

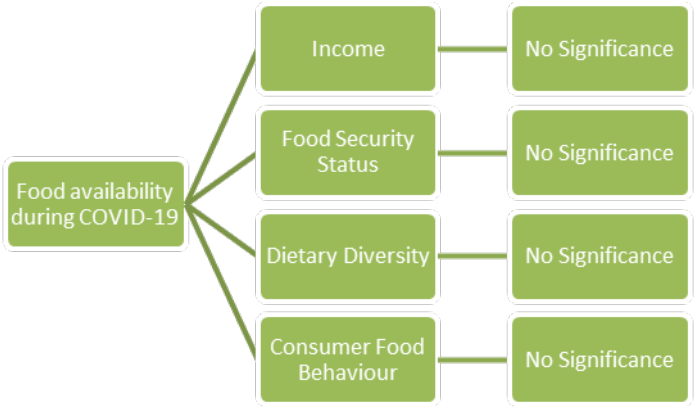

Figure 5.1: Summary of food availability during COVID-19 findings

5.2.1.2 The effect of the COVID-19 pandemic on the elderly's access to food-

This study's findings indicate that the elderly did not experience difficulty in food access due to the COVID-19 pandemic, as the probability was found to be very low ($p<0.001$).

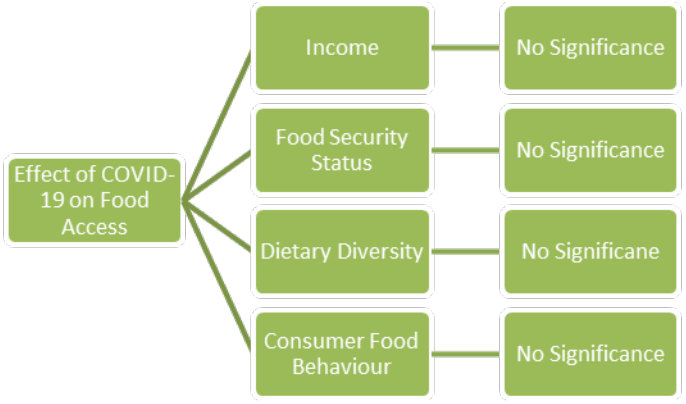

Figure 5.2: Summary of the effect of COVID-19 on food access findings

5.2.1.3 Food utilisation of the elderly during the COVID-19 lockdown

Based on the results from this study, it was observed that many of the elderly experienced health difficulties during the COVID-19 pandemic due to various reasons. Specifically, a majority of the respondents reported an increase in chronic illnesses (69.9%), while others had their mental health affected by social media. On the other hand, only a few experienced nutrient deficiencies.

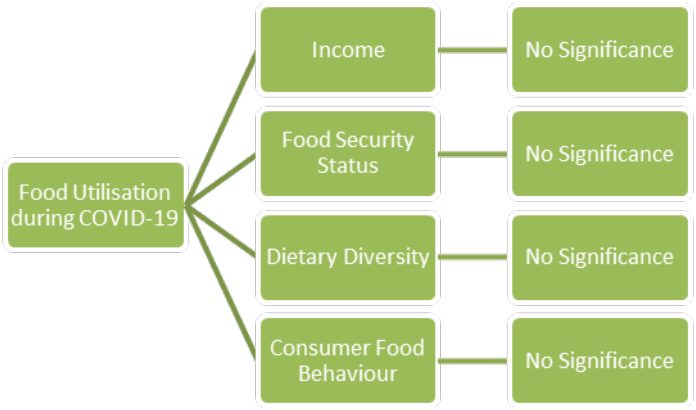

Figure 5.3: Summary of food utilisation during COVID-19 findings.

5.2.1.4 Ascertaining the elderly's household food insecurity before and during the COVID-19 lockdown

This study's findings indicated that there was no significance was found amongst the correlations made in food insecurity prior to and during the COVID-19 pandemic. With the low statistical probability ($p<0.001$) indicating that very few respondents experienced food insecurity prior to and/ during the pandemic.

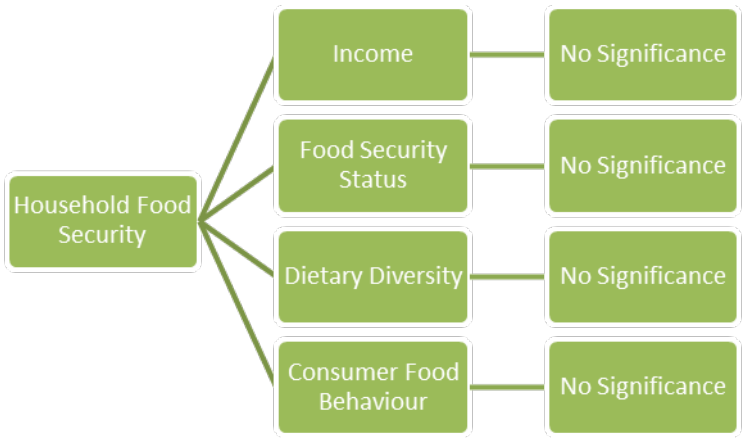

Figure 5.4: Summary of household food security findings

5.2.2 Secondary Objectives

5.2.2.1 Availability of preferred foods for the elderly prior to the COVID-19 lockdown compared to during the COVID-19 lockdown

Results showed that the COVID-19 lockdown had no significant impact on the availability of preferred foods for the elderly, where the statistical probability was found to be very low as stated previously.

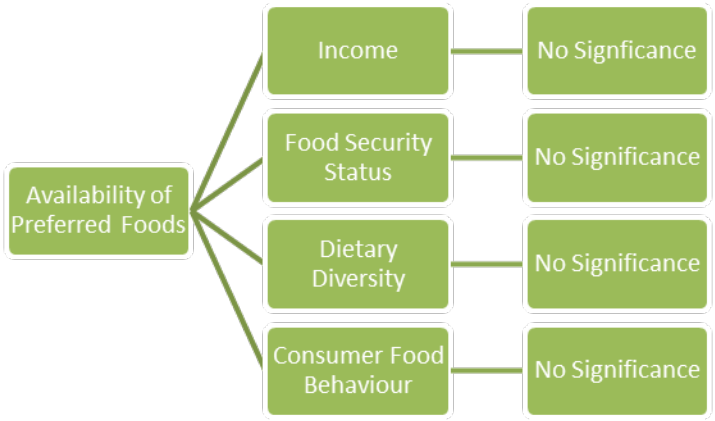

Figure 5.5: Summary of availability of preferred food findings

5.2.2.2 The elderly's food purchasing behaviour of fresh produce, canned foods, meat, pre-prepared foods and other dietary changes during the COVID-19 lockdown

Based on this study's results many household food purchases remained unchanged, and the same for canned and pre-prepared meals, meat, plant-based and less expensive foods.

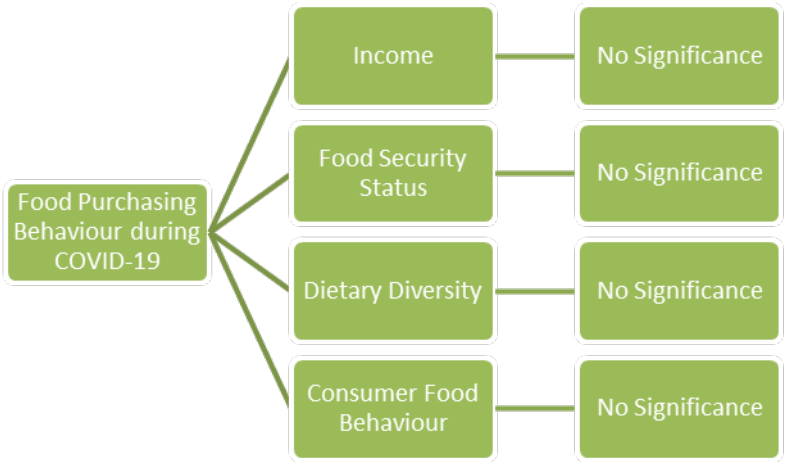

Figure 5.6: Summary of food purchasing behaviour during COVID-19 findings

5.2.2.3 The affordability of a balanced meal or diet for the elderly during the COVID-19 pandemic compared to their previous diets

This study's findings indicated that the respondents in this sample found a balanced meal or diet affordable, with a low probability ($p<0.001$) of finding it otherwise.

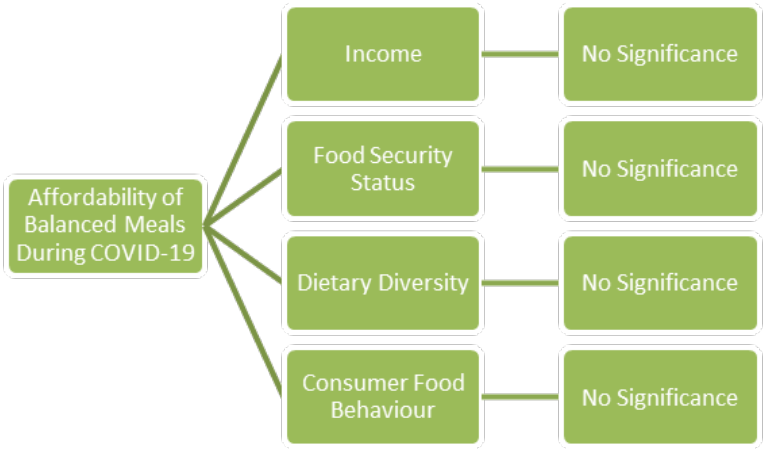

Figure 5.7: Summary of affordability of balanced meals during COVID-19 findings

5.2.2.4 The elderly's experience of hunger during the COVID-19 lockdown due to financial limitations and/or mental difficulties

Based on this study's results a very small probability ($p<0.001$) existed for the elderly to experience hunger due to financial limitations, hunger due to mental difficulties was not found to be significant.

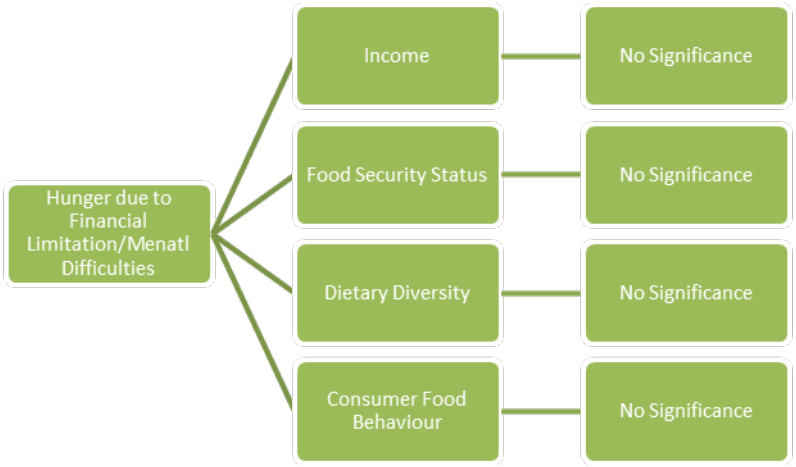

Figure 5.8: Summary of hunger due to financial limitations/mental difficulties findings

5.2.2.5 The elderly's experience of health difficulties during COVID-19

This study's results indicated that the majority of the elderly respondents (69.9%) reported being diagnosed with a chronic illness since the COVID-19 pandemic started, some also experienced difficulty with mental health brought on by social media during the lockdown period.

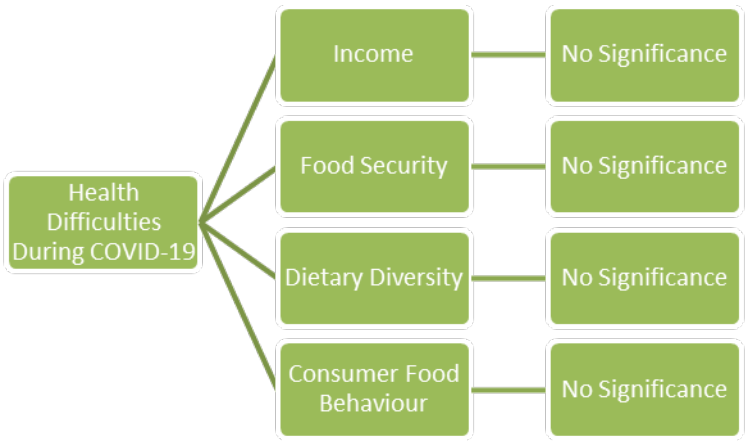

Figure 5.9: Summary of health difficulties during COVID-19 findings

5.2.2.6 The dietary diversity of the elderly prior to and during the COVID-19 lockdown in Mpumalanga

From the results gained by the study, the elderly had a high dietary diversity which was not influenced by the COVID-19 lockdown. This was found in the correlation of dietary diversity prior to and during the COVID-19 pandemic.

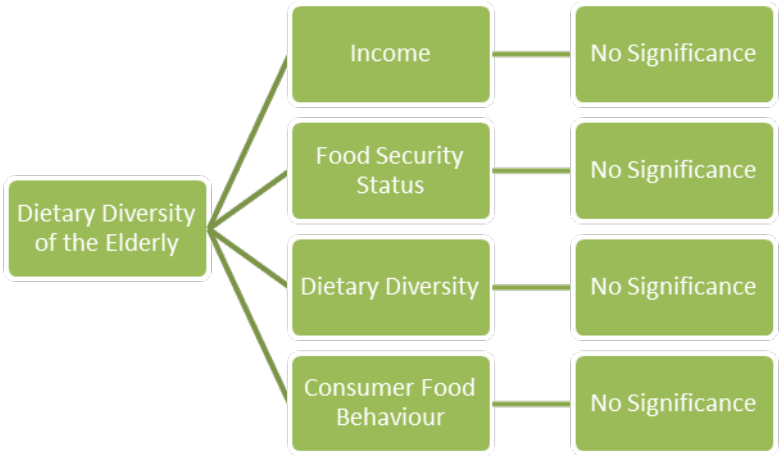

Figure 5.10: Summary of dietary diversity of the elderly findings

5.2.2.7 The affect of the COVID-19 pandemic on smoking/alcohol consumption of the elderly, by comparison of prior to and during the COVID-19 lockdown

Based on this study results, there were no changes among the elderly's consumption of alcohol and cigarettes.

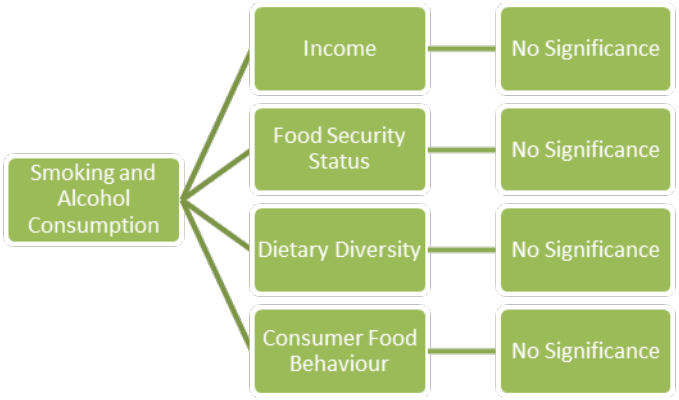

Figure 5.11: Summary of the affect on smoking and alcohol consumption

5.3 STRENGTHS AND LIMITATIONS OF THE STUDY

In this study, there are several strengths and limitations that should be acknowledged. One of the strengths is that even though random sampling was not used, the sample size was based on a calculated sample, and it predominantly represents the Caucasian elderly population within the area. This representation is valuable since previous research has mostly focused on non-Caucasian individuals, making this study contribute to the knowledge gap for this specific demographic group.

The use of both paper-based and online surveys allowed for a wide range of elderly participants in the area to be included, even those residing in old age homes. Additionally, providing the questionnaires and semi-structured interviews in both English and Afrikaans enabled the inclusion of diverse participants and respondents.

However, there are some limitations that need to be recognized. Some limitations were beyond the researcher's control, while others could have been minimized. Balancing

scientific rigor with realism can sometimes create challenges and limitations in research, as discussed by Connelly (2013).

Overall, despite these limitations, the study still provides valuable insights into the impact of the COVID-19 pandemic on the elderly's food security and health in the Bethal District, Mpumalanga.

In order to overcome bias, valid HFIAS and dietary diversity questionnaires were used. The questionnaire was translated from English to Afrikaans and from Afrikaans back to English to avoid language difficulties and ensure clarity. However, it is important to acknowledge the possibility of social desirability bias, which could influence the results of this study. Participants may be inclined to provide positive responses to food insecurity questions to avoid appearing poor or in need.

Another limitation to consider is the diversity of South African culture, which may affect the generalizability of the findings. The use of semi-structured interviews and surveys limited the representation to individuals residing in the Bethal district of Mpumalanga. The willingness and responsiveness of participants to participate in the study may vary, leading to potential variations in the representation of the population. Although the questionnaire used was validated through statistical calculations, it is essential to acknowledge that self-reporting systems can introduce bias. Participants might provide answers they perceive as socially acceptable or safe, which could potentially influence the study's results.

5.4 RECOMMENDATIONS

This study was done in Mpumalanga's Bethal district; however, the same or similar research in other provinces could be beneficial for future insight into food security and the scale of the situation in South Africa. Future research focusing on representing the local community better will also be more insightful, together with the use of translators or native-speaking assistants from the area being researched. Increased knowledge on how and why households or individuals experienced their food security during

compared to after the COVID-19 pandemic would also be beneficial to the literature, as food prices increased due to the Russian-Ukrainian conflict.

5.5 CONCLUSION

The results of this study suggest that the elderly participants in the Bethal district of Mpumalanga were food secure both before and during the COVID-19 pandemic. This was attributed to the fact that the majority of respondents reported no changes in income during the pandemic, which likely contributed to their ability to maintain dietary diversity.

Furthermore, the study found that the COVID-19 pandemic did not significantly impact food availability, access, or utilization for the elderly respondents. They were able to find their preferred foods, and their food purchasing behaviour remained unaffected by the pandemic. Additionally, balanced meals were affordable for most of the elderly individuals included in the sample.

Moreover, it was observed that smoking and alcohol consumption did not change significantly during the pandemic for the respondents. However, a notable finding was that a significant number of respondents reported being diagnosed with a chronic illness during the COVID-19 pandemic.

Finally, it is worth noting that only a small minority of respondents reported testing positive for the COVID-19 virus.

Overall, the study indicates that the elderly participants in the Bethal district of Mpumalanga were able to maintain food security during the COVID-19 pandemic, and their dietary diversity remained high. However, the findings also highlight the impact of the pandemic on health, with a significant number of respondents experiencing new chronic illnesses during this period.

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APPENDICES

APPENDIX A: ETHICAL APPROVAL

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS
UV

GENERAL/HUMAN RESEARCH ETHICS COMMITTEE (GHREC)

08-Dec-2021

Dear Miss Aninka De Jager

Application Approved

Research Project Title:
Elderly obesity and food insecurity in the Bethal district, Mpumalanga, South Africa

Ethical Clearance number:
UFS-HSD2021/0764/21

We are pleased to inform you that your application for ethical clearance has been approved. Your ethical clearance is valid for twelve (12) months from the date of issue. We request that any changes that may take place during the course of your study/research project be submitted to the ethics office to ensure ethical transparency. furthermore, you are requested to submit the final report of your study/research project to the ethics office. Should you require more time to complete this research, please apply for an extension. Thank you for submitting your proposal for ethical clearance; we wish you the best of luck and success with your research.

Yours sincerely

Dr Adri Du Plessis
Chairperson: General/Human Research Ethics Committee

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APPENDIX B: CONSENT FORM

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

RESEARCH STUDY INFORMATION LEAFLET AND CONSENT FORM

DATE

11 April, 2022

TITLE OF THE RESEARCH PROJECT

Influence of the COVID-19 pandemic on elderly food security within in the Bethal district, Mpumalanga, South Africa

PRINCIPLE INVESTIGATOR / RESEARCHER(S) NAME(S) AND CONTACT NUMBER(S):

Aninka de Jager *2014032433* *083 229 8478*

FACULTY AND DEPARTMENT:

Natural and Agricultural Science
Sustainable Food Systems and Development

STUDYLEADER(S) NAME AND CONTACT NUMBER:

Dr Natasha Cronje
(051) 402 7691

Prof Wilna Oldewage-Theron
(806) 834 0567

WHAT IS THE AIM / PURPOSE OF THE STUDY?

This study aims to determine how the elderly's food security was influenced by the COVID-19 pandemic within Mpumalanga.

WHO IS DOING THE RESEARCH?

My name is Aninka de Jager; I am a full-time master's student in Consumer Science at the University of the Free State. I am conducting this research study due to the limited amount of research done on elderly food security, especially the influences that the COVID-19 pandemic had on the 60 years and older age group.

HAS THE STUDY RECEIVED ETHICAL APPROVAL?

This study has received approval from the Research Ethics Committee of UFS. A copy of the approval letter can be obtained from the researcher.

Approval number: UFS-HSD2021/0764/21

WHY ARE YOU INVITED TO TAKE PART IN THIS RESEARCH PROJECT?

Participants within the area of Bethal district will be selected or invited, to represent the average views of the population. Thereby selecting individuals that live in the Bethal district which include the following towns in Mpumalanga: Bethal, Ermelo, Middelburg, Kriel, Secunda, Volksrust and Wakkerstroom. Participants of all ethnicities will be included that can read and write English or Afrikaans, that are between the ages of 60 -100. Therefore, any individual that is willing to participate and falls in the above mentioned criteria will be selected to be part of the study. A total number of 225 participants will be included in the questionnaires, and 20 or more in the semi-structured interviews in this project.

WHAT IS THE NATURE OF PARTICIPATION IN THIS STUDY?

The participant's role within this study is only to fill-in a questionnaire or to participate in a semi-structured interview. The questionnaire will consist of geographical questions, food insecurity and dietary diversity questions. The questionnaire will take only about 15-20 minutes to complete. The purpose of this questionnaire is to gather data within the population, which will only be used for research. The questionnaire will be available in both hard copy and online, participants are allowed to choose which ever they prefer. For the semi-structured interviews, face-to-face sessions are required in order to record the participant's anwers and opinions regarding the questions or topics.

CAN THE PARTICIPANT WITHDRAW FROM THE STUDY?

Participation in this study is voluntary and all participants will remain anonymous. Before any participant can take part in this project, they will have to sign a consent form where they give acknowledgement that they have been informed about the study and are willing to participate. All participants are free to withdraw from the research project at any time prior to submission of the questionnaire.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

You will not receive any direct benefits by taking part in this study. However, your participation is needed to collect data, regarding to determine dietary diversity and food security within the elderly community of the Bethal district. The identification of needs could potentially benefit the community in the future. Your participation will remain confidential.

WHAT IS THE ANTICIPATED INCONVENIENCE OF TAKING PART IN THIS STUDY?

Taking part in this study requires only a few minutes of your time. The anticipated inconvenience that will be experienced by taking part in this study includes only the loss of a few minutes of your time. By taking part in this study you might experience emotional distress, in which case a nurse or social worker will be asked for assistance. By taking part in this study, you could place your health at risk, or others, if contact is required for data gathering during the Covid-19 pandemic. Therefore, Covid-19 protocol will be of great importance during data collection, including mask wearing, social distancing and sanitizing where required.

WILL WHAT I SAY BE KEPT CONFIDENTIAL?

During the filling-in of the questionnaire or semi-structured interview your name will not be asked in a question, thus no one will be able to connect you to your answers. Your answered questionnaire will be given a number for referencing purposes. The individuals that will be able to view your answers will only be the researcher and supervisors, other individuals that might be working with the data will have to sign a confidentiality agreement for the data to remain confidential. Answers may be reviewed by members of the Research Ethics Committee, external coders, or a transcriber, this will only be done to ensure that the research was done properly. Data gathered can viewed by the Post Graduate School, from which a bursary was received for the purpose of this study. Your anonymous data collected during this study may be used for purposes such as journal articles, research reports, conference presentations, etc. During publication, any reference to your questionnaire will only make use of the number given to your answers, making you unidentifiable. For you to remain anonymous, please do not disclose any personally sensitive information that isn't asked for.

HOW WILL THE INFORMATION BE STORED AND ULTIMATELY DESTROYED?

Hard copies of your questionnaire or semi-structured interview will be stored by the researcher for a period of five years in a locked cupboard, for future research or academic purposes; electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. The information will be deleted and destroyed after the five-year period has passed. During the storing time, the information will not be disclosed for non-research related purposes to anyone, to prevent any inconvenience.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICPATING IN THIS STUDY?

No payments or any other rewards will be offered for participants, the participation is fully voluntary. Your participation in this study only requires a few minutes of your time.

HOW WILL THE PARTICIPANT BE INFORMED OF THE FINDINGS / RESULTS OF THE STUDY?

If you would like to be informed of the final research findings, please contact Aninka de Jager on 083 229 8478 or aninkadejager@gmail.com. The findings are accessible for 6 months. Should you have concerns about the way in which the research has been conducted, you may contact Dr Natasha Cronje at CronjeN@ufs.ac.za or 051 401 7691.

Thank you for taking time to read this information sheet and for participating in this study.

You are allowed to keep these 3 pages for future information.

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS
UV

CONSENT TO PARTICIPATE IN THIS STUDY

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet. I have had sufficient opportunity to ask questions and am prepared to participate in the study. I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable). I am aware that the findings of this study will be anonymously processed into a research report, journal publications and/or conference proceedings.

I agree to the recording of the *questionnaire or semi-structured interview*.

I have received a signed copy of the informed consent agreement.

Full Name of Participant: _____

Signature of Participant: _____ Date: _____

Full Name of Researcher: Aninka de Jager

Signature of Researcher: _____ Date: 11/04/2022

Please return this page to the researcher

APPENDIX C: FINAL QUESTIONNAIRE

evasys

University of the Free State | Aninka de Jager

Department of Sustainable Food Systems and | Food Security Questionnaire

Mark as shown: ☐■☐☐☐ Please use a ball-point pen or a thin felt tip. This form will be processed automatically.

Correction: ☐■☐■☐ Please follow the examples shown on the left hand side to help optimize the reading results.

1. Demographics

1.1 What year were you born?/ *In watter jaar is jy gebore?*

☐☐☐☐

1.2 What gender do you associate with? / *Met watter geslag assosieer jy?*

☐ Female / *Vroulik* ☐ Male / *Manlik* ☐ Other / *Ander*

1.3 What is your home language? / *Wat is jou huistaal?*
(Select only one option)

☐ Afrikaans ☐ English ☐ Ndebele
☐ Pedi ☐ Sotho ☐ Swati
☐ Tsonga ☐ Tswana ☐ Venda
☐ Xhosa ☐ Zulu ☐ Other

1.4 What is your marital status? / *Wat is jou huwelikstatus?*

☐ Single/ *Ongetroud* ☐ Married/ *Getroud* ☐ Widowed/ *Weduwee*
☐ Widower/ *Wewenaar* ☐ Divorced/ *Geskei* ☐ Living with a friend/ *Woon saam met 'n vriend*
☐ Living with a partner/ *Woon saam met 'n lewensmaat*

1.5 In which town do you stay? / *In watter dorp woon jy?*

☐ Amersfoort ☐ Bethal ☐ Ermelo
☐ Kriel ☐ Middelburg ☐ Secunda
☐ Standerton ☐ Morgenzon ☐ Volksrust
☐ Wakkerstroom ☐ Other/ *Ander*

1.6 If you selected "Other" in 1.5 please provide your information? / *As jy "Ander" gekies het in 1.5 verskaf asb. jou besonderhede?*

1.7 What is your employment status?/ *Wat is jou indiensnemingstatus?*

☐ Employed/ *Werkend* ☐ Unemployed/ *Werkloos* ☐ Self-employed/ *In eie diens*
☐ Part-time/ *Deeltyds* ☐ Retired/ *Afgetree*

1.8 If you selected "employed" in 1.7, did your number of working hours change due to the COVID-19 pandemic?/ *Indien jy in 1.7 "werkend" gekies het, het jou aantal werksure verander a.g.v. die COVID-19 pandemie?*

☐ Increased/ *Toegeneem* ☐ No change/ *Geen verandering* ☐ Decreased/ *Afgeneem*

1.9 What is your highest qualification?/ *Wat is jou hoogste kwalifikasie?*

☐ Primary school/ *Laerskool* ☐ Grade 9/ *Graad 9* ☐ High school/ *Hoërskool*
☐ Matric/ *Matriek* ☐ Diploma or Higher Certificate/ *Diploma of 'n Hoër Sertifikaat* ☐ Undergraduate/ *Voorgraads*
☐ Postgrad/ *Nagraads*

1.10 What is your accommodation set-up?/ *Hoe lyk jou woonopstel?*

☐ Living on my own/ *Woon op my eie* ☐ Living with my spouse/ *Woon saam met my eggenoot/ eggenote* ☐ Living with my partner/ *Woon saam met my lewensmaat*
☐ Living with my spouse and family/ *Woon saam met my eggenoot en familie* ☐ Living with family/ *Woon by my familie* ☐ Family living with me/ *Familie woon by my*
☐ Living in an old age home/ *Woon in 'n ouetehuis*

1.11 How many individuals live in your house? / *Hoeveel mense bly in jou huis?*

0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ >10 ☐

1. Demographics [Continue]

1.12 How many of your household members are older than 60 years? /*Hoeveel lede van jou huishouding is ouer as 60 jaar?* ☐☐☐☐☐☐☐☐☐☐☐

1.13 How many household members are younger than 60 years? /*Hoeveel lede van jou huishouding is jonger as 60 jaar?* ☐☐☐☐☐☐☐☐☐☐☐

1.14 What is your main source of income?/*Wat is jou hoofbron van inkomste?*

☐ Grant/ *Staatstoelaag* ☐ Pension/ *Pensioen* ☐ Deceased spouse's pension/ *Oorlede eggenoot se pensioen*

☐ Annuity/ *Annuïteit* ☐ Salary/ *Salaris* ☐ Spouse/*Eggenoot*

1.15 Do you have an additional source of income?/ *Het jy 'n bykomende bron van inkomste?*

☐ Yes/ *Ja* ☐ No/ *Nee*

1.16 If Yes in 1.16, what is this source of income? / *Indien Ja in 1.16, wat is hierdie bron van inkomste?* *(Be as descriptive as possible/ Beskryf so deeglik as moontlik)*

1.17 How much do you think you spend on food monthly?/ *Hoeveel geld dink jy spandeer jy maandeliks aan kos?*

1.18 Was your income affected by the COVID-19 pandemic?/ *Is jou inkomste deur die COVID-19 pandemie geraak?*

☐ Yes/ *Ja* ☐ No/ *Nee*

1.19 If "Yes" in 1.18, in which way did your income change?/ *Indien "Ja" in 1.18, op watter wyse is jou inkomste geraak?*

☐ Decrease/ *Afname* ☐ Did not change/ *Het nie verander nie* ☐ Increase/ *Toename*

1.20 Why did it change?/ *Hoekom het dit verander?* ***(Please specify/ Verskaf asb. besonderhede)***

1.21 What is your household's total income?/ *Wat is jou huishouding se totale inkomste?*

2. Impact of COVID-19 on health

2.1 Have you been diagnosed with any of these chronic illnesses listed below since the start of the COVID-19 pandemic?/ *Is jy met enige van die onderstaande kroniese siektes gediagnoseer sedert die aanvang van die COVID-19 pandemie?*

☐ Heart disease/ *Hart siekte* ☐ Stroke/ *Beroerte* ☐ Lung cancer/ *Long kanker*

☐ Depression/ *Depressie* ☐ Type 2 diabetes/ Tipe 2 diabetes ☐ Arthritis/ *Artritis*

☐ Osteoporosis/ *Osteoporose* ☐ Asthma/ *Asma* ☐ High blood pressure/ *Hoë bloeddruk*

☐ High cholesterol/ *Hoë kolesterol* ☐ Other cancers/ *Ander kankers* ☐ HIV

2.2 Do you think alcohol will affect your health?/ *Is jy van mening dat alkohol jou gesondheid kan beïnvloed?*

☐ Yes/ *Ja* ☐ No/ *Nee* ☐ Possibly/ *Moontlik*

2.3 Do you think the use of cigarettes will affect your health? / *Is jy van mening dat sigarette jou gesondheid kan beïnvloed?*

☐ Yes/ *Ja* ☐ No/ *Nee* ☐ Possibly/ Moontlik

2.4 Have you been diagnosed with a nutrient deficiency during COVID-19 pandemic?/ *Is jy met 'n nutriënttekort gediagnoseer gedurende die COVID-19 pandemie?*

☐ Yes/ *Ja* ☐ No/ *Nee*

2.5 If "Yes" in 2.4, please indicate which deficiency you suffer(d) from?/ *Indien "Ja" in 2.4, dui asseblief aan watter tekort jy aan ly/ gely het?*

2.6 Did you gain any weight during the COVID-19 pandemic? / *Het jy gewig opgetel gedurende die COVID-19 pandemie?*

☐ Yes/ *Ja* ☐ No/ *Nee*

2. Impact of COVID-19 on health [Continue]

2.7 If "Yes" in 2.6, how much weight did you approximately gain during the COVID-19 pandemic?/ *Indien "Ja" in 2.6, hoeveel gewig het jy min of meer opgetel gedurende die COVID-19 pandemie?*

☐ 1-2 kg ☐ 2.1-3 kg ☐ 3.1-4 kg
☐ 4.1-5 kg ☐ 5.1-8 kg ☐ 8.1-10 kg
☐ More than 10 kg/ *Meer as 10 kg*

2.8 If "No" in 2.6, did you lose weight during the COVID-19 pandemic? *Indien "Nee" in 2.6 gekies is, het jy gewig verloor gedurende die COVID-19 pandemie?*
(Choose applicable option/ Kies opsie wat van toepassing is)

☐ 1- 2 kg ☐ 2.1-3 kg ☐ 3.1-4 kg
☐ 4.1-5 kg ☐ 5.1-8 kg ☐ 8.1-10 kg
☐ More than 10 kg/ *Meer as 10 kg* ☐ Unchanged/ *Onveranderd*

2.9 Do you participate in some form of physical exercise? / *Neem jy deel aan enige fisiese aktiwiteite?*

☐ Yes/ *Ja* ☐ No/ Nee

2.10 If "Yes" at 2.9, how often?/ *Indien "Ja" by 2.9, hoe gereeld?*

☐ Never/ *Nooit* ☐ Once in a while/ *Nou en dan* ☐ Once in 2 weeks/ *1 keer in 2 weke*
☐ Once a month/ *1 keer per maand* ☐ 1-2 times per week/ *1-2 keer per week* ☐ 3 times per week/ *3 keer per week*
☐ 4 times per week/ *4 keer per week* ☐ 5 times per week/ *5 keer per week* ☐ 6 times per week/ *6 keer per week*
☐ 7 times per week/ *7 keer per week*

2.11 If your exercise programme has changed during the COVID-19 pandemic, how did it change?/ Indien jou oefenprogram gedurende die COVID-19 pandemie verander het, tot watter mate het dit verander?

☐ Increased/ *Toegeneem* ☐ No change/ *Geen verandering* ☐ Decreased/ *Afgeneem*

2.12 Has your screen and sitting time changed during the COVID-19 pandemic? / *Het jou skerm- en sittyd gedurende die COVID-19 pandemie verander?*

☐ Increased/ *Toegeneem* ☐ No change/ *Geen verandering* ☐ Decreased/ *Afgeneem*

2.13 Have you experienced more stress/anxiety/sleep of a lesser quality during the COVID-19 pandemic? / *Het jy meer spanning/angs/'n swakker kwaliteit nagrus ervaar gedurende die COVID-19 pandemie?*

☐ Yes/ *Ja* ☐ No/ *Nee* ☐ Sometimes/ *Somtyds*

	Always/ Altyd	Often/ Gereeld	Sometimes/ Soms	Rarely/ Baie min	Never/Nooit
2.14 Would you say that you were an emotional eater during the COVID-19 pandemic? / *Sou jy sê dat jy 'n emosionele eter was gedurende die COVID-19 pandemie?*	☐	☐	☐	☐	☐
2.15 Were you ever scared to leave your home during the COVID-19 pandemic? / *Was jy ooit bang om jou huis te verlaat gedurende die COVID-19 pandemie?*	☐	☐	☐	☐	☐

2.16 Have you tested positive for COVID-19?/ *Het jy positief getoets vir COVID-19?*

☐ Yes / *Ja* ☐ Nee/ *No*

2.17 If "Yes" in 2.16, have you recovered your sense of smell/taste?/ *As "Ja" in 2.16, het jy al jou reuk-/ smaaksintuig herwin?*

☐ Yes/ *Ja* ☐ No/ *Nee*

2.18 If "Yes" in 2.16, has your diet changed since you tested positive for COVID-19?/ *As "Ja" in 2.16, het jou dieet verander sedert jy positief getoets het vir COVID-19?*

☐ Yes/ *Ja* ☐ No/ *Nee*

2. Impact of COVID-19 on health [Continue]

2.19 If "Yes" in 2.18, please indicate how your diet has changed?/
Indien "Ja" in 2.18, dui asb. aan hoe jou dieet verander het?

3. Impact of COVID-19 on food consumption and behaviour

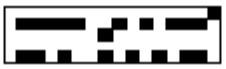
3.1 Was there a greater time lap between your grocery shopping trips during the COVID- 19 pandemic? / *Was daar 'n groter tydsverloop tussen jou kruideniersware-aankope gedurende die COVID-19 pandemie?*

☐ Yes/ *Ja* ☐ No/ *Nee*

3.2 Has your snacking increased since the COVID-19 pandemic?/*Het jy meer gereeld tussen etes begin peusel sedert die COVID-19 pandemie?*

☐ Yes/ *Ja* ☐ No/ *Nee*

		☐ Increased/ Toegeneem	☐ No Change/ Geen verandering	☐ Decrease/ Afgeneem
3.3	Has your fresh produce (fruits and vegetables) consumption been influenced during the COVID-19 pandemic?/ *Is jou gebruik van vars produkte (vrugte en groente) beïnvloed deur die COVID-19 pandemie?*	☐	☐	☐
3.4	Has your purchase of canned/ pre-prepared meals increased during the COVID-19 pandemic?/ *Het jou aankope van gebilkte/ voorafbereide maaltye toegeneem sedert die COVID-19 pandemie?*	☐	☐	☐
3.5	Has your meat consumption been influenced by the COVID-19 pandemic?/ *Is jou vleisverbruik beïnvloed deur die COVID-19 pandemie?*	☐	☐	☐
3.6	Have your plant based product (meat alternative) purchases changed due to the COVID-19 pandemic?/ *Het jou plantgebaseerde (vleis alternatief) aankope verander a.g.v. die COVID-19 pandemie?*	☐	☐	☐
3.7	Has your purchases of less expensive foods been influenced by the COVID-19 pandemic?/ *Hoe het die COVID-19 pandemie jou aankope van meer bekostigbare kossoorte geraak?*	☐	☐	☐
3.8	How has your visits to restaurants been affected by the COVID-19 pandemic?/ *Hoe is jou restaurantbesoeke beïnvloed deur die COVID-19 pandemie?*	☐	☐	☐
3.9	How has your "take away" consumption been influenced by the COVID-19 pandemic?/ *Hoe het die COVID-19 pandemie jou aankope van wegneemetes geraak?*	☐	☐	☐



3. Impact of COVID-19 on food consumption and behaviour [Continue]

Which of these purchasing behaviours did you take part in due to the COVID-19 pandemic's influence?/ *Hoe het die COVID-19 pandemie jou aankoopgewoontes m.b.t. die volgende beïnvloed?*

3.10	Started planting my own food/ *Het my eie kos begin plant*	☐	☐	☐
3.11	Started shopping online/ *Het aanlyn aankope begin doen*	☐	☐	☐
3.12	Someone else purchased my food for me/ *Iemand anders het vir my kos gekoop*	☐	☐	☐

4. Food Security during COVID-19 restriction (27 March untill 17 August 2020)

		☐ Never/ Nooit	☐ Sometimes/ Soms	☐ Always/ Altyd
4.1	Was the food that you were looking for in store always available during the COVID-19 restriction period? / *Was die kos waarna jy op soek was in winkels gedurende die COVID-19 inperkings altyd beskikbaar?*	☐	☐	☐
4.2	Could you afford to eat balanced meals during the COVID-19 restrictions?/ *Kon jy bekostig om gebalanseerde maltye te eet tydens die COVID-19 inperkings?*	☐	☐	☐
4.3	Did you always have enough money to purchase the food you wanted during the COVID-19 restrictions?/ *Het jy altyd genoeg geld gehad om die kos te koop wat jy graag wou eet gedurende die COVID-19 inperkings?*	☐	☐	☐

4.4 Were you ever worried during the COVID-19 restrictions that your household would not have enough to eat? / *Was jy ooit gedurende die COVID-19 beperkinge bekommerd dat jou huishouding nie genoeg kos sou hê om te eet nie?*

☐ Yes/ *Ja* ☐ No/ *Nee*

4.5 Were you or any other household member not able to eat the kind of foods you/ they prefer due to a lack of resources during the COVID-19 restriction period? / *Was jy of enige ander lid van die huishouding gedurende die COVID-19 inperkinge nie in staat om te eet wat julle graag wou nie weens 'n gebrek aan hulpbronne?*

☐ Yes/ *Ja* ☐ No/ *Nee*

4.6 Did you or any other member of your household have to eat a smaller variety of food due to a lack of resources during the COVID-19 restriction period? / *Moes jy of enige ander lid van jou huishouding weens die COVID-19 inperkinge tevrede wees met 'n kleiner verskeidenheid kossoorte?*

☐ Yes/ *Ja* ☐ No/ *Nee*

4.7 Did you or any other household member need to eat some foods that you really didn't want to because of a lack of resources to obtain other types of food during the COVID-19 restrictions? / *Moes jy of enige ander lid van jou huishouding gedurende die COVID-19 inperkinge sekere kossoorte eet wat julle nie eintlik wou eet nie?*

☐ Yes/ *Ja* ☐ No/ *Nee*

4.8 Did you or any other member of your household have to eat a smaller meal than you felt was necessary during the COVID-19 restrictions because there was not enough food? / *Moes jy of enige ander lid van jou huishouding 'n kleiner maaltyd as gewoonlik eet gedurende die COVID-19 beperkinge weens 'n tekort aan kos?*

☐ Yes/ *Ja* ☐ No/ *Nee*

4.9 Did you or any other of your household members have to eat less meals per day, during the COVID-19 restrictions because there was not enough food? / *Moes jy of enige ander lede van jou huishouding minder maaltye per dag eet gedurende die COVID-19 beperkinge vanweë 'n gebrek aan genoeg kos?*

☐ Yes/ *Ja* ☐ No/ *Nee*

4.10 Was there ever no food of any kind available to eat during the COVID-19 restrictions because of a lack of resources to find food? / *Was daar ooit geen voedsel van enige aard beskikbaar gedurende die COVID-19 inperkinge nie vanweë 'n gebrek aan bronne om voedsel te vind?*

☐ Yes/ *Ja* ☐ No/ *Nee*

4. Food Security during COVID-19 restriction (27 March untill 17 August 2020) [Continue]

4.11 Did you or any other member of your household go to bed hungry during the COVID-19 restrictions because of a lack of food? / *Het jy of enige ander lid van jou huishouding gedurende die COVID-19 beperkinge honger bed toe gegaan vanweë 'n gebrek aan voedsel?*

☐ Yes/ *Ja* ☐ No/ *Nee*

4.12 Did you or any household member go a whole day or night without eating, during the COVID-19 restrictions because there was not enough food?/ *Het jy of enige ander huis inwoner 'n hele dag of nag sonder kos geleef gedurende die COVID-19 inperking, as gevolg van 'n tekort aan genoeg kos?*

☐ Yes/ *Ja* ☐ No/ *Nee*

Dietary Diversity During COVID-19 restrictions/ *Dieet verskeidenheid gedurende COVID-19 inperkings*
Did you consume any of the following during a typical week (**27 March until 17 August 2020**)?/ *Het jy enige van die volgende gebruik tydens 'n normale week (**27 Maart tot 17 Augustus 2020**)?*
(***Select as many as applicable/ Kies soveel as van toepassing***)

4.13 **Cereals/ *Graankosse***
☐ Corn/ *Mielies* ☐ Oats/ *Hawermout* ☐ Rice/ *Rys*
☐ Sorghum ☐ Rye/ *Rog*

4.14 **White roots and tubers/ *Wortels en knolle***
☐ Potatoes/ *Aartappels* ☐ Sweet potatoes/ *Patats* ☐ Turnip/ *Rape*
☐ Green bananas/ *Groen piesangs* ☐ Chicory root/ *Sigoreiwortels*

4.15 **Dark green leafy vegetables/ Donkergroen-*groente***
☐ Bean Greens/ *Groenbone* ☐ Broccoli/ *Brokkoli* ☐ Kale/ *Boerekool*
☐ Lettuce/ *Blaarslaai* ☐ Spinach/ *Spinasie*

4.16 **Other vegetables/ *Ander groente***
☐ Cabbage/ *Kool* ☐ Cauliflower/ *Blomkool* ☐ Cucumbers/ *Komkommers*
☐ Garlic/ *Knoffel* ☐ Mushrooms/ *Sampioene* ☐ Brussel sprouts/ *Brusselse spruite*

4.17 **Fruits/ *Vrugte***
☐ Apples/ *Appels* ☐ Figs/ *Vye* ☐ Guavas/ *Koejawels*
☐ Kiwis/ *Kiwi's* ☐ Strawberries/ *Aarbeie*

4.18 **Meats/ *Vleise***
☐ Animal Organs/ Dier *Organe* ☐ Beef/ *Bees* ☐ Lamb/ *Lam*
☐ Mutton/ *Skaap* ☐ Pork/ *Vark* ☐ Chicken/ *Hoender*

4.19 **Fish and seafood/ *Vis en seekosse***
☐ Fresh or dried fish/ *Vars of gedroogde vis* ☐ Canned fish/ *Geblikte vis* ☐ Crab/ *Krap*
☐ Oysters/ Oesters ☐ Other shellfish/ *Ander skulpvis*

4.20 **Legumes/ *Peulgewasse***
☐ Chickpeas/ Kekerertjies ☐ Lentils/ *Lensies* ☐ Peas/ *Ertjies*
☐ Peanuts/ *Grondboontjies* ☐ Soybean/ *Sojabone*

4.21 **Tree nuts/ *Neute***
☐ Almonds/ *Amandels* ☐ Cashewnuts/ *Kasjoeneute* ☐ Chestnuts/ *Kastaiings*
☐ Hazelnuts/ *Haselneute* ☐ Pecannuts/ *Pekanneute*

4.22 **Milk and milk products/ *Melk en melkprodukte***
☐ Full cream milk/ *Volroommelk* ☐ Low-fat milk/ *Laevet melk* ☐ Fat free milk/ *Vetvrye melk*
☐ Milk alternatives/ Melk alternatiewe ☐ Yoghurt/ *Jogurt*

4.23 **Sweets/ *Lekkers***
☐ Biscuits/ *Koekies* ☐ Cakes/ *Koeke* ☐ Candies/ *Lekkergoed*
☐ Chocolates/ *Sjokolades* ☐ Jam or marmalade/ *Konfyt of marmelade* ☐ Pies and pastries/ *Pasteie en gebak*
☐ Sweetened drinks or fruit juice/ *Versoete drankies of vrugtesap*

4.24 **Spices, condiments and beverages/ *Speserye, souse en drank***
☐ Chillies/ *Rissies* ☐ Tomato sauce, mustard/ *Tamatiesous en mosterd* ☐ Herbs/ *Kruie*
☐ Spices/ *Speserye* ☐ Tea/ *Tee* ☐ Coffee/ *Koffie*
☐ Beer/ *Bier* ☐ Wine/ *Wyn* ☐ Other alcoholic beverages/ *Ander alkoholiese drankies*

5. Food security prior to COVID-19 (Prior to 27 March 2020)

		Never/ Nooit	Sometimes/ Soms	Always/ Altyd
5.1	Was the food you looked for in store always available prior to the COVID-19 pandemic?/ *Was die voedsel waarna jy op soek was altyd beskikbaar in die winkels voor die COVID-19 pandemie?*	☐	☐	☐
5.2	Could you afford to eat balanced meals prior to the COVID-19 pandemic?/ *Kon jy dit bekostig om gebalanseerde maaltye te eet voor aangvang van die COVID-19 pandemie?*	☐	☐	☐
5.3	Did you always have enough money to purchase the food you wanted prior to the COVID-19 pandemic?/ *Het jy altyd genoeg geld gehad om die voedsel te kon koop wat jy graag wou koop voor die aanvang van die COVID-19 pandemie?*	☐	☐	☐

5.4 Prior to the COVID-19 pandemic, did you worry that your household would not have enough food?/ *Was jy ooit voor die COVID-19 pandemie bekommerd dat jou huishouding nie genoeg voedsel sou hê nie?*

☐ Yes/ *Ja* ☐ No/ *Nee*

5.5 Were you or any of your household members not able to eat the kind of foods you preferred prior to the COVID-19 pandemic because of a lack of resources? / *Was jy of enige ander lid van jou huishouding voor die aanvang van die COVID-19 pandemie nie in staat om die kossoorte te eet wat julle graag wou eet nie vanweë 'n gebrek aan hulpbronne?*

☐ Yes/ *Ja* ☐ No/ *Nee*

5.6 Did you or any other household member have to eat a limited variety of food due to a lack of resources prior to the COVID-19 pandemic? / *Moes jy of enige ander lid van jou huishouding voor die aanvang van die COVID-19 pandemie van 'n beperkte verskeidenheid kossoorte eet vanweë 'n gebrek aan hulpbronne?*

☐ Yes/ *Ja* ☐ No/ *Nee*

5.7 Did you or any other household member have to eat have to eat some food you really didn't want to eat prior to the COVID-19 pandemic due to a lack of resources to obtain other food? / *Moes jy of enige ander lid van jou huishouding voor die COVID-19 pandemie kosse eet waarvan jy/julle regtig nie wou eet nie vanweë 'n gebrek aan hulpbronne?*

☐ Yes/ *Ja* ☐ No/ *Nee*

5.8 Prior to the COVID-19 pandemic, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?/ *Moes jy of enige ander lid van jou huishouding voor die COVID-19 pandemie kleiner porsies tydens maaltye eet as wat jy gevoel het nodig was vanweë 'n gebrek aan genoeg voedsel?*

☐ Yes/ *Ja* ☐ No/ *Nee*

5.9 Prior to the COVID-19 pandemic, did you or any household member have to eat fewer meals in a day because there was not enough food?/ *Moes jy of enige ander lid van jou huishouding voor die COVID-19 pandemie minder maaltye per dag eet weens 'n gebrek aan genoeg voedsel?*

☐ Yes/ *Ja* ☐ No/ *Nee*

5.10 Prior to the COVID-19 pandemic, was there ever no food to eat of any kind in your household because of lack of resources to get food?/ *Moes jy of enige ander lid van jou huishouding voor die COVID-19 pandemie 'n hele dag en nag sonder kos leef weens 'n gebrek aan genoeg voedsel?*

☐ Yes/ *Ja* ☐ No/ *Nee*

5.11 Prior to the COVID-19 pandemic, did you or any household member go to sleep hungry at night because there was not enough food?/*Moes jy of enige ander huis inwoner honger gaan slaap voor die COVID-19 pandemie, weens 'n tekort aan genoeg kos?*

☐ Yes/ *Ja* ☐ No/ *Nee*

5.12 Prior to the COVID-19 pandemic, did you or any household member go for a whole day or night without eating because there was not enough food?/ *Het jy of enige ander huis inwoner 'n hele dag of nag sonder kos geleef voor die COVID-19 pandemie, as gevolg van 'n tekort aan genoeg kos?*

☐ Yes/ *Ja* ☐ No/ *Nee*

5. Food security prior to COVID-19 (Prior to 27 March 2020) [Continue]

Dietary Diversity prior to the COVID-19 pandemic/ *Dieet verskeidenheid voor die COVID-19 inperking*
Did you consume any of the following in a regular month **prior to 27 March 2020**/ *Het jy enige van die volgende verbruik in 'n gewone maand* ***voor 27 Maart 2020***
(Select as many as applicable/ Kies soveel soos van toepassing)

5.13 **Cereals/ *Graankosse***
- ☐ Corn/ *Mielies*
- ☐ Oats/ *Hawermout*
- ☐ Rice/ *Rys*
- ☐ Sorghum
- ☐ Rye/ *Rog*

5.14 **White roots and tubers/ *Wortels en knolle***
- ☐ Potatoes/ *Aartappels*
- ☐ Sweet potatoes/ *Patats*
- ☐ Turnip/ *Rape*
- ☐ Green bananas/ *Groen piesangs*
- ☐ Chicory/ *Sigoreiwortels*

5.15 **Dark green leafy vegetables/ *Donkergroen-groente***
- ☐ Bean greens/ *Groenboone*
- ☐ Broccoli/ *Brokkoli*
- ☐ Kale/ *Boerekool*
- ☐ Lettuce/ *Blaarslaai*
- ☐ Spinach/ *Spinasie*

5.16 **Other vegetables/ *Ander groentes***
- ☐ Cabbage/ *Kool*
- ☐ Cauliflower/ *Blomkool*
- ☐ Cucumbers/ *Komkommers*
- ☐ Garlic/ *Knoffel*
- ☐ Mushrooms/ *Sampioene*
- ☐ Brussel sprouts/ *Brusselse spruite*

5.17 **Fruits/ *Vrugte***
- ☐ Apples/ *Appels*
- ☐ Fig/ *Vye*
- ☐ Guavas/ *Koejawels*
- ☐ Kiwis/ *Kiwi's*
- ☐ Strawberries/ *Aarbeie*

5.18 **Meats/ *Vleise***
- ☐ Animal Organs/ Dier *Organe*
- ☐ Beef/ *Bees*
- ☐ Lamb/ Lam
- ☐ Mutton/ *Skaap*
- ☐ Pork/ *Vark*
- ☐ Chicken/ *Hoender*

5.19 **Fish and seafood/ *Vis en seekosse***
- ☐ Fresh or dried fish/ *Vars of gedroogde vis*
- ☐ Canned fish/ *Geblikte vis*
- ☐ Crab/ *Krap*
- ☐ Oysters/ *Oesters*
- ☐ Other shellfish/ *Ander skulpvis*

5.20 **Legumes/ *Peulgewasse***
- ☐ Chickpeas/ *Kekerertjies*
- ☐ Lentil/ *Lensies*
- ☐ Peas/ *Ertjies*
- ☐ Peanuts/ *Grondboontjies*
- ☐ Soybeans/ *Sojabone*

5.21 **Tree nuts/ *Neute***
- ☐ Almonds/ *Amandels*
- ☐ Cashewnuts/ *Kasjoeneute*
- ☐ Chestnuts/ *Kastaiings*
- ☐ Hazelnuts/ *Haselneute*
- ☐ Pecannuts/ *Pekanneute*

5.22 **Milk and milk products/ *Melk en melkprodukte***
- ☐ Full cream milk/ *Volroommelk*
- ☐ Low-fat milk/ *Laevet melk*
- ☐ Fat free milk/ Vetvrye melk
- ☐ Milk alternatives/ *Melk alternatiewe*
- ☐ Yoghurt/ *Jogurt*

5.23 **Sweets/ *Lekkers***
- ☐ Biscuits/ *Koekies*
- ☐ Cakes/ *Koeke*
- ☐ Candies/ *Lekkergoed*
- ☐ Chocolates/ *Sjokolades*
- ☐ Jam or marmalade/ *Konfyt of marmelade*
- ☐ Pies and pastries/ *Pasteie en gebak*
- ☐ Sweetened drinks and fruit juice/ *Versoete drankies en vrugtesap*

5.24 **Spices, condiments and beverages/ *Speserye, souse en drank***
- ☐ Chilies/ *Rissies*
- ☐ Tomato sauce or mustard/ *Tamatiesous en mosterd*
- ☐ Herbs/ *Kruie*
- ☐ Spices/ *Speserye*
- ☐ Tea/ *Tee*
- ☐ Coffee/ *Koffie*
- ☐ Beer/ *Bier*
- ☐ Wine/ *Wyn*
- ☐ Other alcoholic beverages/ *Ander alkoholiese drankies*

Thank you for your time and participation. / *Dankie vir jou tyd en deelname.*

APPENDIX D: INTERVIEW SCHEDULE

Semi-structured interview questions

COVID-19 restriction/ hard lockdown took place from 27 March till 17 August 2020
COVID-19 inperking/ streng lockdown het plaas gevind van 27 Maart tot 17 Augustus 2020

1) How did the COVID-19 restrictions influence your life? **From 27 March until now/**
   Hoe het die COVID-19 inperkinge jou lewe beïnvloed? ***Sedert 27 Maart tot nou***.
2) Did you experience this time as stressful? Why? /
   Het jy die tydperk as stressfol ervaar? Hoekom?
3) Did you experience an increase in hunger during the COVID-19 restriction? /
   Het jy 'n toename in hongerte ervaar gedurende die COVID-19 inperking?
4) Were you able to find the foods you were looking for in stores during the COVID-19 restriction? /
   Kon jy die kosse kry in winkels wat jy wou hê tydens die COVID-19 inperking?
5) Were foods affordable for you during the COVID-19 restriction? /
   Was kos vir jou bekostigbaar tydens die COVID-19 inperking?
6) Did you use more alcoholic substances or cigarettes during the COVID-19 restriction? /
   Het jy meer alkoholiese stowwe of sigarette gebruik tydens die COVID-19 inperking?
7) Did you experience any healthy related problems during the COVID-19 restriction? /
   Het jy enige gesondheidsprobleme ervaar tydens die COVID-19 inperking?
8) Did you sit more or use screens more often during the COVID-19 restriction? /
   Het jy meer gesit of skerms gebruik tydens die COVID-19 inperking?
9) Anything that you want to add? / *Is daar enige iets was jy wil byvoeg*?

APPENDIX E: HOUSEHOLD DIETARY DIVERSITY TABLE

	Prior to COVID-19		During COVID-19	
	Frequency (%)	n	Frequency (%)	n
Cereals				
Corn	64.3	72	68.8	77
Oats	70.5	79	75	84
Rice	82.1	92	87.5	98
Sorghum	4.5	5	7.1	8
Rye	5.4	6	8.9	10
White roots and tubers				
Potatoes	95.5	107	94.6	106
Sweet potatoes	71.4	80	77.7	87
Turnip	9.8	11	10.7	12
Green bananas	27.7	31	31.3	35
Chicory root	4.5	5	4.5	5
Dark green leafy vegetables				
Bean Greens	82.1	92	84.8	95
Broccoli	58.9	66	57.1	64
Kale	22.3	25	24.1	27
Lettuce	74.1	83	77.7	87
Spinach	78.6	88	80.4	90
Other vegetables				
Cabbage	64.3	72	70.5	79
Cauliflower	59.8	67	60.7	68
Cucumbers	75	84	71.4	80
Garlic	53.6	60	55.4	62
Mushrooms	67	75	67	75
Brussels sprouts	21.4	24	24.1	27
Fruits				
Apples	88.4	99	88.4	99
Figs	28.6	32	32.1	36
Guavas	29.5	33	32.1	36
Kiwis	21.4	24	28.6	32
Strawberries	46.4	52	50	56
Meats				
Animal organs	21.4	24	21.4	24
Beef	84.8	95	84.8	95
Lamb	43.8	49	51.8	58
Mutton	54.5	61	66.1	74
Pork	58.9	66	62.5	70
Chicken	91.1	102	90.2	101
Fish and seafood				
Fresh or dried fish	47.3	53	51.8	58
Canned fish	58.9	66	62.5	70
Crab	0	0	3.6	4
Oysters	2.7	3	5.4	6
Other shellfish	8.9	10	9.8	11
Legumes				
Chickpeas	20.5	23	19.6	22
Lentils	33	37	36.6	41

Peas	61.6	69	68.8	77
Peanuts	61.6	69	68.8	77
Soybean	7.1	8	8	9
Tree nuts				
Almonds	30.4	34	33.9	38
Cashew nuts	28.6	32	37.5	42
Chestnuts	4.5	5	10.7	12
Hazelnuts	25.9	29	33	37
Pecan nuts	36.6	41	40.2	45
Milk and milk products				
Full cream milk	71.4	80	73.2	82
Low-fat milk	26.8	30	27.7	31
Fat free milk	4.5	5	5.4	6
Milk alternatives	2.7	3	2.7	3
Yoghurt	69.6	78	64.3	72
Sweets				
Biscuits	82.1	92	88.4	99
Cakes	47.3	53	59.8	67
Candies	58	65	56.3	63
Chocolates	71.4	80	70.5	79
Jam/marmalade	70.5	79	74.1	83
Pies and pastries	51.8	58	63.4	71
Sweetened drinks and fruit juice	50.9	57	60.7	68
Spices, condiments and beverages				
Chillies	19.6	22	20.5	23
Tomato sauce, mustard	77.7	87	76.8	86
Herbs	51.8	58	57.1	64
Spices	69.6	78	68.8	77
Tea	82.1	92	83	93
Coffee	78.6	88	80.4	90
Beer	13.4	15	15.2	17
Wine	27.7	31	33.9	38
Other alcoholic beverages	9.8	11	13.4	15

APPENDIX F: PROOF OF LANGUAGE EDITING