Investigation of the food security situation and food consumption patterns in Grassland Phase 4 informal settlement in Mangaung, South Africa

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“IT DOES NOT MATTER HOW SLOWLY YOU GO, AS LONG AS YOU DO NOT STOP.”

Confucius

DECLARATION

I declare that this dissertation, titled "**Investigation of the food security situation and food consumption patterns in Grassland Phase 4 informal settlement in Mangaung, South Africa**", hereby submitted for the qualification of Master of Science in Department of Sustainable Food Systems and Development 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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ABSTRACT

The current food system must provide adequate access to nutritious food for people in poor communities. An inadequate food system can contribute to food insecurity and malnutrition affecting low-income households. Poverty in informal settlements (townships) is the main cause of the lack of physical and economic access to nutritious food. Challenges such as long distances to grocery shops, transport problems, increased inflation rates, low incomes, unemployment, and inadequate information about nutritious food mean that the food system needs to become more effective in distributing adequate food. Many low-income households rely on cheap and nutrient-poor cereals such as bread, maize flour, and rice without adding many other nutrient-rich food groups to their meals.

The objective of this study was to investigate the food security and consumption habits of households in Grassland Phase 4 informal settlement in Mangaung. The study looked at preparation and consumption patterns, coping strategies, access to water sources, location of food purchases, total household income, and household transport. Challenges in the food system prevent adequate access to food, making households in informal settlements such as Grassland Phase 4 vulnerable to food insecurity and poor consumption patterns.

The research design is quantitative, with a descriptive and exploratory approach. The sample size was 300, with compensation for incomplete questionnaires. In this study, a structured questionnaire with closed and open-ended questions was used to collect the required data. In this study, the software program EvaSys© was used to compile and construct the questionnaire. The HFIAS score, HFIAP indicator, and CSI score were used to determine the level of food insecurity. In this study, the FCS method was used to determine dietary diversity and frequency of food groups consumed. SPSS version 25 was used for basic descriptive statistics. The data collected were presented as frequencies and percentages in tables and graphs for each categorical question. Pearson and Spearman correlation coefficients were calculated in this study using the scaled data.

The results of the study show that 54% of the respondent population was female, and 78.5% of the household heads were in a productive and economically active age group of 21 to 59 years. Only 27.9% of the respondents had tertiary education. Most (73.8%) of the respondents occupied a shack or informal dwelling. The main income of the household came from social benefits (51.4%) and old age pensions (45.5%). The results showed that 4.7% of the households had an income of less than R1000 per month.

In addition, 19.4% of the households had no electricity and used a paraffin cooker to prepare meals. Many (66.8%) of the respondents used a minibus taxi for grocery shopping. The study found that 54.1% of households needed access to a water source for cooking. The HFIAS score of 3.32 showed that households had a medium level of food insecurity. The HFIAP category showed that 49.9% of households were food insecure, of which 17.8% were severely food insecure. These households went to bed hungry and sometimes had nothing to eat for a whole day. The CSI score of 41.8 indicates a moderate level of food insecurity. The FCS value of 31 indicates that the status of food security in Grassland Phase 4 is borderline (acceptable). This study thus shows that households are experiencing moderate to severe food insecurity and are consuming only certain major food groups. This study shows that the most consumed cereal was maize flour and the least consumed was whole grains. A process such as nixtamalization, which increases the nutritional value of maize, is essential for households where maize is consumed as a staple food, as maize contains little fibre and other nutritional components.

Keywords: Food system, food access, food security, food insecurity, informal settlements, townships, hunger, poverty, households, food consumption, food preparation, and dietary diversity.

TABLE OF CONTENTS

LIST OF FIGURES

Chapter 2 list of Figures

Chapter 3 list of Figures

Chapter 4 list of Figures

Chapter 5 list of Figures

LIST OF TABLES

Chapter 1 list of Tables

Chapter 3 list of Tables

Chapter 4 list of Tables

Chapter 5 list of Tables

LIST OF ABBREVIATIONS

%	Percentage
n	Number of respondents
BFAP	Bureau for Food and Agricultural Policy
CS	Community Survey
CSI	Coping Strategies Index
DAFF	Department of Agriculture, Forestry and Fisheries
DGAC	Dietary Guidelines Advisory Committee
EWN	Eyewitness News
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization
FBDGs	Food-based dietary guidelines
FCS	Food Consumption Score
GDP	Gross Domestic Product
GHS	General Household Survey
GNI	Gross National Income
GRiSP	Global Rice Science Partnership
HDDS	Household Dietary Diversity Score
HFIA	Household Food Insecurity Access
HFIAP	Household Food Insecurity Access Prevalence
HFIAS	Household Food Insecurity Access Scale
IFAD	International Fund for Agricultural Development
INDDEX	International Dietary Data Expansion

MMM	Mangaung Metropolitan Municipality
NDP	National Development Plan
OECD	Economic Co-operation and Development
PMBEJD	Pietermaritzburg Economic Justice & Dignity group
RDA	Recommended Dietary Allowance
SASSA	South African Social Security Agency
SDGs	Sustainable Development Goals
SPSS	Statistical Package for the Social Sciences
Stats SA	Statistics South Africa
UN	United Nations
UNICEF	United Nations Children's Fund
USDA	United States Development Agency
WDR	World Development Report
WEF	World Economic Forum
WFP	World Food Programme
WHO	World Health Organization
WPI	Worcester Polytechnic Institute

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND OF RESEARCH STUDY

The food system is not a linear process, but rather a complex system that needs to be examined to create a food secure future for South Africa (Hospes, 2014). The food system has a direct impact on a country's food security. The current food system is failing and is manifested in increasing hunger, malnutrition, increased vulnerability to disease and lack of diversity in the diet, leading to malnutrition, emaciation, stunting of children or obesity. All these aspects pose a risk of food insecurity, especially in poor communities (Von Bormann, 2019).

Research shows that about 2 billion people worldwide are affected by moderate to severe food insecurity. Food insecurity results in limited access to sufficient and nutritious food, putting people at risk of malnutrition and poor health (FAO *et al*., 2019). A variety of reasons can lead to people being unable to eat a healthy and nutritious diet. These reasons include inadequate income, housing instability and energy insecurity (King, 2016; FRAC, 2017). Low-income households are particularly vulnerable to food insecurity and poor nutrition caused by risk factors related to insufficient resources in a household (Hartline-Grafton, 2015). Risk factors can include a lack of affordable and healthy food, food deprivation cycles, overeating, limited access to health care, poor access to full-service grocery shops, poor water quality and poor housing conditions, leading to stress and anxiety (FRAC, 2017).

Inflation can directly affect any country's food security. South Africa's high inflation rate imposes unnecessary costs on economic growth and low-income households (Loewald, 2022). Low-income households spend a high percentage of their income on food and are therefore most affected by food inflation (Rossouw, 2022). Constantly rising food prices can make food unaffordable for the poor. Food categories such as meat, milk, vegetables, and fruits have a high inflation rate. As a result, these food categories have become difficult to access for poor households, leading people to choose low-quality diets that are high in salt, fat and sugar, which are cheaper compared to foods with high nutritional value (Hrisca, 2022). Research shows that people living in low-income households tend to buy affordable staple foods such as maize flour (consumed as cornmeal), bread and rice to alleviate the pain of hunger (The World Bank, 2016). According to Rojo *et al*. (2017), the impact of poor access to

healthy food/balanced meals cannot be underestimated as it often leads to malnutrition and obesity. Food insecurity does not only manifest itself as malnutrition, but can also be observed in overweight individuals, even if this seems paradoxical (Rojo *et al*., 2017).

Food-insecure households, mainly due to limited financial resources, may use coping strategies to stretch their budget, even if this has a detrimental effect on their well-being. These coping strategies include turning down medical care, foregoing necessary foods for special medical diets such as diabetic diets, relying on low-cost, high-energy but nutrient-poor diets, and using trade-offs between food and essentials such as transportation, utilities, and housing (Afulani *et al*., 2015; Mayer *et al*., 2016; Kushel *et al*., 2006).

1.2 MOTIVATION FOR THIS STUDY

The motivation for this research came from an informal settlement (Township) called Grassland Phase 4, informally referred to as "Khayelitsha" by the locals. This informal settlement includes about 2000 to 6000 households (Mphambukeli, 2015). Grassland Phase 4 is in Mangaung (one of South Africa's eight metropolitan municipalities), Bloemfontein, Free State (Ntema *et al*., 2018). Like many other informal settlements in South Africa, it lacks adequate infrastructure, most households do not have electricity, there are mainly unstructured dirt roads, there is a lack of social services, community services (most houses do not have a water source or toilet) and there is poverty and crime (Verster, 2012). Gangsterism has also become a major problem, leaving many residents fearing for their lives. As there are no streetlights in certain areas, many residents are mugged at night (Mphambukeli, 2015). A major reason for underdevelopment in Grassland Phase 4 is that many of the residents are immigrants and do not hold South African citizenship (Verster, 2019).

Many of the residents live in shacks (unstable structures built from various materials). According to Moletsane (2014), many of the residents of Grassland Phase 4 feel a sense of hopelessness due to the government's unfulfilled promises. High unemployment in the informal settlements leads to poverty, which in turn leads to food insecurity, affecting children the most (Verster, 2012). Households rarely consume vegetables and fruits. Grains are the most common food source because they are the most affordable for low-income households (Drimie *et al*., 2013). The lower dietary diversity puts these families at risk of malnutrition and health problems.

1.3 RESEARCH PROBLEM / PROBLEM STATEMENT

Sustainable Development Goal 2 states that there should be zero hunger for all, optimal food security, improved nutrition, and sustainable agriculture (UN, 2015a).

However, the responsibility for providing safe and nutritious food lies with all stages of the food chain, such as production, processing/preparation, trade, and consumption (FAO, 2003b). The final consumer is responsible for ensuring that food is prepared in a hygienic and safe environment and stored properly (FAO, 2003b). Webb & Rogers (2003) define the concept of food security as the situation in which adequate access to, availability and proper use of food are ensured. When people do not have daily physical or economic access to nutritious food, they are food insecure (FAO, 2002). The affordability and accessibility of food influences dietary diversity and food portions (Kearney, 2010). Almost 20% of South African households do not have adequate access to food and a varied diet (Stats SA, 2019; Maluleke, 2019). Many South Africans face hunger daily because the food system is unable to provide optimal access to varied food (Stats SA, 2019). In South Africa, many people live mainly on maize and maize products (Shiferaw *et al*., 2011). Maize flour products are used in food preparation and consumed daily (Lombard *et al*., 2013). The introduction of nixtamalization of maize can increase food security and reduce malnutrition in South Africa (Nesamvuni *et al*., 2022). Therefore, the availability of diversified foods and access to more nutritious foods should be improved.

1.4 PURPOSE OF THE STUDY (AIM)

The objective of this study is to examine the food security situation and consumption patterns in Grassland Phase 4 informal settlement in Mangaung. Factors such as household income, transport, consumption patterns, cereal consumption, food preparation, access to water, where food is purchased and coping strategies of Grassland Phase 4 households were investigated to assess the dietary diversity and food insecurity levels of these households. This research aims to identify and highlight the challenges experienced by Grassland Phase 4 residents in relation to food insecurity and diversity. The data obtained in this study could provide a well-defined description of the actual grievances in the current food system in Grassland Phase 4.

1.5 RESEARCH QUESTIONS

The aim of the study was to answer the following questions in relation to Grassland Phase 4 township in Mangaung:

- What do demographic characteristics tell us about households?

- How does household income influence the availability of nutritious food?

- How does food preparation (preparation methods, type of fuel and equipment used) influence the availability of nutritious food?

- To what extent do households in Grassland Phase 4 have access to adequate water sources?

- How does the location of shops and transport affect the availability of nutritious food?

What are the patterns of cereal consumption among households in Grassland Phase 4?

- What do patterns of food consumption tell us about household dietary diversity?

- What do coping strategies for dealing with food insecurity tell us about households' levels of food insecurity?

1.6 SIGNIFICANCE OF THE STUDY

The importance of this study is to identify the daily challenges faced by informal settlements that affect their food security and diversity. The study of Grassland Phase 4 informal settlement can provide the necessary knowledge to initiate change. Other informal settlements are likely to face the same challenges as Grassland Phase 4.

1.7. DEFINITION OF TERMS

Table 1.1: The following terms are frequently used in this thesis:

Key term	Definition
Food security	It measures an individual's ability to access (both physical and economic) food that is nutritious and sufficient in quantity (Fahy, 2021).
Food insecurity	Food insecurity is defined as a lack of access to proper amounts of food necessary for each member of a household to lead an active and healthy lifestyle (Gajanan & Babu, 2022).
Food system	The food system is a complex of activities involving food production, processing, transport, and consumption (Tendall *et al*., 2015).
Food access	It is the ability to source adequate and nutritious food for our individual needs (Lee, 2020).
Malnourished	Malnutrition is an imbalance in dietary intake, and it occurs when a person's body absorbs too little or too many essential nutrients by overeating or not eating enough food (Brazier, 2022).
Nutritious food	Nutritious food provides beneficial nutrients and minimises potentially harmful elements (Drewnowski, 2005).
Poverty	It is a state where one needs more access to basic needs such as food, clothing, and shelter due to the absence of money (Okalow, 2022).
Informal settlement	In South Africa, informal settlements are housing areas often illegally built on municipal land by the country's impoverished population (WPI, 2015).
Hunger	Hunger is defined as a persistent state of physical and psychological harm caused by a lack of nutritional food (Krajewski, 2017).
Household income	Household income is defined as the total gross income before taxes received within 12 months by all household members (Scott, 2022).
Transport	It is a system for taking people or goods from one place to another using a bus, train, car, or taxi (Collins, 2022).

Consumption	Consumption means using, buying, or eating something and using economic goods to satisfy needs (Bellisle, 2019; Vocabulary.com, 2022).
Food preparation	It involves getting raw ingredients and processing them to be ready for consumption (Muscato, 2021).
Diet diversity	Diet diversity refers to the number of food groups consumed over a particular period (Gonete *et al*., 2020).
Nixtamalization	It refers to a traditional maize preparation process in which dried kernels are cooked and steeped in an alkaline solution (Orchardson, 2021).

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

One in ten of the 7.4 billion people on earth have no food and experience hunger every day (Mann, 2017). Ensuring that the current food system provides adequate food security worldwide is an ongoing challenge. Many factors can contribute to household food insecurity in South Africa, such as rising food prices, population growth, climate change, conflict and instability, inadequate access to food and poverty (Manning, 2021). This chapter discusses the determinants, challenges, and consequences of food insecurity. The concept, classification, definition, including the four dimensions of food security, and measurement methods of food security are discussed in this chapter. This chapter outlines the levels and global perspective of food security. The impact of poverty and the influence of the current dysfunctional food system on food insecurity are discussed. Grains are the cheapest and the main source of food consumed by food insecure households in South Africa. Therefore, the history, background and influence grains on food security will also be discussed.

2.2 THE CONCEPT AND DEFINITION OF FOOD SECURITY

Food security is a multidimensional phenomenon. In the 1970s, when there was a global food crisis, the concept of food security focused on price stability and food availability as commodity prices fluctuated wildly and currency was affected (Clay, 2002). The phenomenon of hunger, famine and food crises called for a definition of food security that considers the needs of vulnerable people (Berry *et al*., 2015 & Shaw, 2007). The first definition of food security came from the World Food Summit in 1974. Food security was defined as "the adequate availability of food to support the expansion of food consumption and to reduce fluctuations in food production and prices" (UN, 1975).

Based on further research on food security, FAO revised the definition of food security. According to the revised definition, economic and physical access to food must be possible. The focus on food availability shifted to a broader approach due to a better understanding of the food security crisis, which led to an expansion of the FAO definition of food security. The FAO definition now includes access to food for

vulnerable people, and economic access to food also became part of the concept of food security (Berry *et al*., 2015). Therefore, the new FAO (1996) definition defines food security as a situation "...in which all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and preferences for an active life." This FAO definition, established at the 1996 World Food Summit, refers to food security at both national and household levels (FAO, 1996). Webb & Rogers (2003) explain the concept of food security as a situation in which there is adequate access to, availability of, and proper use of food. Food insecurity is when people do not have daily access to nutritious food (FAO, 2002).

2.3 CLASSIFICATION OF FOOD INSECURITY

Food insecurity is classified as chronic or transitory (acute). FAO (2008) defines chronic food insecurity as a situation where people do not have enough food for a prolonged period. The cause is usually a lack of financial resources due to poverty. Chronic food insecurity is usually the result of poor food production practises and low income, making food unattainable (National E-agriculture Solutions, 2017). Chronic food insecurity is usually prevalent when structural or market failures occur repeatedly in a nation (Misselhorn *et al*., 2010). According to Matemilola & Elegbede (2017), chronic food insecurity can be described as persistently inadequate nutrition caused by the inability to obtain, purchase, or produce sufficient food.

Acute/temporary food insecurity is defined as short-term and usually requires immediate action to save livelihoods. It is usually the result of a shock or emergency such as droughts, conflicts, floods, storms, or a sudden increase in food prices. Such an event requires the support and assistance of national and international organisations, including the private sector, to provide food aid or other life-saving interventions (National E-agriculture Solutions, 2017). Temporary food insecurity is usually more severe than chronic food insecurity, as it can lead to famine and starvation (Staatz *et al*., 2009).

2.4 DIMENSIONS OF FOOD SECURITY

The four pillars of food security include food access, food availability, food stability/vulnerability and food utilisation (Russell *et al*., 2011). Each dimension is discussed individually below. The four dimensions are interdependent and interrelated, and food security can only be achieved if all four dimensions are present. The weight of each dimension is context and country specific (Berry *et al*., 2015).

2.4.1 Food access

South Africa is food secure at a national level, but not all households have access to adequate food due to the country experiencing food insecurity at the household level (Stats SA, 2019). Research shows that about 20% of households experienced inadequate food access in 2017 (Stats SA, 2019). Food access can be defined as the ability of people to acquire adequate food for a nutritious diet (Russell *et al*., 2011). Food accessibility mainly depends on household income, prices, and distribution. When households have obtained sufficient, diverse, and good-quality food, only then is food accessibility achieved (Maluleke, 2019). According to Nord *et al*. (2009), people from rural areas have restricted access to food due to the distances they must travel to and from the markets and often need adequate transport. Households with many dependents were more susceptible to severely inadequate food access than smaller households. Regarding demographics, households with black Africans and people of colour were more prone to inadequate access to food than white and Indian/Asian-headed households (Stats SA, 2019).

Food access encompasses both economic and physical factors. In contrast, the economic factor relates to the financial means, and the physical factor relates to where food can be obtained (Staatz *et al*., 2009). Several factors influence access to food, such as employment status, gender, and age, according to Benson (2004). A study by Musemwa *et al*. (2013) indicates that the most common factors influencing food access are increased food prices, unemployment, gender, household size, agricultural training, and educational level. According to Choudhary *et al.* (2007), many households may have different available food for each member. Therefore, household food security is not a guarantee for individual food security.

2.4.2 Food availability

According to the USDA (2006), food must be made available in optimal quality and quantities to achieve food security. The FAO (2006) states that food availability requires that sufficient food of good quality should be made available to every human being. Food can be available nationally through commercial imports and exports, domestic food stocks and food aids. Unfortunately, food availability only guarantees food access due to factors such as specific government policies and institutional structures (Page & Redcliff, 2002). The factors that create challenges in the availability and supply of food are ineffective transportation, political instability, riots, and wars (Benson, 2004).

2.4.3 Food stability

The concept of food stability refers to food that is available and accessible for an extended period. Food stability occurs when one consistently has access to food, and no household or individual should be at risk of inadequate access to food (Russell *et al*., 2011). Drimie *et al*. (2009) refer to food stability as food security maintained over time. Food instability can occur due to unemployment, high prices, or climatic and economic shocks.

2.4.4 Food utilisation

Food utilisation is defined as food consumption by an individual or household (Russell *et al*., 2011). WFP (2007) states that food utilisation should safely provide sufficient food of good quality to a household or individual. According to Devereux and Maxwell (2001), proper food utilisation involves adequately extracting nutrients from food. For this to occur, the food must be prepared, distributed, eaten, and stored correctly. Certain factors limit optimal food utilisation. These factors are inadequate sanitation, unclean water, the loss of nutrients during food production, and insufficient health care (Yin *et al*., 2008).

2.5 LEVELS OF FOOD SECURITY

2.5.1 Global food security

Food insecurity may appear at a global, national, household, and individual level (Hart, 2009). Global food insecurity ensures that people on both national and sub-national levels have sufficient food access worldwide and focuses on what factors may influence food distribution internationally and domestically (Ecker & Breisinger, 2012). The five chain activities of the food system, namely: production, processing, distribution, and consumption, also influence food security globally (Misselhorn *et al*., 2010). Global food security is influenced by political, economic, social, and ecological factors, which determine whether people worldwide are food secure or food insecure (McDonald, 2010).

2.5.2 National food security

According to Labadarios *et al*. (2009), national food security occurs when a country can supply adequate food through food imports or national production. Factors that can influence national food security are economical, climate, and land degradation (FAO, 2008).

2.5.3 Household food security

When all members of the household have proper access to nutritious food to sustain a healthy life, food security is achieved (Tonukari & Omotor, 2010). Factors influencing household food security are the number of household members, income status, employment status, food production, and health status (Labadarios *et al*., 2009).

2.5.4 Individual-level food security

Individual-level food security occurs when an individual experience the sensation of hunger and do not have the resources to obtain sufficient food (Labadarios *et al*., 2009).

2.6 GLOBAL PERSPECTIVE ON FOOD SECURITY

During 2020, about 720 to 811 million people experienced hunger worldwide (FAO, 2021). The COVID-19 pandemic has taken a toll on the global food systems, compromising the ability to feed the world's 7.9 billion people. The United Nations' Sustainable Development Goal to end hunger by 2030 has become more challenging (WEF, 2022). The primary purpose of the FAO is to ensure that all people worldwide have access to enough food to ensure a healthy life and that households become food secure (McDonald, 2010). Figure 2.1 shows that undernourished people continued to rise in 2020.

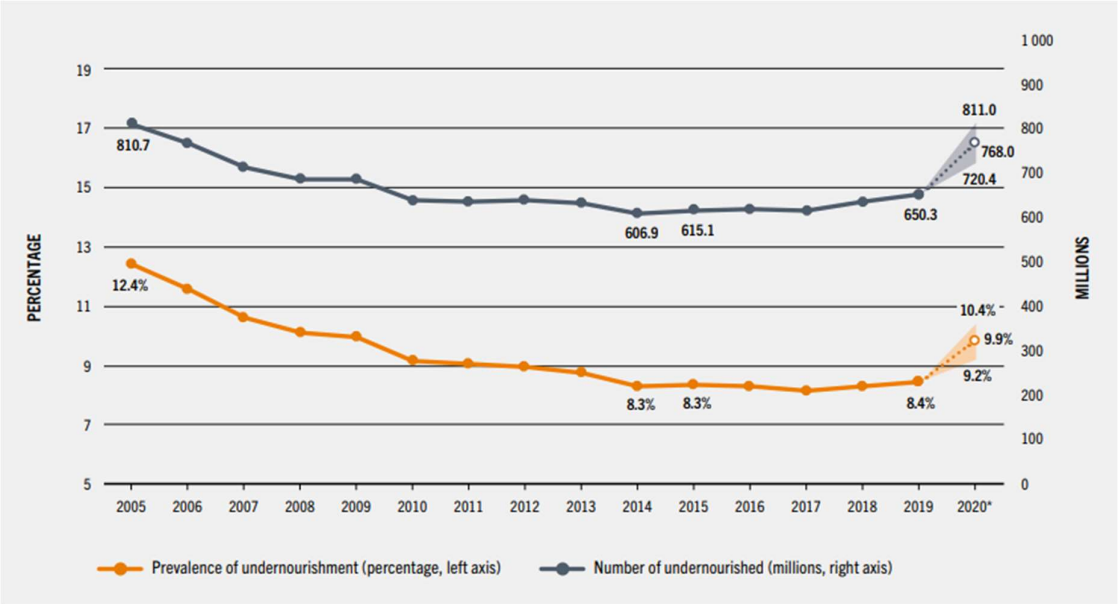


Figure 2.1: The rise in the number of malnourished people from 2005 to 2020 (WEF, 2022).

2.6.1 Factors that influence food security from a global perspective

Many factors exacerbate food security in today's global environment. Even though we live in an age where more food is produced than ever, we still need to properly feed the world's population.

2.6.1.1 Inadequate food distribution

Worldwide food needs to be distributed equally and culturally appropriately around the globe (Hazell & Wood, 2008). The three areas of global concern that significantly impact food security are overpopulation, urbanisation, and climate change. Countries around the world where demand often exceeds supply are those countries with high population and birth rates (Ericksen, 2008). Limited food sources and inadequate food distribution causes an increase in diseases and exacerbates already existing health conditions (Wakabi, 2006).

2.6.1.2 Climate change

Rising temperatures, frequent extreme weather, and water scarcity impact food distribution systems and production. Climate change has reduced agricultural productivity by 21% since 1961 (Brenton *et al*., 2022). Climate change creates considerable uncertainty about future water availability. Increased water scarcity will present a significant challenge to food production and availability, impacting the livelihoods of the poor and the income of small-scale food producers (FAO, 2015).

2.6.1.3 Urbanization

Urbanisation is defined as an “increase in the proportion of a population living in urban areas” and the “process by which a large number of people becomes permanently concentrated in relatively small areas, forming cities” (OECD, 2012). Urbanisation poses a predicament to food availability regarding evolving food production and consumption patterns (Szabo, 2016). Land-poor households are often considered the poorest because they cannot produce adequate food to feed their families (FAO, 2011).

2.6.1.4 Conflict

Conflict has been a factor in social unrest and induced food insecurity. A lack of food has been the source of conflicts in the past and present. Competition for food production is a major cause of conflict due to the pressure on land and water to feed the growing population (WDR, 2011). Conflict can negatively affect every part of the food system, from harvesting, production, processing, and transportation to marketing and consumption. Conflict’s direct impacts on food security include the destruction of livelihood and agricultural assets, which can disrupt the movement of goods and

services. Conflict can negatively affect food prices and the availability of nutritious food (Whiting, 2022). Conflict affects food-insecure households by reducing the availability income and production income, increasing the time that poor households must eat less preferred foods, the smaller portion size of meals and limiting the variety of foods consumed (Lin *et al*., 2022). The current Russia-Ukraine war crisis has a definite effect on food security. Together they account for 29% of the world's grains; thus, grains worldwide have become more expensive. The crises also impacted oil prices, affecting transport and food prices (The World Bank, 2022).

2.7 FOOD SECURITY: POVERTY AND HUNGER

There are about 1.2 billion people who live in extreme poverty globally, and most of these people, including children, are malnourished, which leaves little doubt that poverty is the main contributor to food insecurity. To achieve food security, especially in informal settlements, which are the poorest of communities, strategies need to be developed to improve the livelihoods of these communities (UN, 2015b). The FAO (2011) and the European Commission (2009) indicate that low-income households are the most vulnerable to food insecurity. Women from low-income households experience food insecurity more often than the rest of the household because they spend most of their income and energy on the needs of children, purchasing and preparing food (FAO, 2011). Low-income households find it difficult to sometimes purchase plenty of fruit and vegetables due to disproportionate increases in the prices of fruit and vegetables (Rossimel *et al*., 2015).

Transportation difficulties may influence the purchase of fresh produce. In most of these rural areas, the cost of healthy foods tends to be more expensive than that of less nutritious foods, increasing the purchase of less nutritious foods (Pollard *et al*., 2014). Financial illiteracy is another factor that contributes to food insecurity. People who are not financially literate do not know how to save money and therefore are not protected during financial instability (Carlin & Robinson, 2010).

The elderly tends to be very vulnerable to food insecurity (Oldewage-Theron & Egal, 2021). In low-income households, most elderly enter this phase of their lives after a lifetime of poverty, poor diet, and inaccessibility to proper health care. Most low-income households where the head of the household is an elderly adult who receives

an old-age pension tend to be more food insecure than a household that a younger person runs, and this is because the older person must share their pension with the rest of the household (Charlton & Rose, 2001).

2.7.1 Food security: poverty and hunger in South Africa

Poverty lines estimate the poverty in a country. Poverty lines can be used as statistical tools to report on poverty and the evaluation, planning and monitoring of poverty reduction programmes. The country's official national poverty lines were published in 2012 by Stats SA (2021). Stats SA used a cost-of-basic-needs approach to develop the poverty lines, which link welfare to the consumption of goods and services. The constructed poverty lines (Figure 2.2) contain food and non-food components of a household's consumption expenditure (Stats SA, 2021).

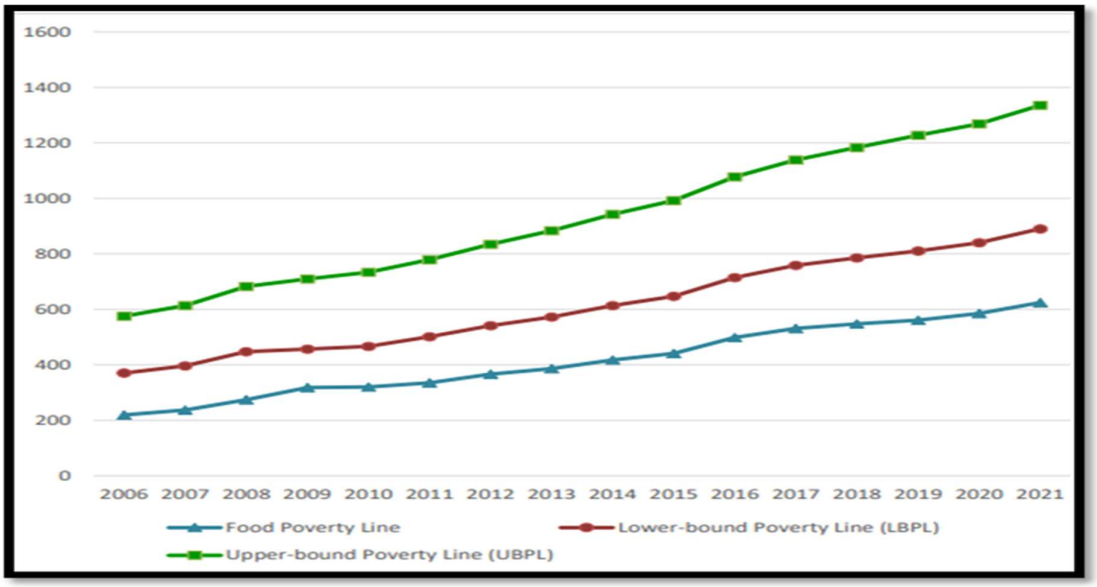


Figure 2.2: Inflation-adjusted poverty lines of South Africa from 2006 to 2021 per person per month (Writer, 2021).

The inflation-adjusted national poverty lines for 2021, according to Stats SA (2021), are the food poverty line, the lower-bound poverty line, and the upper-bound poverty line.

Food poverty line: The food poverty line is R624 per person per month, which is the extreme poverty line. This amount refers to the amount of money available to a person for their minimum required daily food intake (Stats SA, 2021).

Lower-bound poverty line: The lower-bound poverty line is R890 per person per month and refers to the food poverty line amount plus the amount derived from non-food items whose total expenditure is equal to the food poverty line (Stats SA, 2021).

Upper-bound poverty line: The upper-bound poverty line is R 1335 per person per month. This poverty line refers to the food poverty line plus the average amount derived from non-food items of households whose food expenditure is equal to the food poverty line (Stats SA, 2021).

A person living on less than R890 in 2021 was considered poor, and according to the South African National standards, people living on R624 per month were living below the poverty line (Galai, 2021). The Pietermaritzburg Economic Justice & Dignity group (PMBEJD) indicated that approximately 13.8 million people in South Africa live below the food poverty line, and about 30.4 million people live below the upper-bound poverty line. The PMBEJD group shows that food prices have increased significantly, with a 10% rise from 2020 to 2021 (Staff Writer, 2021).

The annual consumer price index inflation rate reached a 7.4% high in the last thirteen years due to the Russia/Ukraine conflict, which disrupted the commodity markets. The increase in food prices was exacerbated by the frequent load-shedding/prolonged power outages (Attaché Report, 2022). It cost approximately R4700 to feed a South African household in 2022, with the average cost of the Household Food Basket at R 4748 in July 2022. The household food basket comprises 44 core items most frequently purchased by lower-income households. The following food items have shown an increase in price by June 2022: cooking oil (+13%), green pepper (+10%), cake flour (+7%), onions (+6%), curry powder (+6%), brown bread (+5%), Cremora (+5%), apricot jam (+5%), white bread (+4%), maize flour (+4%), margarine (+4%), salt (+4%), chicken feet (+3%) canned beans (+3%) Maas (+3%) cabbage (+3%) and samp (+3%) (Pillay, 2022).

Statistics from 2009 indicated an increase in poverty during the 2008 global economic recession, which greatly affected low-income households in South Africa (Maluleke, 2019). In 2015, an income gap of 51% was stipulated, which clearly shows the inequality in South Africa, which limits proper access to food in low-income households, especially in informal settlements (Maluleke, 2019). The high unemployment rate of 33,9% in South Africa caused by slow job creation also

contributes to decreased access to food aggravating food insecurity (Stats SA, 2022; Maluleke, 2019). Figure 2.3 shows that there has been a drop in the occurrences of hunger among South Africans from 2002 to 2017, from 13,5 million to 6,8 million. About 1,7 million households are still affected by food insecurity and daily hunger (Stats SA, 2019).

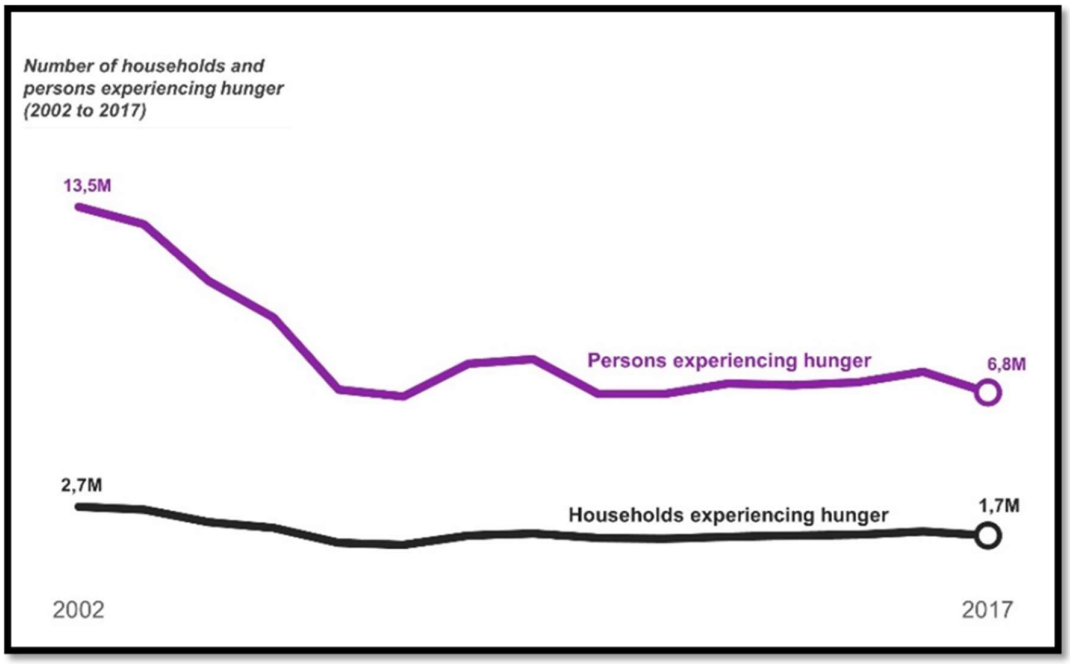


Figure 2.3: Households and individuals experiencing hunger in South Africa (Stats SA, 2019).

Various studies, including the National Development Plan (NDP), suggest a strong correlation between poverty, unemployment, inequality, and food insecurity in South Africa (FAO, 2017; Wight *et al*., 2014). Research by the NDP indicates that food insecurity is the cause and the consequence of poverty. Former apartheid policies of South Africa that supported segregation and racial inequality contributed majorly to poverty which had a long-term effect on food insecurity in the disadvantaged communities (Bhorat & Kanbur, 2006).

Research indicates that household food security in South Africa depends more on household income than household food production, which means that people are more likely to depend on any form of income to buy food rather than to produce their own food (Hendriks *et al*., 2006). The South African government has implemented an inter-ministerial National Food Security Plan to promote food security. The government's essential priorities are reducing poverty, decreasing unemployment, and increasing economic growth, rural development, and agricultural production (Maluleke, 2019).

Agricultural production in South Africa is vital to ensure optimal food security and cannot be emphasised enough (FAO, 2004).

Agricultural policies (developed by DAFF) enable South Africans to grow and produce their own food (Maluleke, 2019). These policies ensure that people can support themselves by producing food, which will alleviate poverty. Sufficient agricultural production also increases wages and income for farmers and farm workers, decreasing unemployment and positively affecting the economy (Von Braun, 2007). Decreased agricultural activities can be attributed to the droughts that South Africa has experienced since 2015, and these droughts negatively affected food accessibility and availability in South Africa (Maluleke, 2019).

2.7.2 The influence of social grants on food security in South Africa

The South African government introduced social grants paid by SASSA to help alleviate hunger and poverty in low-income households, which has improved food security in poor households (Chakona & Shackleton, 2019). Social assistance grants ensure that the poor have fundamental human rights and a dignified life. It alters the levels of inequality slightly, but it has significantly reduced poverty in poor households (OECD, 2010).

The South African social grants programme is a significant government attempt to financially support people who cannot support themselves (Woolard *et al*., 2010). The social grants available include the Old Age Grant, Disability Grant, Child Support Grant, Foster Child Grant, War Veteran's Grant, Dependency Grant, Social-relief of Distress Grant, Grant-in-Aid, Covid-19 Social-relief of Distress Grant (Kelly, 2017; SASSA, 2013).

Since April 2022, the Old Age Grant, Disability Grant, Care Dependency Grant, and the War Veteran's Grant values have been R1980 per month (Human, 2022). The value of the Grant-in-Aid and the Child Support Grant are R480 per month from April 2022, and the Foster Child Grant is R1070 per month. The Social Relief of Distress Grant is granted monthly for three months, and an extension of a further three months may occur in certain circumstances. The Covid-19 Social Relief of Distress Grant is temporary and was extended until March 2023, paying R350 per month (Kelly, 2017; Human, 2022).

These grants intend to reduce the effects of low income on vulnerable members of society, such as the elderly, children, and people with disabilities (Grobler, 2015). The national proportion of grant beneficiaries has rapidly increased (Brockerhoff, 2013; Grobler, 2015). In 2017, monthly social grant payments expanded to more than 17 million beneficiaries nationally, and more than half of South African households received at least one social grant from the government (Devereux, 2017). The total number of social grants has increased from 17 million to 18 million between 2017 and 2021. The major drivers for the increase in social grants were the Old Age Grant, Child Support Grant, and the Grant-in-aid (Kosie, 2022).

2.7.3 Covid-19 influence on poverty and hunger in South Africa

The outbreak of the Covid-19 pandemic presented the world's greatest challenge since the Second World War and the formation of the United Nations (UN, 2020). Research indicates that the SARS-CoV-2 virus was responsible for Covid-19 in 2019 in China, Wuhan City (UN, 2020). The pandemic has caused a devastating economic shock to the livelihoods of low-income households worldwide and has negatively affected the food system. The disparate economic impacts of the pandemic caused hardship for low-income families and people of colour, women, and parents (Benton *et al*., 2021).

The lockdowns implemented during the Covid-19 pandemic decreased the spread of the virus, causing significant economic turmoil and disruptions which resulted in many people's income loss and livelihoods (Stats SA, 2022). The pandemic affected female-headed households the most because almost half of the female-headed households did not have an employed person in 2020. The disruption to the food supply system brought on by the Covid-19 pandemic has led to a decrease in purchasing power, a high percentage of food demand, and an increase in food prices (Hossain, 2020; Weissman *et al*., 2020). This disruption has negatively influenced the accessibility of food in South Africa. The government intervened by helping poor communities access food during the pandemic and lockdown (Hossain, 2020). The government and non-government organisations distributed food to vulnerable households to secure food security. Approximately 500 billion rands in Covid-19 financial support were set aside for food distribution and socioeconomic relief (Fourie, 2020). The government tasked SASSA to drive the social distress programme aimed at the most vulnerable during

the first 21 days of the lockdown (EWN, 2020). This programme was temporary, and the plan was to deliver food weekly to all vulnerable households. However, the government mismanaged the finances for this programme, and the distribution of food parcels was planned poorly (Fourie, 2020).

2.8 THE FOOD SYSTEM AND FOOD SECURITY

The food system links the activities of production, aggregation, processing, distribution, consumption, and disposal of food together that was manufactured in an agricultural environment (UN, 2018). The food system also involves a few sub-systems, such as the input supply system, the waste management system, and the farming system. These sub-systems also interact with other essential systems, such as health, trade, and energy. A sustainable food system ensures everyone is food secure and receives proper nutrition in a profitable way, benefits society, and positively affects the natural environment. Therefore, it must be socially, economically, and environmentally sustainable. (FAO, 2018).

An important role of the food system is to improve diet quality to prevent insufficient nutrition in the human population (Global Panel, 2016). Figure 2.4 represents consumer purchasing power's influence on diet quality and how food environments influence expended income. Food environments cater for various purchasing and consumption choices for the consumer while providing ideas on how to spend their income on food. The food environment also shapes the food culture, attitudes, beliefs, and preferences of the consumer in a broader sense (Herforth & Ahmed, 2015; Hawkes *et al*., 2015). The food environment (Figure 2.4) is, in turn, influenced by broader food systems, and they provide numerous opportunities to improve diet quality (Global Panel, 2016).

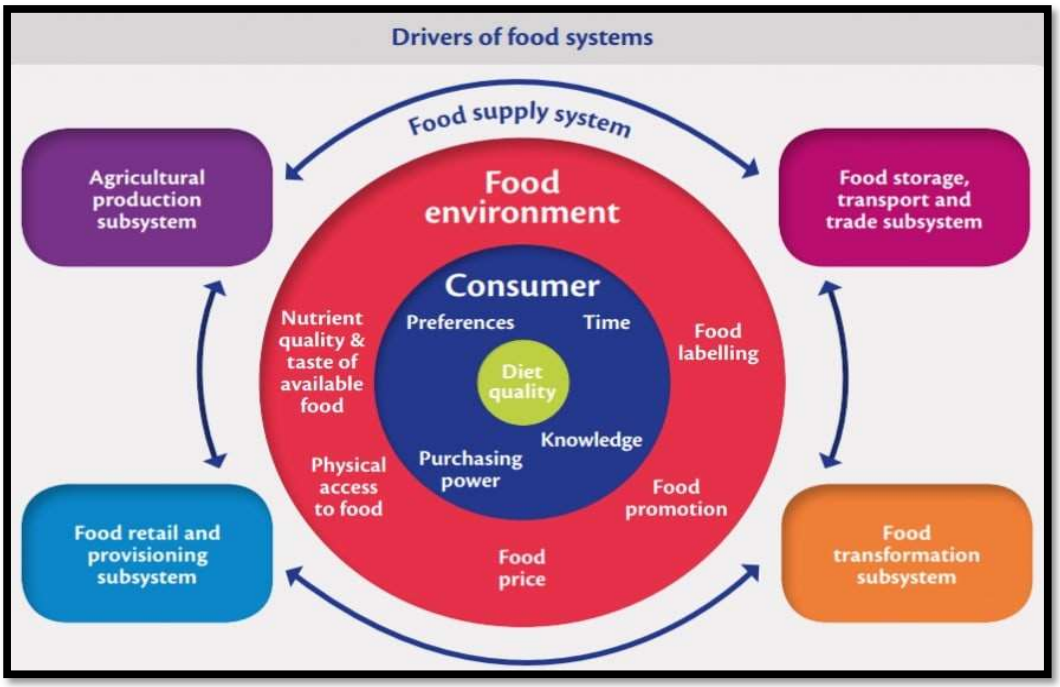


Figure 2.4: Drivers influencing the food system (Global Panel, 2016).

2.9 THE CURRENT FOOD SYSTEM OF SOUTH AFRICA

The current food system of South Africa ensures sufficient food to meet every person's calorie requirement, but still, about 22% of households have inadequate access to food (Von Bormann, 2019). In comparison, 33% of all food produced in South Africa goes to waste. A few signs indicate that the food system is failing us. These signs are increased poverty, malnutrition, hunger, child stunting, lack of diversity in diet, and increased consumption of high calorie processed foods that are low in nutritive value, which leads to vulnerability to diseases such as obesity (Termeer *et al*., 2017; Von Bormann, 2019). All these signs pose a significant risk to public health and people living in poverty because they are the most food insecure (Von Bormann, 2019). Studies show that by 2050, a 50% increase in production is necessary to meet the dietary requirements of about 10 billion people worldwide. In South Africa, an increase in population to about 73 million people will cause a rise in the demand for food products such as meat and milk, with demand expected to increase to 200% (Von Bormann, 2019). Income and population growth are linked to a resource-intensive diet, leading to more waste and further environmental stress. A food system transformation is necessary to achieve food security for all and to provide a sustainable food supply to meet the nutritional demands of the growing population worldwide. Therefore, the

impacts of poverty and ecological and climate change must be addressed and improved (Von Bormann, 2019; Lawrence, 2014).

The current food system directly influences the well-being and health of its people while also influencing economic productivity directly with long-term implications (Termeer *et al*., 2017). South Africa is nearly reaching the World Summit goal of decreasing the undernourished population to 50%. However, it is still burdened with significant challenges, such as increased non-communicable diseases and obesity, major nutrient deficiency conditions, stunting and hunger persistence (Von Bormann, 2019).

Food consumption patterns high in sodium, sugar, and saturated fats are highly processed, energy-dense, and low in nutrition and have become readily available, affordable, and, unfortunately, socially acceptable (Von Bormann, 2019; Feeley *et al*., 2009). Research stipulates that food-related diseases such as diabetes, coronary heart disease, and stroke already caused a loss of R27 million to South Africa's Gross Domestic Product (GDP) from 2006–2015 (Von Bormann, 2019).

Ecosystems and natural resources of the world influence the food system. In South Africa, the agricultural sector uses about 60% of the country's water resources, with most of the natural water resources distributed unevenly across the country. This water usage means that an increase in irrigation for the growth and production of food will have an immense impact on the energy and water systems of the country (Carter & Gulati, 2014).

Food waste in South Africa is a considerable factor negatively affecting the current food system (Nahman & De Lange, 2013). Research indicates that in 2013, food waste accounted for about 10 million tons, with cereals, fruits, and vegetables accounting for about 70% of the wastage, which occurs early in the food supply chain. According to Nahman and De Lange (2013), food waste in South Africa is calculated to be around R61,5 billion (2,1%) of the national GDP, which is a substantial financial burden for a country with significant poverty, malnutrition, and hunger. Reduction in food waste and loss can be achieved by diverting excess food from becoming food waste, thereby significantly improving the food system (Oelofse & Nahman, 2013). Food affordability is another challenge impacting the food system, which is influenced by factors such as high poverty levels, increased delinked livelihoods from agriculture, and the high

reliability of households on social grants (Pereira *et al*., 2014; Thornton, 2008). The rural areas are increasingly relying on supermarkets and local stores rather than growing and producing food themselves due to deagrarianisation trends. Most households cannot invest in food production (Thornton, 2008). Low-income households in South Africa are the most susceptible to increases in food prices. They spend approximately 35% of their income on food purchases, making these households vulnerable to malnutrition and hunger (McLachlan & Landman, 2013; Schönfeldt *et al*., 2010). Many low-income households cannot afford a nutritionally diverse diet and rely heavily on maize meal porridge to alleviate hunger and achieve satiety. The problem with consuming maize porridge in excess to alleviate hunger is that it does not meet the nutritional demands of the human body. Even with commercially produced maize that is fortified, it still does not meet the nutritional requirements of the Recommended Dietary Allowance (RDA). Therefore, people living in informal and rural settlements are more severely affected by sudden price increases and are more vulnerable to an unbalanced and less nutritional diet (Schönfeldt *et al*., 2013).

2.10 HISTORY AND BACKGROUND OF GRAINS

According to Diamond (1997), archaeological discoveries indicate that people consumed certain forms of grains (barley and wheat) since 8000 BC, but according to National Geographic (2011), the earliest consumption of grains was discovered in western Asia at about 75 000 years ago. These grains were emmer and einkorn, the early variants of today's wheat. People of ancient times consumed grains like we do today, in the form of flour, to make bread, such as steamed rice, oatmeal, and beer, which were low in alcohol content but high in carbohydrates. Ancient civilisations such as the Egyptians used grains as a form of currency and as wages to pay the workers who built the pyramids (National Geographic, 2011). The importance of grains throughout the history of humanity cannot be emphasised enough, as it was and still is, used in many religious festivities and symbolism. Research indicates that grains are the world's most vital crop and have numerous varieties (Brown, 2015: 345). The FAO (2022) states that by 2030, the demand for grain will increase to 2.7 billion tons while global production will only reach 2.1 billion tons. The global food production of grain will need to increase by at least 50% by 2050 to feed the growing population (Erokhin, 2017).

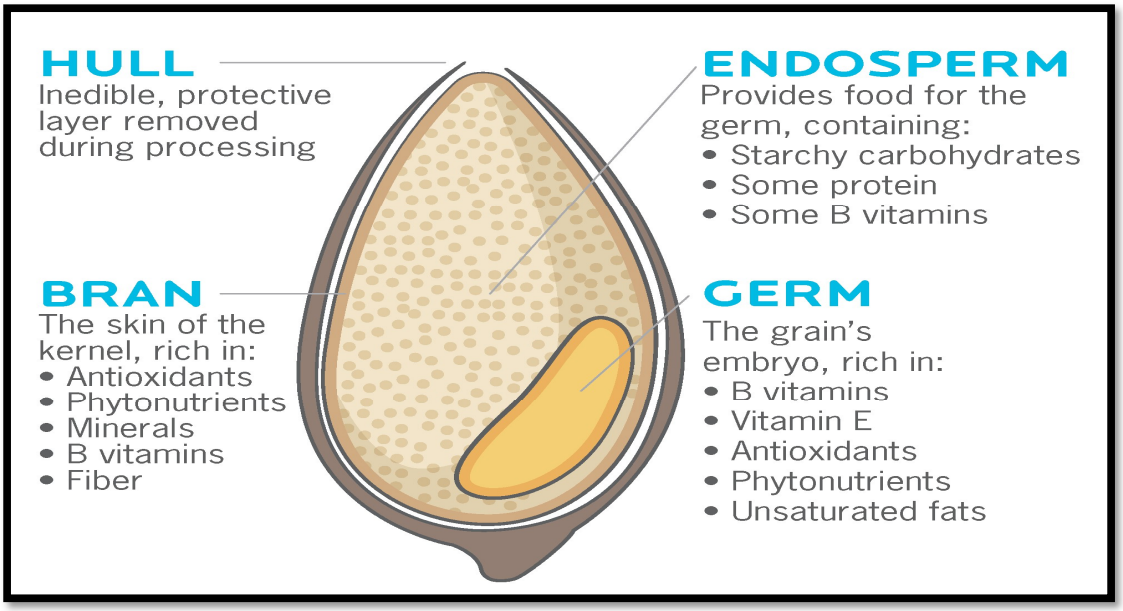


Figure 2.5: Anatomy of a grain (Precision-nutrition, 2021).

Grains are the hard and edible part of the seeds (Figure 2.5) of grasses that come in many varieties (Brown, 2015:345). Grains are also cereals and are consumed globally as a staple food. The most common varieties of grains are wheat, rice, corn (maize),

and barley, which account for 95% of the world's grain production. The remaining 5% comprises oats, millet, rye, and sorghum (Brown, 2015:345). Grains constitute the most significant component of the recommended daily intake in all dietary guidelines, with about 48% of the calories from grains the human body needs to meet its energy demands (Flight & Clifton, 2006; National Geographic, 2011). Grains have numerous health benefits because of their rich nutrient content: fibre, vitamins, minerals, and antioxidants. Eating a balanced diet of grains could decrease cardiovascular disease, blood pressure, type 2 diabetes, colorectal cancers, and better weight management (Slavin *et al*., 2001; Ye *et al*., 2012).

2.10.1 Whole grains

A whole grain is the entire seed (kernel) of a grass plant, consisting of three edible parts: the bran, germ, and endosperm (Gunnars, 2017). These grain parts contain fibre and other nutrients, which is good for the human body. Therefore, health experts urge people to include whole grains in their diets (Lapid, 2021). The bran is the hard part or skin of the kernel and is high in nutrients. The germ is the plant's embryo responsible for developing a new plant and is the nutrient-rich core (Gunnars, 2017). The endosperm is the biggest part of the kernel and provides enough food for the plant to grow (Gunnars, 2017). The inedible part, namely the husk, which encloses the kernel, protects the kernel from excess sunlight, water, diseases, and pests. Brown rice, whole-grain bread, whole-grain pasta, oats, barley, rye, and wheat are examples of whole-grain foods (Van der Kamp, 2013). In 2015, the DGAC recommended that "to improve dietary quality, the US population should replace most refined grains with whole grains" (Office of Disease Prevention and Health Promotion, 2015). Maize is a whole grain that is low in fibre and, therefore, is not included in the fibre-oriented recommendations for dietary intake (Van der Kamp, 2013).

2.10.2 Refined grains

A refined grain is a grain in which the bran and the germ have been removed through milling to create a grain with a finer texture and to ensure a longer shelf life (Pruthi, 2020). The disadvantage of a refined grain is that many essential nutrients, such as fibre, are absent. Food products made of refined grains are sure crackers, desserts, white bread, white pasta, and white rice (Gaesser, 2019).

2.10.3 Enriched grains

Enriched/fortified grains (like breakfast cereals) are refined grains to which certain nutrients have been added to replace those nutrients, such as the B vitamins lost during the milling process (Pruthi, 2020). Enriched grains decrease nutrient deficiency diseases and other lost vitamins and minerals, including protein, fibre, calcium, iron, and magnesium. Certain whole grains may also be fortified (Spencer, 2017).

2.10.4 Grains with complete and incomplete proteins

Grains are rich in carbohydrates and other important nutrients, providing all living organisms with the necessary energy to live. However, unfortunately, certain grains often lack some of the important proteins (National Geographic, 2011). Protein is a nutrient essential for every biological process in all living organisms, and protein is responsible for maintaining body structure, building muscles, blood formation, and hormone production (Fetters, 2020). The human body breaks down proteins into their building blocks, namely amino acids, of which there are about 20 known amino acids. The body cannot make nine out of the 20 amino acids, therefore, referred to as essential amino acids. The nine essential amino acids are methionine, isoleucine, leucine, lysine, histidine, tryptophan, threonine, valine, and phenylalanine, which must all be obtained through the consumption of various food groups (Kubala, 2018a).

Most food products contain all the nine essential amino acids, such as all animal-based food sources and specific plant-based sources (Lee, 2018). Certain grains, such as quinoa, buckwheat, and amaranth, have all nine essential amino acids (Lee, 2018; Fetters, 2020). Grains such as corn, wheat (bread), and rice are considered incomplete amino acids due to the deficient levels of some essential amino acids such as lysine and methionine. Grains are sometimes combined with legumes and beans

to add to the protein content since legumes and beans are rich in complete proteins called protein complementation (National Geographic, 2011; Lee, 2018).

2.11 THE THREE IMPORTANT GRAIN STAPLES

A staple food or crop is a food source consumed regularly or daily with every meal by a population and is, therefore, the dominant food source of that population or country. The staple crop also provides the population's major nutrient and energy needs (Kilian, 2012; National Geographic, 2014). Staple crops can add to national and individual food insecurity if threatened by pests, droughts, climate changes, or inadequate nutrient-rich soil, which can lead to poverty, hunger, and diseases in the human population (Kilian, 2012).

Only a few hundred of about 50 000 edible plant species contribute significantly to the human diet (Kilian, 2012). Maize, wheat, and rice account for about 66% of the few hundred plant crops that contribute significantly to people's diets and feed about seven million people worldwide. These three grains are the world's most widely consumed crops and often form the basis for food staples (National Geography, 2014).

2.11.1 Wheat bread

Wheat (Triticum aestivum) is a cereal grain that was first cultivated from wild grasses by ancient civilizations around 8 000 to 10 000 years ago in the Fertile Crescent (between Armenia and Western Asia) (Lu *et al*., 2009). In the winter of 1652, Jan van Riebeeck planted the first wheat crops in South Africa, and now wheat is cultivated worldwide as one of the most important crops (Wetherell, 2019). Wheat has excellent plasticity, making it highly adaptable to environments ranging from high to low rainfall, warm to cold, and under-irrigated areas. Wheat can be processed into flour to make soft bread with a fine texture due to the protein gluten in wheat. Other uses of wheat include the production of cereals, cookies, pasta, noodles, and cakes. Wheat is used in alcoholic beverages (History of Bread, 2021).

2.11.2 Rice

Rice is the staple food for billions of people worldwide, and it has a significant cultural, social, and economic influence on many countries (Rutledge *et al*., 2022). Rice farming started about 10 000 years ago and was the basis of Asian culture and customs. Rice is still used to pay debts, rent, and wages in some rural areas of Asia (GRiSP, 2013). According to Westlake (2019), rice is a cereal grain with seeds with one embryonic leaf. Rice grows in wet areas such as flood plains, ponds, wetlands, and streams. Two types of cultivated rice are *Oryza glaberrima* (African rice) and Oryza sativa (Asian rice). About 90% of rice is produced in Asia, and only about 7% of all rice is exported from its country of origin. In tropical areas of Latin America and the Caribbean, rice provides more calories than other staples such as maize, wheat, potatoes, and cassava (GRiSP, 2013).

Rice (specifically brown rice) can protect against malnutrition due to Vitamin B, fibre, protein, manganese, and iron content (Kubala, 2018b). Rice can also be used in traditional medicine to treat gastric or skin conditions. When rice is milled for too long, it loses some of its nutritious qualities and becomes increasingly white in appearance (Kubala, 2018b). Techniques such as puffing, polishing, and parboiling turn the rice into different types purchasable at the shops (Westlake, 2019). The rice plant consumes a vast amount of water, threatening the rice production industry, and extreme temperatures can easily stress the plant. Over-irrigation or improper use of insecticides can negatively influence the production of rice. Rice as grain must be protected because it is vital to people's livelihoods, sustainable agriculture, and food security (Westlake, 2019).

2.11.3 Maize (corn)

Maize is a grain that forms part of the grass family Poaceae, and this classification forms part of other grass crops such as barley, rice, sugarcane, wheat, sorghum, and oats (Christenhusz & Byng, 2016). Fossil discoveries indicate that the grass lineage of maize and other grass crops originate from an ancestor that is 55 – 70 million years old. Maize falls into the genus Zea, a group of grasses native to Central America and Mexico (Buckler & Stevens, 2005). According to Sandhu *et al*. (2007), maize is the third most important crop after rice and wheat, and it is considered a staple food in

many parts of the world. Maize is also known as the queen of cereals due to its high yield potential. The United States is the largest producer of maize, contributing around 35% of the world's maize production (Milind & Isha, 2013). A maize kernel is the edible part of the maize plant and the most nutritive part of the plant (Rouf Shah *et al*., 2016). Below in Figure 2.6 is a summary of the nutrient content in a maize kernel.

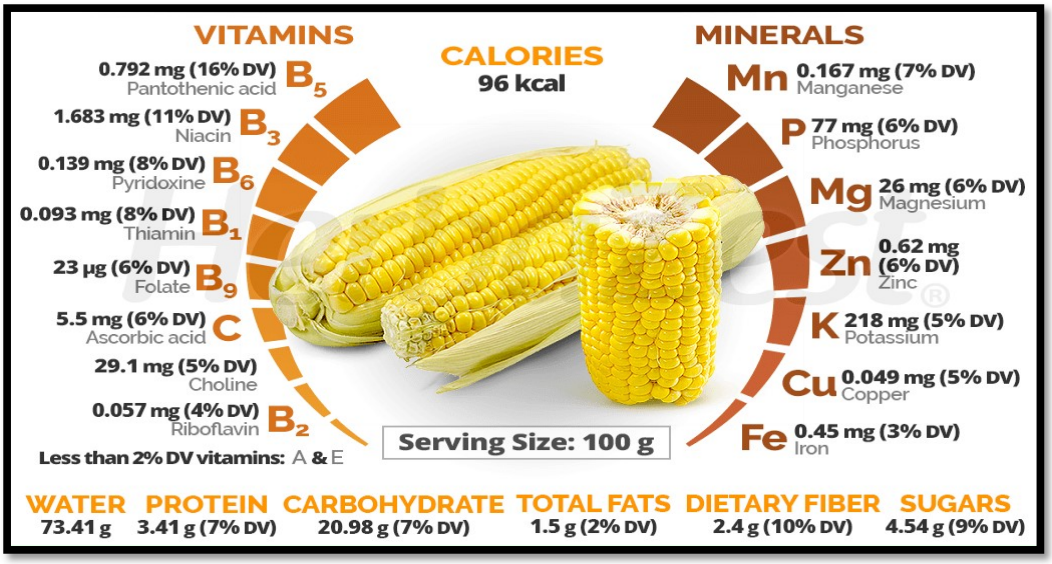


Figure 2.6: Maize nutrition (Herbazest, 2021).

A variety of products can be obtained and produced from maize kernels, such as maize flour, cornmeal, breakfast cereals, tortillas, chapatis, maize snacks, starch, etc. The maize grits can be used as animal feed (Mehta & Dias, 1999).

2.11.4 Nixtamalization

Nixtamalization is an ancient process involving treating dried maize kernels with lime water/alkaline solution (Arendt & Zannini, 2013). Nixtamalization adds nutritional value to maize. Untreated maize does not contain free niacin (Vitamin B3), and nixtamalization makes niacin bioavailable (Serna-Saldivar, 2015). A lack of niacin in the human body can lead to Pellagra, a systemic disease caused by severe deficiency. A deficiency of the essential amino acids leads to Kwashiorkor in children (Wacher, 2003). Maize is cooked in the slaked lime solution, soaked (8 to 16 hours or more), washed by hand, and hulled to remove the pericarp to obtain a product called nixtamal (Katz *et al*., 1974). The nixtamal is then stone-ground to form a dough called masa, which can be processed into dried, instant corn flour and finely ground or whole.

Coarsely ground nixtamal may be referred to as hominy. The alkaline treatment removes about 90% to 100% of aflatoxins (a type of mycotoxin) from mycotoxin-contaminated corn (Wacher, 2003; Guzmán-de-Peña, 2010). The nixtamal (Figure 2.7) is then used to create a dough that is used to make a variety of products for consumption, such as tortillas, tortilla chips, arepas, tamales, tacos, enchiladas, tostadas, atoles, sopes of which tortilla is the most used product in rural areas of Mexico (Wacher, 2003).

Figure 2.7: Masa after the limewater treatment (Brown, 2019).

2.11.4.1 History and origin of nixtamalization

The origin of maize can be traced back to Mesoamerica, a region in Northern Mexico to Nicaragua and Honduras). Maize was cultivated, domesticated, and consumed as the leading staple food in Mesoamerica, the South-east of the United States, and South America (Katz *et al*., 1974). According to Staller *et al*. (2009) and Ellwood *et al*. (2013), it still needs to be discovered how the nixtamalization process was discovered or started. However, people from ancient cultures may have used hot stones to boil maize. In regions such as Southern Mexico and Guatemala, where limestone is plentiful, people may have used pieces of this limestone during the cooking process of maize. Archaeological discoveries indicate that using limestone during these ancient times was sufficient to sufficiently alkaline the water to cause nixtamalization. Staller *et al*. (2009) confirmed no specific date when the nixtamalization process was

discovered. However, archaeological evidence suggests that the earliest uses of nixtamalization date back to about 1200 to 1500 BC.

The Mesoamericans were not the only civilization that used the process of nixtamalization, as the process can be traced to the Mayan and Aztec civilizations (Ellwood *et al*., 2013). The Aztec and Mayan people made their alkaline solution by using calcium hydroxide, also called slaked lime, and they used potassium hydroxide found in ash. Calcium hydroxide was also used by the people of ancient Inca and people from North America used ash in the form of sodium carbonate (Envirologix, 2019; Ellwood *et al*., 2013). Christopher Columbus brought maize to Europe, rapidly cultivated in significant quantities by the sixteenth century and exported to Turkey. Unfortunately, the practice of nixtamalization was unknown in Europe or Turkey, and this caused malnutrition in populations that depended mainly on maize as a staple food (Fussell, 1999).

During the early 20th century, the poor populations of the southern United States experienced an endemic disease called Pellagra, and this was because the poor populations did not treat their maize with nixtamalization (Latham, 1997). Maize is still a relatively young staple in Africa compared to sorghum and millet. Maize was first introduced in Africa and South Africa during the sixteenth century by the new world explorers who had yet to learn of the nixtamalization process. Today, countries in Africa such as Zambia, Lesotho, and Malawi surpass Mesoamerican countries with their maize production, and they rank as the world's top three maize-subsisting countries (McCann, 2005). Figure 2.8 shows the early production method used to produce maize tortillas through nixtamalization.

Figure 2.8: Lithograph of maize tortilla production in rural Mexico around the 1800s (Wichner, 2018).

2.11.4.2 The process of nixtamalization

The first step of nixtamalization involves soaking (steeping) the dried maize kernels in an alkaline solution to modify the corrugated-like structure, namely the pericarp, the outer layer of the maize kernels (Paredes-López & Saharópulos, 1982). The steeping process allows for faster water and calcium absorption by the maize kernels. The alkaline water (pH is 10.9 or higher) makes the pericarp or hull of the maize kernel soft, gummy, and sticky because the pericarp contains hemicellulose and pectin, which is soluble in alkaline solutions (Martínez-Bustos, 2001). During the washing process, rubbing or grinding the kernels easily removes the pericarp/hull. The combination of alkaline and heat application to the maize kernels alters the kernels chemically. Several B vitamins, such as niacin and essential amino acids, are available in the nixtamal for absorption in the human body through consumption (Bressani *et al*., 1958).

The nixtamalization process allows for easier grinding of the maize kernels, making the dough created from the nixtamal less breakable and more tolerant to mixing. These properties are attributed to the swelling of the starch granules during the nixtamalization process (Martínez-Bustos, 2001). The alkaline solution contributes to desirable organoleptic properties, such as the increased flavour, smell, and colour intensity of maize kernels. The quality of maize corn proteins is enhanced during

nixtamalization, which might be due to the decreased solubility of the zein protein (Wacher, 2003). The alkaline water left after the cooking and washing process of the maize kernels can be used to make amate bark paper. The alkaline water discarded or used for amate bark paper contains dissolved corn matter (hull and starch), referred to as nejayote and has an unpleasant flavour (Wolfgang von Hagen, 1944).

Figure 2.9: Dry untreated maize kernels maize (left) and treated with nixtamalization (right) (Salvador, 2011).

2.12 CONCLUSION

The literature study concludes that South Arica experiences many challenges regarding food security, which is attributed to a failing food system that does not provide proper distribution and access to nutritious food. Low-income households are the most susceptible to food insecurity due to their inability to afford food because of low income, rapid increases in food prices and transportation difficulties. There are strategies to be implemented to help combat food insecurity and to make low-income households in South Africa more food secure. The literature study concluded that bread, rice, and maize are the three most essential grains consumed worldwide, and these grains are a significant part of the food consumption patterns of most people worldwide. Low-income households rely primarily on maize, bread, and rice due to their affordability and ease of access. Maize is a grain that has more nutrients available after nixtamalization, which increases the bioavailability of niacin. A nixtamalization process can be applied to maize kernels to increase the bioavailability of certain nutrients, such as niacin. Nixtamalization can enhance the nutrient content of regularly consumed grains like maize in low-income households that cannot afford a wide variety of food from the different food groups.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter describes the methods used in collecting and analysing the data concerning the primary purpose of this study, which was to investigate the food security situation and consumption patterns of the informal settlement of Grassland Phase 4 in Mangaung. This chapter outlines the research approach, sampling and population procedure, the data collection instruments and methods used, data analysis and interpretation, the study's limitations, and the ethical considerations.

3.2 RESEARCH APPROACH

This study applied a quantitative research approach during the data collection process by using a standardised questionnaire to investigate the factors affecting the food security and consumption patterns in Grassland Phase 4 informal settlement. Quantitative research is a process whereby the researcher collects and analyses numerical data (Bhandari, 2020). A quantitative research approach seeks to answer the questions of why and what. Data collecting methods such as structured surveys and unmoderated testing are examples of quantitative research. Quantitative research discovers patterns and averages, test causal relationships, and makes predictions (Thomas, 2020; Bhandari, 2020). Therefore, a quantitative approach was ideal for this study whereby numerical data and statistics were used to determine patterns and relationships in the dietary patterns and food security factors.

When using quantitative research, the relation between a dependent and independent variable of a population can be determined, and this type of research approach enables the researcher to collect information or data quickly (Babbie, 2010). The data collection process for this study required anonymity because a few sensitive questions were asked in the questionnaire relating to the respondents' salaries, ability to provide for the household, and educational level, which was possible to achieve with a quantitative design and allowed the researcher to generalise the results, specifically to Grassland Phase 4 community while maintaining anonymity (Moore, 2016).

This study followed a descriptive and exploratory approach to determine the food security and dietary diversity profiles and characteristics of the Grassland Phase 4 informal settlement households in Mangaung, Free State. A descriptive research

approach identifies the demographic, socio-economic characteristics, dietary diversity profiles, and food security situation of the participating households for this study. When using a descriptive research design, the questions of what, when, where and how can be answered, but not the why questions. A descriptive research approach can use various research methods where one or more variables are investigated. This method does not control or manipulate the variables but only observes and measures them (McCombes, 2019).

The descriptive research approach is instrumental when describing a population or phenomenon accurately and identifying trends, frequencies, categories, and characteristics. The descriptive research approach uses a questionnaire (Babbie, 2010). A descriptive approach is practical when little is known or identifiable about a specific topic or situation. The problems encountered can be solved or improved through descriptions, observation, and analysis (Koh & Owen, 2000; McCombes, 2019). Little is known about the characteristics, trends, and frequencies of the food security and consumption patterns of Grassland Phase 4; therefore, a descriptive research approach was applied to this study.

An exploratory research approach is applied when a research study seeks to investigate a research problem or question that has yet to be studied in-depth or clearly defined (Moore, 2016). No in-depth research studies were found on the food insecurity situation and consumption patterns in Grassland Phase 4 informal settlements; thus, the questions asked in this study were descriptive and exploratory. Exploratory research can be quantitative if applied to a large sample, and this approach is often used due to its open-ended and flexible nature. This approach does not intend to offer the researcher conclusive solutions to the problem or questions. However, it does focus on clarifying concepts, gathering insights, articulating challenges more precisely, forming hypotheses, and presenting explanations (Moore, 2016).

3.3 POPULATION AND SAMPLING

3.3.1 Population

A research population is a group of people with common characteristics distinguishing them from others (Landry, 2010). The target population for the current research was the inhabitants of an informal settlement named Grassland Phase 4, informally referred to as Khayelitsha by the local inhabitants of Bloemfontein. Bloemfontein is one of the three Mangaung Metropolitan Municipality urban centres (Figure 3.1). It is the capital city of the Free State Province of South Africa, also known as one of the seven most prominent cities in South Africa (Mphambukeli, 2015).

Grassland (Figure 3.2) is a small informal settlement developed in the 1990s and was previously a privately owned agricultural small-holding area. The Manguang Municipality originally planned to develop this area into three phases, but it has developed on its own into many phases (Mphambukeli, 2014). Grassland consists of four phases (Figures 3.3 & 3.5), namely, Phase 1, Phase 2, Phase 3 (known as Bergman square), and Phase 4 (Grassland Phase 4 informal settlement). All these areas need more basic services, such as improper stormwater drainage, poor sanitation, and water. These areas also need proper security and roads (Mangaung Metropolitan Municipality. n.a; Mphambukeli, 2014).

Figure 3.1: Map of Mangaung Metropolitan Municipality with its three urban cities (Bloemfontein, Thaba Nchu, and Botshabelo) (Municipalities of South Africa, n.a).

Figure 3.2: Arial photograph of Bloemfontein, showing the location of Grassland Phase 4 informal settlement (Mphambukeli, 2014).

Key: Phase1 – **Yellow**; Phase 2 – **Orange**; Phase 3 – **Green**; Phase 4 – **Blue**.

Figure 3.3: The four phases of Grassland informal settlement (Squatter camp) in Bloemfontein (Mangaung Metropolitan Municipality; Mphambukeli, 2015).

Grassland Phase 4 (Figure 3.3) is an extension of Grassland Phases 2 and 3 with an estimated 2500 to 6000 plus households (MMM, 2017; Mphambukeli, 2015). Grassland Phase 4 is characterised by many immigrants from Lesotho, a significant reason for underdevelopment because they do not possess a South African identity document or citizenship (Verster, 2019). Grassland Phase 4 was selected for this study because compared to the other phases, it only acquired electricity in 2012, still has gravel roads, lacks proper infrastructure and social services, and experiences immense poverty and crime. Most residents in Grassland Phase 4 have connected themselves to waterpipes to access water (Verster, 2012; Mphambukeli, 2014).

3.3.2 Sampling

A sample is selected when someone wants to research a group of people, and it is impossible to collect data from every group member (McCombes, 2019). This study applied a purposive sampling technique. Purposive sampling, also called judgemental or selective sampling, is a form of non-probability sampling where one uses their judgement when selecting respondents to participate in a survey and thoroughly thinks about how they will determine a sample population (Alchemer, 2021). During this

process, a community is intentionally visited because the individuals fit the profile of people the researcher intends to reach. This sampling technique is best used to access a particular population subset with specific shared characteristics. Therefore, purposive sampling is best used when information is known about the research topic's background (Nikolopoulou, 2022). This type of sampling allows for generalisations about the sample on the condition that these generalisations are analytical, logical, or theoretical to be considered valid. Purposive sampling is prone to bias due to using one's judgement and is vulnerable to errors (Saunders *et al*., 2012; Nikolopoulou, 2022). This sampling technique was applied to Grassland Phase 4 because it fit the profile of the intended purpose of this study. The individuals in this informal settlement shared common characteristics such as living in poverty and improper housing.

Non-probability sampling uses non-random ways to select a group of people to participate in a study and relies heavily on the researcher's subjective judgement, and not every individual has a chance of being included (Nikolopoulou, 2022). Non-probability sampling aims to develop an understanding of an under-researched or small population. It is essential to make non-probability sampling as representative of a population as possible, as it has a higher risk of bias, which means that the inferences about a population are weaker than with probability sampling techniques. This sampling technique is less stringent, easier, and cheaper to access. This sampling technique is most useful for exploratory research when deploying a pilot study (McCombes, 2019; Qualitrics, 2022).

The sample size for this study, compensating for incomplete or non-usable questionnaires, was determined at 300 households based on a 95% level of significance and 0.05 margin of error (Wessa, 2018). This study used a sample size of 300 from 2500 to 6000 established households in Grassland Phase 4. Using a sample size of 300 provides an acceptable margin of error and falls before the point of diminishing returns (Minsel, 2021). Figure 3.4 indicates the number of respondents who completed the questionnaire from the three strata (A, B, C).

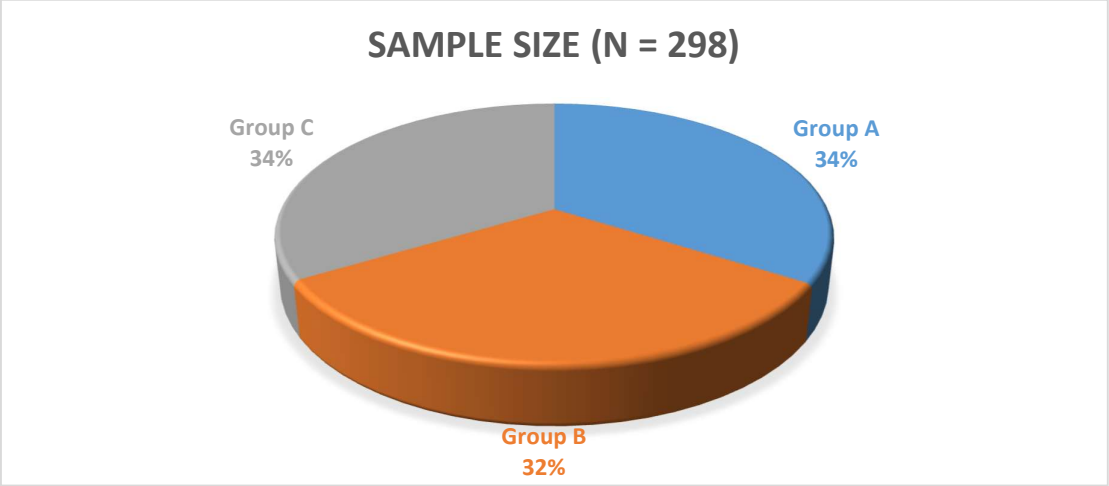
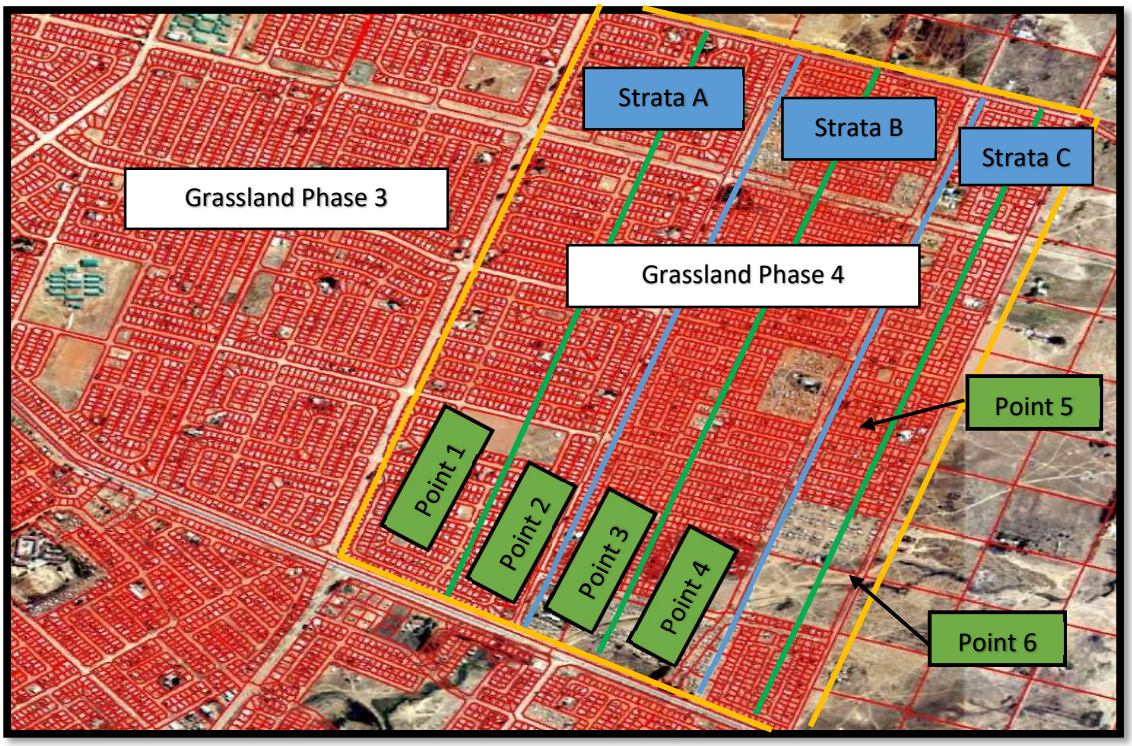


Figure 3.4: Sample size of respondents who completed the questionnaires.

Grassland Phase 4 was divided into three groups/blocks, commonly referred to as strata, namely strata A (area nearest to other settlements and shops), strata B, and strata C (Area is the furthest from other settlements and shops), as indicated on the map (Figure 3.5). Each stratum was separated into two sections: point 1 and point 2 for strata A, 3 and 4 for strata B, and 5 and 6 for strata C. At each point, 50 randomly selected respondents were asked to complete the questionnaire. This study distributed 300 questionnaires throughout Grassland Phase 4 in predetermined locations (strata A, B, C) using cold canvassing until the intended number was reached.



Key: **Yellow line**: Grassland Phase 4 informal settlement; **Blue lines**: strata A, B, and C; **Green lines**: points 1 to 6.

Figure 3.5: Map illustrating the household settlements currently in Grassland Phase 4 (Stander, 2021).

Specific inclusion criteria were used in this research study for the respondents in Grassland Phase 4. An inclusion criterion is “the key features of the target population that the researchers will use to answer their research question” and is determined at the beginning of a study to ensure that the data collected are aligned with the research objectives (Patino & Ferriera, 2018). Individual respondents within the sampled households completed the questionnaires, although households were the unit of analysis. The person participating in the survey on behalf of the household was selected because he/she is older than 18. Whether related (belonging to the same family) or not, any member in the household could be responsible for a household’s food purchases. In cases where the older respondent (parent, guardian, head of household) was illiterate or had a physical disability that rendered them incapable of completing the questionnaire, the field workers who administered the questionnaire assisted.

3.4 DATA COLLECTION

3.4.1 Data collection instrument

This research study used a structured, standardised questionnaire to gather the survey data (Appendix A). The questionnaire consists of both closed and open-ended questions. It is commonly used when there is a need to accommodate an extensive range of responses and when the research study is explorative (Eticha, 2019). This study used the EvaSys© software program to compile and generate the questionnaire for this study. Due to this study's explorative aspect (limited research on this topic), the questionnaire consisted of existing. It validated questionnaires based on the GHS survey from Stats SA, the 9-point HFIAS, the FCS, and the CSI questionnaires. The demographic questions were based on the food surveys by Sustainable food places.org (2020) and newly formed questions by the researcher based on literature and observations from the pilot questionnaire.

The researcher tested both hard copy and electronic versions of the questionnaire during a pilot study of 11 randomly selected respondents and found that the electronic version (use of a tablet) worked better and faster. The pilot study concluded that many questions needed to be more varied and varied. During the pilot study, the researcher discovered no group/section number option to indicate which household strata (group A, B, or C in Figure 3.5) completed the study. Another discovery during the pilot study was that specific questions were removed and did not apply to the respondents. Questions that gave a more profound understanding or information on a particular situation during the pilot study were added to the final questionnaire.

The Pilot questionnaire was rectified and reintroduced to the population as the final and corrected questionnaire. The questionnaire used in the study consisted of seven different sections. The first section of questions contained information about the demographic profile of the respondents. Sections two to five are food preparation, transport, water access, and food security questions. Section six elicited information about the household's consumption patterns, and the last section of questions provided information about the income of each household. Table 3.1 describes each section and the type of question used in the questionnaire. The questionnaire consisted of nominal, ordinal, binary, closed, and open-ended questions. This study applied Likert scaling as possible answers to some closed-ended questions.

Table 3.1: Questionnaire composition

Section	Question content	Question type
Section 1	Point/section number of household	Open ended question (Nominal)
	Respondent composition	Close ended question (Nominal)
	Age of participant	Close ended question (Nominal)
	Age of household members	Close ended question (Ordinal)
	Gender of participants	Close ended question (Nominal)
	Language spoken by the household	Close ended question (Nominal)
	Level of education	Close ended question (Nominal)
	Occupancy status	Close ended question (Nominal)
Section 2 Subsection A: Food preparation	Frequency of meal preparation	Close ended question (Nominal)
	Areas used for cooking	Close ended question (Ordinal)
	Appliances and facilities present	Close ended question (Nominal)
	Source use when preparing food	Close ended question (Ordinal)
Section 2 Subsection B: Transport	Distance (in minutes) traveled to shop	Close ended question (Ordinal)
	Transport method use to purchase food	Close ended question (Nominal)
	Income spent on transportation	Close ended question (Ordinal)
Section 2 Subsection C: Water access	Sources of water use for cooking	Close ended question (Ordinal)
	Water safety considerations	Close ended question (Nominal)
Section 2 Subsection D: Food consumption	Frequency of food purchases at shops	Close ended question (Nominal)
	Frequency of food purchases in last 30 days	Close ended question (Ordinal)
	Consumption of grains in the last 7 days	Close ended question (Nominal)
	Money spent on main food products	Close ended question (Ordinal)
	Frequency of buying food at spaza shop	Close ended question (Nominal)
	Frequency of buying food at supermarket	Close ended question (Nominal)
	Amount of food cultivated by households	Close ended question (Ordinal)
	Food received from relatives or neighbours	Close ended question (Ordinal)
Section 3	Household's food access for the past year	Close ended question (Nominal)
	Coping strategies for the past 30 days	Close ended question (Nominal)
Section 4	Sources of household income	Close ended question (Ordinal)
	Estimated combined income of household	Close ended question (Ordinal)
	Obstacles causing inadequate food access	Open ended question (Nominal)

3.4.2 Data collection process

The data was collected over three months, from February 2021 to April 2021, and each questionnaire took about 25 to 40 minutes to complete. The questionnaires were physically administered using a tablet (electronic device) by two trained field workers. The field workers adhered to the Covid-19 protocol set by the Government of the Republic of South Africa during data collection (Appendix E). The face-to-face interaction allowed the questionnaire to be completed more thoroughly and made the respondents feel more at ease if they needed clarification. The field worker did not in any way interfere with the completion of the questionnaire. If necessary, the field

workers translated the questions into Sesotho. One of the field workers was a resident of Grassland Phase 4 and is fluent in Afrikaans, Sesotho, and English. The researcher administered 300 questionnaires, and the respondents completed 298 questionnaires in this study. Two respondents started with the questionnaire but did not complete it due to a loss of interest.

The emphasis on completing the questionnaire was based on the person responsible for purchasing the food and preparing the meals in the household. Participation in this study was voluntary, and no incentive was given to the respondents. All signed consent forms (Appendix D) were separated from the questionnaires once the data collection was completed to protect the anonymity of the respondents.

During the pilot, respondents preferred having the field worker read the questions and enter the response on the electronic device. Consequently, the same approach was used for the data collection through the EvaSys captured using EvaSysThe data was collected over three months, from February 2021 to April 2021, and each questionnaire took about 25 to 40 minutes to complete. The questionnaires were physically administered using a tablet (electronic device) by two trained field workers. The field workers adhered to the Covid-19 protocol set by the Government of the Republic of South Africa during data collection (Appendix E). The face-to-face interaction allowed the questionnaire to be completed more thoroughly and made the respondents feel more at ease if they needed clarification. The field worker did not in any way interfere with the completion of the questionnaire. If necessary, the field workers translated the questions into Sesotho. One of the field workers was a resident of Grassland Phase 4 and is fluent in Afrikaans, Sesotho, and English. The researcher administered 300 questionnaires, and the respondents completed 298 questionnaires in this study. Two respondents started with the questionnaire but did not complete it due to a loss of interest.

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During the pilot, respondents preferred having the field worker read the questions and enter the response on the electronic device. Consequently, the same approach was used for the data collection using the EvaSys© programme.

3.5 DATA ANALYSIS

The data was exported from the EvaSys© software to Statistical Package for the Social Sciences (SPSS) version 25. SPSS was used to do basic descriptive statistics. Descriptive statistics is the term given to data analysis that describes or summarises the data's basic features meaningfully (William, 2021). This study presented the data as frequencies and percentages in tables and graphs for each categorical question. R statistical software was used to determine Cronbach's alpha (α) to test the reliability of the questionnaire. A statistician at the Department of Mathematical Statistics and Actuarial Science: Statistical Consultation, Unit of the University of the Free State, carried out the statistical analysis of this study.

This study calculated the Pearson and Spearman correlation coefficients using the scale data. The correlation graphs in chapters four and five of this study were discussed based on the correlation data in Appendix F to H. Correlation measures the strength of association between two variables and the direction of the relationship. The value of the correlation coefficient varies between +1 and -1, and a value of ± 1 indicates a perfect degree of association between the two variables. If the correlation coefficient value reaches 0, the relationship between the two variables will weaken (Chen & Popovich, 2002). A positive (+) correlation means that if one variable increases, the other moves in the same direction. A negative (-) correlation means that if one variable increases, the other variable decreases and moves in the opposite direction of one another (Nurse Killam, 2014).

Table 3.2: Strength of correlation

Correlation	Strength of linear relationship
1	Perfect
0.8 to 1.0	Very strong
0.6 to 0.8	Strong
0.4 to 0.6	Moderate
0.2 to 0.4	Weak
0.00 to 0.2	None to extremely weak

3.6 VALIDITY AND RELIABILITY

Reliability and validity are important concepts when using measuring instruments in quantitative research. They evaluate the quality of the instrument and indicate how well a specific technique or method measures. These concepts determine the consistency and accuracy of the measurement instrument (Kimberlin & Winterstein, 2008). Reliability and validity are closely related but have different meanings; for example, a measurement can be reliable without being valid, but if a measurement is valid, it is usually also reliable (Middleton, 2019). This study performed Reliability analysis for each set of grouped scale questions.

3.6.1 Validity

Validity measures the intent and accuracy of a questionnaire in a quantitative study and the sincerity of scientific findings or the degree to which measured results match reality (Korb, 2012; Babbie, 2010). This research study tested the validity of the standardised questionnaire by submitting it to the research supervisors/experts at the University of the Free State, where it was scrutinised for internal, external, and construct validity. The content validity of the questionnaire was tested to find questions that the respondents could have understood better. This study amended the poorly understood questions to ensure that the questionnaire obtained the required information from respondents.

3.6.2 Reliability

Reliability is defined as the consistency of measurements and the stability of findings in the absence of measurement error. Essentially, the measurement is considered reliable if the same test results are achieved using the same method or instrument (Middleton, 2019). There are two types of reliability, namely absolute (the degree to which repeated measurements vary for individuals) and relative (the degree to which individuals maintain their position in a sample with repeated measurements) (Babbie, 2010; McMillan & Schumacher, 2010).

For this study, the reliability was determined by executing a pilot study, or pre-test, in which the questionnaire was the measuring instrument administered to a group of 11 people, revealing that the answers were consistent and understood without difficulty.

An instrument's reliability (internal consistency) is determined by Cronbach's alpha (α) test, in which the average of all correlations in every combination of split halves is determined. Instruments with questions that have more than two answers can be used in this test (Shuttleworth, 2009). The Cronbach's α result is a number between 0 and 1. Reliability measures lower than 0.7 suggest that multiple concepts are being measured, while measures above 0.95 suggest that the same question is asked in different words. A value in the target range of 0.7 to 0.95 is desired.

This section aimed to determine how many specific questions measure the same thing. The measures calculated here include the famous Cronbach's α and McDonald's omega (ω), which are more accurate.

McDonald's omega coefficient is an alternative to Cronbach's alpha for measuring internal reliability or consistency, which is robust to most alpha assumptions (Kalkbremer, 2021). This alternative means that omega can be computed for test scores in which every test item does not equally contribute to the total score. It provides more accurate reliability measurements than Cronbach's alpha (McNeish, 2018). McDonald's omega is a generalised form of Cronbach's alpha, and the omega coefficient offers more practical utility than the alpha coefficient (Hayes & Coutts, 2020).

Table 3.3 shows the average calculated Cronbach's alpha and McDonald's omega coefficients. The omega coefficient measures 0.78, and the alpha coefficient measures 0.67, which indicates good internal reliability.

Table 3.3: Summary of average alpha and omega coefficients used

	Coefficient used	
Grouped question measured	**Cronbach'sAlpha (α)**	**McDonald's Omega (ω)**
1. How much of the following products did you get from relatives or neighbours in the past year?	*0,86*	*0,9*
2. How often do you buy the following products at a spaza shop or tuck shop?	*0,83*	*0,89*
3. How often do you buy the following products at a supermarket?	*0,95*	*0,97*
4. Please indicate whether your household has the following appliances and facilities inside your house or yard	*0,83*	*0,92*
5. When you cook at home, how often do you cook food in each of the following areas?	*-0,14*	*0,23*
AVERAGE TOTAL	***0,67***	***0,78***

Only a few groups of questions were considered valid selections for reliability analysis at the time of the analysis. The statistician made a few data changes by removing some of the data from the correlation and Cronbach's analysis.

Data changes: *removed from correlation and Cronbach analysis*

- Empty spaces in questions 1.5-1.9 (Appendix A) were assumed to be zero.
- IsiZulu, English, and Other had no values, so those categories were removed.
- Food Preparation:
    - Inside the house. – no variation
    - Other – no variation
    - Animal Dung – no variation
    - Other – no variation
- Transport
    - Tuck/spaza shop – no variation
    - Bus – no variation
    - Metered taxi – no variation
- Water Access:

    - Other – no variation
- Food Consumptions – Cultivate/Produce yourself:
    - Bread – no variation
    - Rice – no variation
    - Meat – no variation

Considerations:

For the total correlation, incomplete observations were deleted, which caused certain categories to lose variation. This means that correlation couldn't be calculated.

3.7 LIMITATIONS OF THE STUDY

The questionnaire was only in English and not in languages like Sesotho or Afrikaans, leading to more translation from the field workers. It thus took more time to complete the questionnaire.

Only a few respondents (mostly the older population) were illiterate and did not finish school; therefore, the questions needed to be explained in more depth to these respondents.

Another limitation of this study is that the results cannot be used for any area other than Grassland Phase 4; thus, it cannot be generalised for all the informal settlements in Bloemfontein. However, the same study can be replicated elsewhere, and comparisons can be drawn between the areas.

There is a possibility of social desirability bias, where the respondents might have responded to specific questions that they conceived as sensitive in a positive light, even though they may not practice or believe those responses, to avoid embarrassment and repercussions from disclosing sensitive information.

Another limitation was that data collection was done just after Covid-19. The hard lockdown during 2020, including the global and national economic turmoil, could have impacted data received regarding physical and economic access.

3.8 ETHICAL CONSIDERATIONS

Ethics is defined as the norms of conduct connected to moral beliefs that differentiate between right and wrong or acceptable and unacceptable (Resnik, 2020). The researcher must be open to the respondents about all aspects of the study. Participation in this study should be voluntary, which means the respondents cannot be forced to participate or complete the study (Moore, 2016).

The researcher is responsible for ensuring that no physical, social, or mental harm befalls the respondents during the questionnaire administration. No embarrassing information about the respondents that may lead to danger or negative consequences may be revealed (Møller *et al*., 2014). The researcher must anticipate such risks carefully and minimise them. It is of utter importance that the privacy of the respondents is protected by using three methods: appropriate storage of data collected, confidentiality, and anonymity (McMillan & Schumacher, 2010).

Ethical clearance for this research study was obtained through the University of the Free State's General/Human research ethics Committee (GHREC- UFS-HSD2020/0517/1007) (Appendix C). Ethical clearance is the explicit stipulation of a strategy to avoid and mitigate the above-mentioned ethical considerations. Respondents in this study were informed verbally and through written confirmation that their information would be confidential and anonymous responses. The respondents were informed that their participation is voluntary, and all responses will only be used for this research study.

The respondents were also encouraged to ask questions for clarification purposes if they did not understand something. Table 3.4 describes the possible risks involved in the study and the preliminary precautions taken to mitigate these risks. A professional therapist (Appendix B) was consulted to provide counselling services free of charge in cases where the respondent felt traumatised by the questions in this study.

Table 3.4: Summary of risks and precautions during the survey

Possible risks to participants	How risks will be reduced/eliminated	Possible benefits of participation in the questionnaire
Personal embarrassment	Risk will be reduced by reassuring the participant that his/her identity (name & address) will remain anonymous so that no one can trace information back to the participant.	Participation will create awareness into the food security and food consumption patterns obstacles of Grassland Phase 4 informal settlement in Mangaung, Free State.
Cultural embarrassment	The race of the participant will not be included in the questionnaire to avoid cultural embarrassment. The questionnaire will also be translated to Sesotho, Afrikaans, and English to make the participant feel comfortable while answering and feel less embarrass.	There will be no cultural benefits for the participants in this study.
Emotional distress	The questions will be asked with great sensitivity and psychological counselling will be available. Questions relating to sexual abuse and violence will not be asked to avoid emotional distress.	A possible emotional benefit may be that the participant will feel empowered to participate in a research study and help create awareness.
Unfulfilled expectations	During the administration of the questionnaire, it will be made clear to the participants that the questionnaire is strictly for a M.S.c research dissertation and not for the government and should not expect any intervention.	Possible benefits is that the participants can expect that their participation will create awareness into their food security and dietary diversity by investigating their food consumption patterns.

3.9 CONCLUSION

A structured questionnaire was compiled and administered to the households of Grassland Phase 4 to explore the objectives of this study. The questionnaire was compiled in such a way as to ensure that the questions and statements were easy to understand by all the respondents. Quantitative methods and descriptive statistics were used to analyse the data obtained from the questionnaire. This research study ensured reliability and validity during the administration of the questionnaire, including ethical aspects.

CHAPTER 4

Investigation of the food security situation in Grassland Phase 4 informal settlement in Mangaung by using the different food security measuring methods

Abstract

Food security allows people to have adequate access to food and live a quality life; it is therefore a priority for the economic development of any country. Low-income households in informal settlements need assistance to access adequate and nutritious food. This study aimed to investigate how food insecure households in Grassland Phase 4 informal settlement are. Data were collected using a structured questionnaire as the main instrument. The HFIAS, HFIAP status indicator and CSI methods were used to determine the level of food insecurity. The results showed that many of the households surveyed (54%) were headed by women and occupied an informal dwelling (shack). Many households (51.4%) relied on government social benefits as their main source of income. The average HFIAS score was found to be 3.32, indicating that Grassland Phase 4 was moderately food insecure. According to the HFIAP score, 49.9% of households were food insecure, with 17.8% experiencing severe food insecurity, meaning they had nothing to eat for an entire day. The score of CSI was found to be 41.8, indicating a medium level of food insecurity. To alleviate food insecurity, the government can encourage Grassland Phase 4 residents to invest more in vegetable gardens and sell their produce to generate additional income, especially in very low-income households. The government can train people to improve their food intake and quality through workshops and self-help groups.

Keywords: Food security, food insecurity, food access, income, nutritious food, HFIAP, HFIAS, CSI.

4.1 Introduction

Food security is "the situation in which all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and preferences for an active life" (FAO, 1996). Food insecurity occurs when people do not have access to healthy food, making them vulnerable to hunger (Crush *et al*., 2012). The concept of food insecurity has changed significantly over the years to include factors such as limited access to food, hunger, and vulnerability to malnutrition (Peng & Berry, 2019).

FAO (2010) indicates that malnutrition and hunger remain a major problem in developing countries due to food insecurity. The African continent is considered the most food insecure continent in the world, and one in four sub-Saharan African households lack access to adequate food (UN, 2012). Food insecurity is most prevalent among poor rural and urban households in South Africa, as they often cannot afford healthy food due to low income, unemployment, or large household sizes (Tonukari & Omoto, 2010). Research shows that the inability of households to adequately obtain food due to poverty leads to food insecurity, which in turn leads to significant health problems. An increase in food costs or inflation is another risk factor for households experiencing food insecurity (UN, 2012).

The motivation for this research study came from a small informal settlement (township) called Grassland Phase 4, which lacks adequate infrastructure, some households do not have electricity, most households need a working tap and toilet, and poverty and crime are prevalent. High unemployment in informal settlements such as Grassland Phase 4 leads to poverty and consequently food insecurity (Verster, 2012).

The purpose of this study is to examine the factors that influence physical access to food, as well as the factors that cause households in Grassland Phase 4 to experience food insecurity. The methods used to assess the food security situation include the HFIAS, the HFIAP indicator, and the CSI score. The methods used to measure food security come from the Food and Nutrition Technical Assistance III (FANTA) project. FANTA aims to improve the health and well-being of vulnerable populations through technical assistance in the areas of food security and livelihood strengthening, as well as emergency assistance during food crises (Fanta Project, 2018).

4.2 Material and methods

This study used a quantitative research approach in combination with a descriptive and exploratory approach to determine the food security situation of Grassland Phase 4 informal settlement. Quantitative research is a process in which the researcher collects and analyses numerical data (Bhandari, 2020). Quantitative research makes predictions and uncovers patterns (Thomas, 2020; Bhandari, 2020). Therefore, a quantitative approach was ideal for this study, which used numerical data and statistics to identify patterns and relationships related to the food security situation in Grassland Phase 4. Very little is known about the characteristics, trends, and frequencies of Grassland Phase 4 food security and consumption patterns; therefore, a descriptive and exploratory research approach was taken in this study. A descriptive approach is useful when little is known or identifiable about a particular issue or situation. Issues encountered can be resolved or improved through description, observation, and analysis (Koh & Owen, 2000; McCombes, 2019). An exploratory research approach is used when a research study is to investigate a research problem or question that has not yet been explored in depth or clearly defined (Moore, 2016).

4.2.1 Population and sampling

4.2.1.1 Population

The target population for this research study was the residents of an informal settlement called Grassland Phase 4, informally referred to as Khayelitsha by Bloemfontein residents. Bloemfontein is one of the three urban centres of the Mangaung Metropolitan Municipality. It is the capital of South Africa's Free State province and is also referred to as one of the seven largest cities in South Africa (Mphambukeli, 2015). Grassland is a small informal settlement that emerged in the 1990s and was previously a privately owned small agricultural area with approximately 2500 to 6000 households (Mphambukeli, 2014).

4.2.1.2 Sampling

This study used a non-probability purposive sampling technique to select the sample of respondents. This sampling technique is applied when one uses their judgement

and thoroughly thinks about selecting the respondents to participate in the research survey (Alchemer, 2021).

The sample size for this research study, compensating for incomplete or non-usable questionnaires, was determined at 300 households based on a 95% level of significance and 0.05 margin of error (Wessa, 2018). A sample size of 300 was drawn from the established households in Grassland Phase 4. This study divided Grassland Phase 4 into three groups/blocks, commonly called strata: stratum A, stratum B, and stratum C. Each stratum was separated into two sections: points 1 and 2 for stratum A, 3 and 4 for stratum B, and points 5 and 6 for stratum C. At each point, 50 randomly selected respondents were asked to complete the questionnaire. Three hundred questionnaires were evenly distributed throughout Grassland Phase 4 in predetermined locations (strata A, B, C) using cold canvassing until the intended number was reached. The inclusion criteria used in this study included that the person participating in the survey on behalf of the household was selected because he/she is older than 18. Whether related (belonging to the same family) or not, any member in the household could be responsible for a household's food purchases.

4.2.2 Data collecting instruments

This research study used a structured, standardised questionnaire to collect data (Appendix A). The questionnaire consists of both closed and open-ended questions. EvaSys© software program was used to compile and generate the questionnaire for this study. Due to this study's explorative aspect (limited research on this topic), the questionnaire consisted of questions from existing and validated questionnaires based on the 9-point HFIAS and the CSI questions. The demographic questions were based on the food surveys by Sustainable food places.org (2020) and newly formed questions by the researcher based on literature and observations from the pilot questionnaire. The data was collected over three months, from February 2021 to April 2021, and each questionnaire took about 25 to 40 minutes to complete. The questionnaires were physically administered using a tablet (electronic device) by two trained field workers. The field workers adhered to the Covid-19 protocol set by the Government of the Republic of South Africa during data collection (Appendix E). The face-to-face interaction allowed the questionnaire to be completed more thoroughly and made the respondents feel more at ease if they needed clarification. The

researcher administered 300 questionnaires, and the respondents completed 298 questionnaires in this study. Two respondents started with the questionnaire but did not complete it due to a loss of interest. Participation in this study was voluntary, and the respondents received no incentive. All signed consent forms (Appendix D) were separated from the questionnaires after completion to protect the anonymity of the respondents.

4.2.3 Methods used to determine food insecurity in households

4.2.3.1 Household Food Insecurity Access Scale (HFIAS)

One of the methods used to determine the level of food insecurity in Grassland Phase 4 was the HFIAS method. The HFIAS is one of the experience-based food insecurity scales, and it captures the behavioural and psychological manifestations of a household's insecure access to food (Coates *et al*., 2007). The HFIAS is constructed from two types of questions: nine "occurrence" and nine "frequency-of-occurrence" questions. Food Insecurity questionnaires usually employ 9 to 15 questions that detect the level of concern and the lack of access to, variety, and quantity of food (Castell *et al*., 2015). The HFIAS module covers a recall period of 30 days. However, for this research study, a recall period of 12 months was used to get a longitudinal view of the food security situation in Grassland Phase 4 due to the Covid-19 pandemic that influenced food access. Research by INNDEX Project (2018) used a 12-month recall period. The respondent is first asked an occurrence question if a given condition was experienced (yes or no), and if answered yes, then a frequency-of-occurrence question (Coates *et al*., 2007). A frequency-of-occurrence question consists of three frequencies: *rarely* - once or twice during the year, *sometimes* - once every two months and monthly, or *often/always* - once a week or more often).

The responses from the HFIAS questionnaire can be transformed into a continuous or categorical indicator of food security (Coates *et al*., 2007). When calculating the HFIAS as a continuous indicator, each of the nine questions is scored 0-3, with never = 0, rarely = 1, sometimes = 2, often/always = 3, with 3 being the highest frequency of occurrence. The score for each question is added together (Figure 4.1). The total HFIAS can range from 0 to 27, indicating the degree of insecure food access. The maximum score for a household is 27 when a household response to all nine frequency-of-occurrence questions was "often" (coded with a response code of 3), and

the minimum score is 0 if the households responded “no” to all occurrence questions. The higher the score, the more food insecure a household is the lower the score, the less food insecurity a household experiences (Valid International, 2018; Coates *et al*., 2007).

The seven questions from Table 4.5 were used to calculate the HFIAS as a continuous indicator based on the nine questions from the HFIAS questionnaire. Therefore, the HFIAS range for this study is 0 to 21 (all households responded “often” for the frequency-of-occurrence” questions and responded “yes” to the occurrence questions).

When calculating the HFIAS as a categorical variable, the households are categorised as food secure, mildly food insecure, moderately food insecure, or severely food insecure. The households that respond more favourably to severe behaviours (experience them more frequently) are classified as more severely food insecure (Coates *et al*., 2007).

Average HFIAS Score	Calculate the average of the Household Food Insecurity Access Scale Scores $\frac{\text{Sum of HFIAS Scores in the sample}}{\text{Number of HFIAS Scores (i.e., households) in the sample}}$

Figure 4.1: The calculation of the average HFIAS score (Coates *et al*., 2007).

Bickel *et al.* (2000), provided a basis for interpreting the HFIAS score and categorising the households as food secure, food insecure without hunger, moderately food insecure with hunger, and severely food insecure with hunger. Below, Table 4.1 shows the scale used to interpret the HFIAS average score.

Table 4.1: Scale used for Interpreting HFIAS *Average Scores* (Bickel *et al*. (2000).

<table>
<tr><th>Up to 2.32</th><th>Up to 4.56</th><th>Up to 6.53</th><th>Up to 10</th></tr>
<tr><td rowspan="3">Food Secure</td><td colspan="3">Food Insecure</td></tr>
<tr><td rowspan="2">Food Insecure Without Hunger</td><td colspan="2">Food Insecure With Hunger</td></tr>
<tr><td>(Less Severe) “Moderate”</td><td>(More Severe) “Severe</td></tr>
</table>

4.2.3.2. Household Food Insecurity Access Prevalence (HFIAP)” status indicator

The final indicator of Food Insecurity Status is the categorial indicator. The HFIAP indicator was used to evaluate the prevalence levels of food insecurity and access in Grassland Phase 4 informal settlement. The questions in Table 4.5 were based on the HFIAP status indicator. The HFIAP indicator categorises households into four levels (1 - 4) of household food insecurity (access): food secure (1), mild (2), moderately (3), and severely food insecure (4) (Coates *et al*., 2007). Below, the meaning of each level of the HFIAP status indicator is discussed and explained.

Food secure (access) households according to the HFIAP status indicator (Coates *et al*., 2007)

- A situation where a household experience none of the food insecurity (access to food) conditions.
- A situation where the household just experiences anxiety, but only rarely.

Mildly food insecure (access) households (Coates *et al*., 2007)

- Not having enough food sometimes or often.
- Unable to eat preferred foods.
- Consume a more monotonous diet than desired.
- Some foods are considered undesirable, but only rarely.

Moderately food insecure (access) households (Coates *et al*., 2007)

- Sacrifices quality more frequently by eating a monotonous diet or undesirable foods sometimes or often.
- Has started to cut back on quantity by reducing the size of meals or number of meals, rarely or sometimes.

Severely food insecure (access) households (Coates *et al*., 2007)

- Household cuts back on meal size or number of meals often
- Running out of food
- Going to bed hungry
- Going a whole day and night without eating

To calculate the Household Food Insecurity Access (HFIA) category (Figures 4.2 & 4.3) for each household, a category is calculated by assigning a code (1 = Food Secure, 2 = Mildly Food Insecure Access, 3 = Moderately Food Insecure Access, 4 = Severely Food Insecure Access). Where the occurrence question was answered as "no," the corresponding frequency-of-occurrence questions should be recorded as 0.

HFIA category	**HFIA category = 1 (Food Secure)** if [(Q1a=0 or Q1a=1) and Q2=0 and Q3=0 and Q4=0 and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0]
	HFIA category = 2 (Mildy Food Insecure) if [(Q1a=2 or Q1a=3 or Q2a=1 or Q2a=2 or Q2a=3 or Q3a=1 or Q4a=1) and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0]
	HFIA category = 3 (Moderately Food Insecure) if [(Q3a=2 or Q3a=3 or Q4a=2 or Q4a=3 or Q5a=1 or Q5a=2 or Q6a=1 or Q6a=2) and Q7=0 and Q8=0 and Q9=0]
	HFIA category = 4 (Severely Food Insecure) if [Q5a=3 or Q6a=3 or Q7a=1 or Q7a=2 or Q7a=3 or Q8a=1 or Q8a=2 or Q8a=3 or Q9a=1 or Q9a=2 or Q9a=3]

Figure 4.2: How to calculate/determine the HFIA category variable (Coates *et al*., 2007).

HFIA Prevalence	Percentage of households that fall in each food insecurity (access) category. For example: "Percentage of severely food insecure (access) households Example: Number of households with HFIA **category = 4** X 100 Total number of households with a HFIA category

Figure 4.3: Calculation of the HFIA Prevalence (HFIAP) indicator for a household (Coates *et al*., 2007).

4.2.3.3 Coping Strategies Index (CSI)

The CSI was employed to analyse the coping strategies used by the households in Grassland Phase 4. This method is used as a proxy measure of household food insecurity and how people react when they cannot access food (Maxwell & Caldwell, 2008). The CSI shows that food-insecure households employ four types of consumption coping strategies, as shown in Table 4.2 (Anderson, 2010).

Table 4.2: The four categories of the Coping Strategies Index (Maxwell & Caldwell, 2008).

1. Dietary Change
a. Rely on less preferred and less expensive foods
2. Increase Short-Term Household Food Availability
b. Borrow food from a friend or relative
c. Purchase food on credit
d. Gather wild food, hunt, or harvest immature crops
e. Consume seed stock held for next season
3. Decrease Numbers of People
f. Send children to eat with neighbors
g. Send household members to beg
4. Rationing Strategies
h. Limit portion size at mealtimes
i. Restrict consumption by adults in order for small children to eat
j. Feed working members of HH at the expense of non-working members
k. Reduce number of meals eaten in a day
l. Skip entire days without eating

According to Tables 4.5 and 4.7, the households in this study used all four CSI categories to cope with food insecurity. These coping strategies assign different weights according to severity (Table 4.2). For example, dietary change (eating less preferred food) is assigned category 1 and is considered least severe/mild. Category 2 (moderately severe) is assigned to "increase short-term household food availability." Category 3 (severe) is assigned to the questions of "decreased number of people", and lastly, category 4 (most severe) is assigned to the questions of "rationing strategies" (Maxwell & Caldwell, 2008).

Two pieces of information are needed to analyse the CSI results: scoring the relative frequency and scoring the weights assigned in Figure 4.4. Frequency is a measure of how many days in the past week or month a household had to rely on the various coping strategies—ranging from "never" (0) to "every day" (7). The frequency score is then multiplied by the severity weight (Anderson, 2010; Maxwell & Caldwell, 2008).

Never	Once a week or less	Twice a week	Often/3-6 times a week	Every day
0	*0.5*	*1.5*	*4.5*	*7*

Figure 4.4: Relative frequency categories of coping strategies for a 30-day recall period (Modified from CARE and WFP, 2003).

4.3 Statistical analysis

A statistician at the Department of Mathematical Statistics and Actuarial Science: Statistical Consultation, Unit of the University of the Free State, performed the statistical analysis. The data was exported from the EvaSys© software to SPSS version 25. SPSS was used to do basic descriptive statistics. Data were presented as frequencies and percentages in tables and graphs for each categorical question. R statistical software was used to determine Cronbach's alpha (α) to test the reliability of the questionnaire. Pearson's chi-squared tests were implemented and intended to test how likely an observed distribution is due to chance (Fall, 2008).

The Pearson and Spearman correlation coefficients were calculated using the scale data. Pearson's correlation graph/matrix used in this study was discussed based on the correlation data in Appendix F. Correlation measures the strength of association between two variables and the direction of the relationship. The value of the correlation coefficient varies between +1 and -1, and a value of ± 1 indicates a perfect degree of

association between the two variables. When the correlation coefficient value reaches 0, the relationship between the two variables will weaken (Chen & Popovich, 2002). A positive (+) correlation means that if one variable increases, the other moves in the same direction. A negative (-) correlation means that if one variable increases, the other variable decreases and moves in the opposite direction of the other (Nurse Killam, 2014).

4.4 Results and discussion

The study assessed the level and experiences indicative of food insecurity in the households of Grassland Phase 4 (Grassland phase 4 – informal settlement) in Bloemfontein.

4.4.1 Demographic results from the questionnaire

The following section presents findings on the demographic characteristics of the respondents in this study.

Table 4.3: Demographic characteristics of the respondents

Demographic characteristics	Label/Item	n	%
Person purchasing the food in Household	Head of the household - support household financially	*236*	*79.7*
	Head of household - do not support household financially	*1*	*0.3*
	Related to head of household - purchase food	*51*	*17.2*
	Not related to head of household but purchase food	*8*	*2.7*
	Total	*298*	*100*
Age of household head/person responsible for food purchases	60 years and older	*63*	*21.2*
	36 - 59 years	*144*	*48.5*
	21 - 35 years	*90*	*30.3*
	18 - 20 years	*1*	*0.3*
	Total	*298*	*100*
Number of dependants per age group	Younger than one year	*33*	*11.1*
	Between one and five years	*139*	*46.6*
	Between six and 18 years	*208*	*69.8*
	Between 19 and 64 years	*180*	*60.4*
	65 years and older	*70*	*23.5*
Gender of respondents	Male	*138*	*46*
	Female	*160*	*54*
	Total	*298*	*100*
Home language	Sesotho	*275*	*92.3*
	IsiXhosa	*36*	*12.1*
	Afrikaans	*35*	*11.7*
	Setswana	*1*	*0.3*
	IsiZulu, English, other	*0*	*0*
Highest level of education	Attended grade 8 -12 but did not complete matric	*101*	*33.9*
	Never attended school	*23*	*7.7*
	Attended tertiary education but did not finished	*1*	*0.3*
	Did not attend school past grade 7	*90*	*30.2*
	Completed matric	*83*	*27.9*
	Total	*298*	*100*
Occupancy status	Live in a shack that head of household built	*220*	*73.8*
	Live in shack that head of household rent	*23*	*7.7*
	Live in brick house that head of household built	*48*	*16.1*
	Live n brick house that head of household rent	*6*	*2*
	Live in a RDP government house	*1*	*0.3*
	Total	*298*	*100*

The demographic results in Table 4.3 show that the majority (79.7%) of food purchases are done by the head of the household and in most households. More than half (54%) of the respondents were female. The finding implies that most households were in the care of females. Households in the care of females may be more vulnerable to food insecurity; women account for most unemployed adults (Zepeda *et al*., 2013). Almost half (47%) of South African working-age women were unemployed compared to 35.6% of men in 2022 (Stats SA, 2022). Table 4.3 shows that the head of the household was not the only one responsible for food purchases and was supported by either a relative (17.2%) or a non-related member (2.7%) within the household. The majority (78.5%) of the family heads were in the age bracket between 21-59 years old; this implies that most of the respondents were in a productive and economically active age bracket. Most (69.8%) of the dependents were between six and 18 years old. According to Moffitt and Ribar (2016), the prevalence of food insecurity among teenagers is twice that of younger children in low-income households, possibly due to households prioritizing food more for younger children than older children. The home language of most (92.3%) of the respondents was Sesotho, implying that black Africans head most households. Households headed by black Africans and people of colour were less likely to have adequate food access than households headed by whites and Indians/Asians (Stats SA, 2019).

Table 4.3 shows that a third (33.9%) of the respondents attended secondary school but did not manage to complete matric, and 30.2% did not attend school past grade seven. Roughly 27.9% of respondents completed their matric qualifications. Only 0.3% attended a tertiary institution, but none of the respondents obtained a tertiary qualification. Access to quality education can help people build a better future for themselves and escape the cycle of poverty (Wassil, 2022). Table 4.3 shows that most (73.8%) respondents occupy a shack/informal dwelling. Dilapidated housing (i.e., shacks) is associated with exposure to dust, mould, moisture, mites, and rodents, leading to mental health stressors and decreased food safety (Hood, 2005). Households in this study could, therefore, be at risk of decreased food safety, exacerbating food insecurity (Garcia *et al*., 2020).

4.4.1.8 Main sources of income

According to Table 4.4, a large portion (+/- 50%) of the respondents' income is from the following sources: social grants (51.4%), old-age pensions (45.5%), and monthly salaries (30.3%) (Table 4.4). Roughly 45.6% of respondents in Table 4.4 received a small portion (10-25%) of their income from cash loans from family/friends or neighbours, and 1.4% received it as the only source of income. Stats SA (2019) indicates that the most popular sources of income for households are salaries (62.2%) and grants (46.2%). South African households receiving social grants increased from 30.8% in 2003 to 45.6% in 2019 (Stats SA, 2019). Table 4.4 shows that only a few households receive an income from salaries which may indicate that not many respondents are working or cannot find a permanent job to sustain the household, thereby causing decreased access to adequate food and increasing food insecurity. Many respondents depend on social and pension grants, meaning many households rely on government assistance to buy food (Altman & Ngandu, 2010).

Table 4.4: Main sources of household income in Grassland Phase 4

		Not at all	Small portion (10-25%)	Some extent (+/-25%)	Large portion (+/-50%)	Only source	Total
Social Grants	n	*101*	*30*	*3*	*152*	*10*	*296*
	%	*34.1*	*10.1*	*1*	*51.4*	*3.4*	*100*
Old-age pension	n	*150*	*5*	*2*	*135*	*5*	*297*
	%	*50.5*	*1.7*	*0.7*	*45.5*	*1.7*	*100*
Monthly salary	n	*156*	*20*	*1*	*90*	*30*	*297*
	%	*52.5*	*6.7*	*0.3*	*30.3*	*10.1*	*100*
Piece jobs	n	*192*	*34*	*4*	*39*	*27*	*296*
	%	*64.9*	*11.5*	*1.4*	*13.2*	*9.1*	*100*
Self-employment	n	*284*	*0*	*0*	*0*	*11*	*295*
	%	*96.3*	*0*	*0*	*0*	*3.7*	*100*
Cash loans from family, friends or neighbours	n	*137*	*135*	*7*	*13*	*4*	*296*
	%	*46.3*	*45.6*	*2.4*	*4.4*	*1.4*	*100*
Cash loans from financial institution	n	*214*	*62*	*0*	*11*	*11*	*298*
	%	*71.8*	*20.8*	*0*	*3.7*	*3.7*	*100*
Student bursary money	n	*272*	*4*	*0*	*8*	*11*	*295*
	%	*92.2*	*1.4*	*0*	*2.7*	*3.7*	*100*
Other	n	*267*	*0*	*0*	*0*	*13*	*280*
	%	*95.4*	*0*	*0*	*0*	*4.6*	*100*

4.4.1.9 Combined monthly household income of the households in Grassland Phase 4

Figure 4.5 indicates that almost half of this study's households (43.3%) earned a combined income of R3331 to R5000. The income is low relative to the cost of living in each household and, therefore, could contribute to food insecurity and decreased food access (Altman & Ngandu 2010). About 4.7% of households earned a combined income of less than R1000 per month, close to the food poverty line of R624 per person per month, indicating that these households are especially vulnerable to food insecurity. Only about 0.3% of households earned a combined income of more than R10 000.

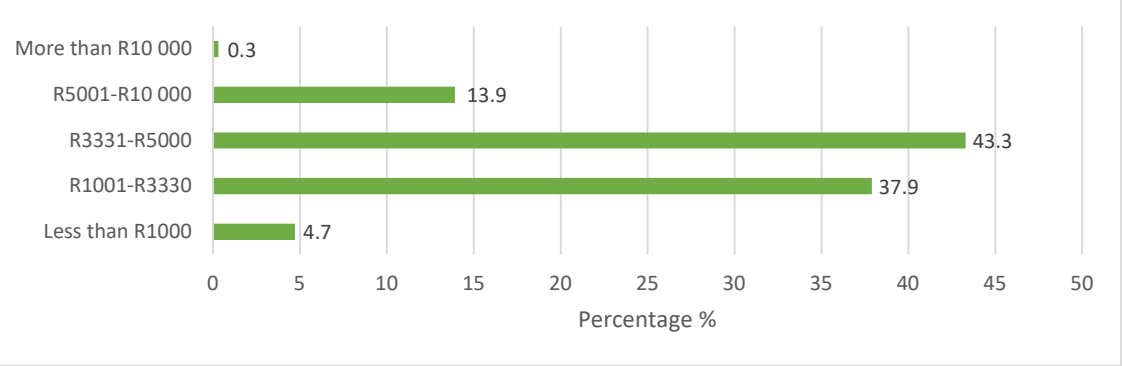

Figure 4.5: Combined monthly household income of the households in Grassland Phase 4.

4.4.1.10 Generic questions of household's access to food in the past year (365 days) based on the HFIAS and CSI questionnaire

Table 4.5 represents the households of Grassland Phase 4's access to adequate food for the past year. Table 4.5 shows that 26.3% of households ran out of money to buy food at least once a week or more often, and about 21.5% ran out of money monthly. Only about 8% of households experience "running out of money to buy food" once or twice a year, and 41.8% never run out of money. Households had to cut the size of their meals/or eat less, more likely monthly (39.9%) and once a week or more (38.6%). Some households had to eat a smaller variety of food, mostly monthly (41.6%) and weekly (36.2%). More than half (64.4%) of the households never had to skip all three meals daily, but some households had to skip all three monthly and weekly (8.6%). Only about 4.2% of households had to skip meals once or twice during the year or

once every two months. Table 4.5 indicates that about 12% of children had to eat less than they usually eat weekly and about 17% monthly. In some households, the children had to skip more than one meal per day, with 4.4% skipping more than one meal monthly and 0.7% weekly. About 10.4% of children had to skip a meal at least twice a year. Most children (82.8%) never had to skip a meal. Table 4.5 also shows that in some households, the children were hungry due to the absence of food in the house, with at least 17.1% of children experiencing this phenomenon monthly and about 3% experiencing it weekly or more. About 6.4% of children experienced hunger at least once or twice during the year, and most children, 71.1%, did not experience hunger.

Table 4.5: Food insecurity-related questions based on the HFIAS and CSI questionnaire during the past year (365 days) of the households in Grassland Phase 4

		Never	Once or twice during the year	Once every two months	Monthly	Once a week or more often	Total
Our household ran out of money to buy food	n	*124*	*24*	*7*	*64*	*78*	*297*
	%	*41.8*	*8.1*	*2.4*	*21.5*	*26.3*	*100*
Our household had to cut the size of our meals/or ate less	n	*39*	*16*	*9*	*119*	*115*	*298*
	%	*13.1*	*5.4*	*3*	*39.9*	*38.6*	*100*
Our household skipped all three meals in a day	n	*192*	*44*	*11*	*25*	*26*	*298*
	%	*64.4*	*14.8*	*3.7*	*8.4*	*8.7*	*100*
Our household had to eat a smaller variety of food than usually	n	*40*	*18*	*8*	*124*	*108*	*298*
	%	*13.4*	*6*	*2.7*	*41.6*	*36.2*	*100*
The children (under 18s) had to eat less than what they usually eat	n	*190*	*19*	*3*	*50*	*34*	*296*
	%	*64.2*	*6.4*	*1*	*16.9*	*11.5*	*100*
The children (under 18s) had to skip more than one meal per day	n	*246*	*31*	*5*	*13*	*2*	*297*
	%	*82.8*	*10.4*	*1.7*	*4.4*	*0.7*	*100*
The children (under 18s) in the household are hunger due to no food in house	n	*212*	*19*	*8*	*51*	*8*	*298*
	%	*71.1*	*6.4*	*2.7*	*17.1*	*2.7*	*100*

4.4.1.10.1 Calculating and interpreting the average HFIAS score for the households of Grassland Phase 4

The average HFIAS score was calculated as described in Figure 4.1 and the data from Table 4.6 was used to execute the calculation. The total number of households in this sample is 298. The average HFIAS score was calculated as follows (Figure 4.1):

$$\frac{\text{Sum of HFIAS scores in the sample}}{\text{Number of households in the sample}} = \frac{2082}{298}$$

Average HFIAS = **6.98**

According to the scale for interpreting HFIAS scores by Bickel *et al*. (2000), the score should be converted to a 0-10 metric by dividing individual household score by the maximum household score (21) and multiplying by ten. An average HFIAS of 6.98 means that majority of the households had a score of 6.98X10/21 = **3.32** and are classified as food insecure without hunger based on the classification scale (Table 4.1).

Table 4.6: Food insecurity questions from Table 4.5 with the HFIAS frequency-of-occurrence scores assigned

	Never = 0	**Rarely = 1**	**Sometimes = 2**	**Often = 3**	**Total for each question**
	Never	Once or twice during the year	Once every two months & Monthly	Once a week or more often	
	n values of respondents				
Our household ran out of money to buy food (Household worries about food)	*124*	*24*	*71*	*78*	*297*
Our household had to cut the size of our meals/or ate less	*39*	*16*	*128*	*115*	*298*
Our household skipped all three meals in a day (Go without food for a whole day)	*192*	*44*	*36*	*26*	*298*
Our household had to eat a smaller variety of food than usually	*40*	*18*	*132*	*108*	*298*
The children (under 18s) had to eat less than what they usually eat	*190*	*19*	*53*	*34*	*296*
The children (under 18s) had to skip more than one meal per day	*246*	*31*	*18*	*2*	*297*
The children (under 18s) in the household are hunger due to no food in house	*212*	*19*	*59*	*8*	*298*
TOTAL HOUSEHOLD RESPONSES FOR EACH FREQUENCY	***1043***	***171***	***497***	***371***	***2082***

4.4.1.10.2 Calculating and interpreting the HFIAP score for the households of Grassland Phase 4

The HFIAP score was calculated as described in Figure 4.3 and the data from Table 4.6 was used to execute the calculation. The HFIA category and HFIA prevalence was calculated as described in Figures 4.2 and 4.3.

$$\frac{\text{Number of households with HFIA category = 1 or 2 or 3 or 4}}{\text{Total number of households with a HFIA category}} \times 100$$

HFIAP for category = 1 (Food Secure): 1043/2082 X 100 = **50.1%**
HFIAP for category = 2 (Mildy Food Insecure): 171/2082 X 100 = **8.21%**
HFIAP for category = 3 (Moderately Food Insecure): 497/2082 X 100 = **23.9%**
HFIAP for category = 4 (Severely Food Insecure): 371/2082 X 100 = **17.8%**

According to the HFIAP category calculations above, about half (50.1%) of the households in this study are considered food secure and therefore experienced none of the food insecurity conditions or experienced some anxiety but only rarely. The households that experienced food insecurity accounts for 49.9% (8.21% + 23.9% + 17.8%) and therefore experienced some food insecurity conditions (eating less preferred food, cutting back on meals, running out of food). The households that experienced severe food insecurity account for 17.8%, indicating that these households went a whole day without food, cut back on the size and number of meals, and went to bed hungry.

4.4.1.11 Coping strategies that households in Grassland Phase 4 used to manage household food shortage.

Coping strategies are employed when a household needs to combat food shortages or change its eating habits. Coping strategies involve methods used to identify how food insecure a household is. It is also used as a social response to offset or navigate through a household's economic and food resources in times of hardship (Ninno *et al*., 2003). Table 4.7 describes the coping strategies used by the households of Grassland Phase 4. Most respondents in Table 4.7 'relied on less expensive food' (97.9%) or 'less preferred food' (96.6%). More than half restricted consumption by adults for small children to eat (54.2%), of which 15.8% restricted consumption 'every day' and 48.1% of respondents 'asked neighbours for food'. According to Table 4.7, about 28.3% of

the respondents had to ‘sell some belongings to get money to buy food’, and 27.6% had to ‘send household members to beg for food or money’. Approximately 22.9% of the respondents indicated they obtained vegetables from their garden. Respondents with vegetable gardens show that they engage in agricultural activity to secure an additional food source or augment their existing food sources (Stats SA, 2019). To secure food over a short period, some respondents (11.4%) contributed to a ‘stokvel’, and 25.5% did ‘piece’ jobs (Table 4.7).

Table 4.7: Food insecurity questions for the last 30 days based on the CSI questionnaire

		Everyday	Once a week	Once every two weeks	Once during the 30 days	Never	Total
Asked neighbours for food	n	3	23	28	89	154	297
	%	1	7.7	9.4	30	51.9	100
Relied on less expensive food	n	277	9	1	3	6	296
	%	93.6	3	0.3	1	2	100
Relied on less preferred food	n	236	28	11	11	10	296
	%	79.7	9.5	3.7	3.7	3.4	100
Household members went begging for food/money	n	3	6	17	56	215	297
	%	1	2	5.7	18.9	72.4	100
Gathered wild food	n	1	5	10	110	171	297
	%	0.3	1.7	3.4	37	57.6	100
Restricted consumption by adults for small children to eat	n	47	49	19	46	136	297
	%	15.8	16.5	6.4	15.5	45.8	100
Restricted consumption by small children for adults to eat	n	4	1	0	1	292	298
	%	1.3	0.3	0	0.3	98	100
Obtained vegetables from own garden as food	n	1	5	35	27	228	296
	%	0.3	1.7	11.8	9.1	77	100
Received vegetables from neighbours' gardens	n	1	4	17	105	171	298
	%	0.3	1.3	5.7	35.2	57.4	100
Sold belongings to purchase food	n	1	1	7	75	212	296
	%	0.3	0.3	2.4	25.3	71.6	100
Received food from welfare or church organizations	n	1	0	0	3	291	295
	%	0.3	0	0	1	98.6	100
Went to local soup kitchen for a meal	n	1	8	3	24	259	295
	%	0.3	2.7	1	8.1	87.8	100
Use stockvel to ensure food security during periods of food scarcity	n	0	1	0	33	263	297
	%	0	0.3	0	11.1	88.6	100
Did small piece jobs to have money for food	n	18	42	3	13	222	298
	%	6	14.1	1	4.4	74.5	100

Table 4.8: Household CSI score of Grassland Phase 4 calculated based on the frequency categories in Figure 4.4 and the severity weights discussed in Table 4.2

Consumption questions based on the four categories of CSI with a recall period of 30 days	Frequency score	Severity score	Weighted score = Frequency x severity score
Rely on less preferred and less expensive foods?	*7*	*1*	*7*
Borrow food, or rely on help from a friend/relative?	*0.5*	*2*	*1*
Purchase food on credit?	*0.5*	*2*	*1*
Gather wild food, hunt, or harvest immature crops?	*0.5*	*2*	*1*
Consume seed stock held for next season?	*N/A*	*N/A*	*0*
Send household members to eat elsewhere?	*0.5*	*3*	*1.5*
Send household members to beg?	*0.5*	*3*	*1.5*
Limit portion size at mealtimes?	*1.5*	*4*	*6*
Restrict consumption by adults in order for small children to eat?	*1.5*	*4*	*6*
Feed working members at the expense of non-working members?	*N/A*	*N/A*	*0*
Reduce number of meals eaten in a day?	*1.5*	*4*	*6*
Skip entire days without eating?	*2.7*	*4*	*10.8*
TOTAL HOUSEHOLD SCORE			***41.8***

Please note that the consumption coping strategy questions in this table are scored based on the food security questions from Tables 4.5 and 4.7. The not applicable (N/A) questions mean these types of questions did not appear in Tables 4.5 and 4.7.

The households in Table 4.8 show a CSI score of 41.8, and at first glance, the results indicate a moderate level of food security and a low frequency in most severe coping behaviours. According to Maxwell & Caldwell (2008), a score of 41.8 has little meaning. However, suppose another informal settlement near Grassland Phase 4 scored higher (i.e., 55) than 41.8; then we can state that the households with a score of 41.8 are less food insecure than those with a score of 55 (Maxwell & Caldwell, 2008).

4.4.1.12 Pearson's correlation analysis of the food security situation of households in Grassland Phase 4.

Pearson's correlation is used to determine the relationships between variables and is commonly applied to numerical variables. The relationship observed can either be negative (-) or positive (+) (Nettleton, 2014).

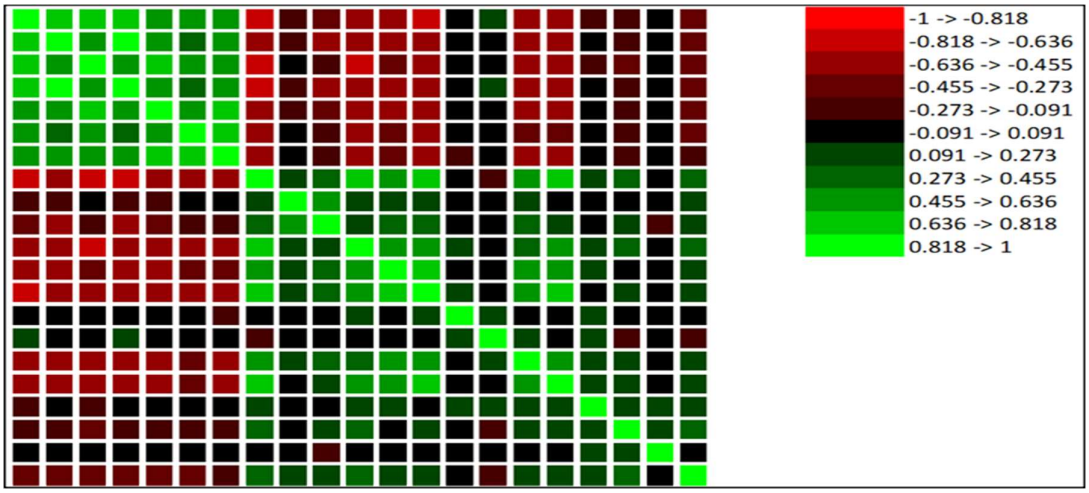

Figure 4.6: Pearson's correlation matrix of the food security situation of Grassland Phase 4.

In Figure 4.6 'our household ran out of money to buy food' shows a strong positive significant ($p < 0.001$) correlation of $r = 0.763$ with 'our household had to cut the size of our meals/or ate less because there was not enough food,' a strong positive significant ($p < 0.001$) correlation of $r = 0.765$ with 'our household had to eat a smaller variety of food than we usually do,' a strong positive significant ($p < 0.001$) correlation of $r = 0.693$ with 'our household skipped all three meals in a day because there was no food in the house,' a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.596$ with 'children had to eat less than what they usually eat because of a lack of food in the house,' a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.562$ with 'children in the household complained because they were constantly hungry from not having food in the household,' and a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.467$ with 'children had to skip more than one meal per day because there was no food to eat in the house.' The positive correlations indicate that when the household runs out of money to buy food, they also must cut the size of their meals, eat a smaller variety of food, and skip all three meals daily.

Children had to eat less; the children complained of constant hunger, and the children had to skip more than one meal per day.

A strong negative significant ($p < 0.001$) correlation of $r = -0.736$ is observed between 'our household ran out of money to buy food' and 'asked neighbours for food (Figure 4.10),' a strong negative significant ($p < 0.001$) correlation of $r = -0.695$ with 'restricted consumption by adults for small children to eat,' and a moderately strong negative significant ($p < 0.001$) correlation of $r = -0.595$ with 'sold some belongings to get money to buy food,' a moderately strong negative significant ($p < 0.001$) correlation of $r = -0.511$ with 'received vegetables from other people's vegetable gardens,' a moderately strong negative significant ($p < 0.001$) correlation of $r = -0.509$ with 'gathered wild food,' a moderately strong negative significant ($p < 0.001$) correlation of $r = -0.440$ with 'relied on less preferred food,' and a weak negative significant ($p < 0.001$) correlation of $r = -0.369$ with 'did small/piece jobs for food/money to buy food with.' These negative correlations indicate that when there is a decrease in the chances of a household running out of money to purchase food, there is an increase in asking neighbours for food, restricting consumption by small children, selling belongings, receiving vegetables from others, and gathering wild food.

'Our household had to cut the size of our meals/or ate less because there was not enough food' shows a strong negative significant ($p < 0.001$) correlation of $r = -0.628$ with 'asked neighbours for food,' a moderately strong negative significant ($p < 0.001$) correlation of $r = -0.595$ with 'restricted consumption by adults for small children to eat,' a moderately strong negative significant ($p < 0.001$) correlation of $r = -0.515$ with 'sold some belongings in order to get money to buy food,' a moderately strong negative significant ($p < 0.001$) correlation of $r = -0.510$ with 'sent household members to beg for food or money,' a moderately strong negative significant ($p < 0.001$) correlation of $r = -0.496$ with 'relied on less preferred food,' a moderately strong negative significant ($p < 0.001$) correlation of $r = -0.487$ with 'gathered wild food,' a moderately strong negative significant ($p < 0.001$) correlation of $r = -0.475$ with 'received vegetables from other people's vegetable gardens,' and a weak negative significant ($p < 0.001$) correlation of $r = -0.378$ with 'did small/piece jobs for food/money to buy food with.' The negative correlations indicate that when there is a decrease in cutting the size of their meals or eating less, there is an increase in asking neighbours for food, restricting consumption by adults, selling some belongings, sending household members to beg

for food, relying on less preferred food, gathering wild food, receiving vegetables, and doing piece jobs.

In conclusion, the positive correlations discussed in Figure 4.6 indicate that when a household does not have enough money or food available, they usually revert to reducing their meals and a variety of food, selling belongings, and skipping all meals, which often leads to children complaining about constant hunger and adults restricting their food consumption. The negative correlations discussed in Figure 4.6 shows that when some households experience a decrease in running out of food and money, skipping meals, and a decrease in children complaining about hunger, they still rely on their neighbours for food. They also continue to gather wild food, sell their belongings, do piece jobs, and even restrict the consumption of food by small children for adults to eat.

4.5 Conclusion

The demographic results conclude that the majority (54%) of this study's respondents were female and responsible for the household's food purchases. The majority (73.8%) of respondents occupied a dilapidated dwelling/shack as a permanent residence. Only 27.9% of the respondents completed their matric qualification and might have better work opportunities available and break the cycle of poverty. Social grants and Old-age pensions contributed to the most significant portion of income, indicating that most of the households in Grassland Phase 4 depend on the government for financial support.

Results from the HFIAS and HFIAP scales conclude that the households of Grassland Phase 4 did experience some level of food insecurity. The HFIAS score was determined to be 3.32, implying that the households did experience food insecurity. The HFIAP category indicated that half (50%) of the households were food secure and did not experience food insecurity except for some minor anxiety and worry about access to food. About 49.9% of households did experience food insecurity, of which 17.8% experienced severe food insecurity, implying that these households had to cut back on the size and number of meals per day, went to bed hungry, and sometimes went a whole day without food.

The CSI score of 41.8 depicted a moderate level of food insecurity, meaning households most often increase their short-term food availability by borrowing food

from friends or relatives, purchasing food on credit, and gathering wild food. The CSI frequency score indicated that the households in this study had a low frequency in the most severe coping strategies and the highest frequency in the least severe coping behaviours, thereby confirming that most households in Grassland Phase 4 experienced moderate levels of food insecurity. The correlations discussed in Figure 4.6 conclude that some households did experience food shortages and made use of the coping strategies in Table 4.7. In contrast, some households did not experience food insecurity but still used coping strategies.

4.6 Recommendations

The South African government can help implement strategies to address food insecurity at a household level by empowering the community of Grassland Phase 4. The community can be trained through workshops and support groups implemented by the government to help train people to improve their dietary intake and quality foods.

For future studies, a better comparison of the CSI score can be achieved by comparing Grassland Phase 4 informal settlement with another informal settlement within proximity. The questionnaire used in this study can be adjusted for future studies to include more food insecurity questions, thereby providing a broader perspective of the food security situation in Grassland Phase 4.

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CHAPTER 5

The investigation of the food consumption patterns used in Grassland Phase 4 informal settlement

Abstract

A healthy diet or consumption pattern consists of nutrient-rich foods from all food groups. The objective of this study is to investigate the dietary pattern of households in Grassland Phase 4. The results showed that more than half (54%) of the respondents were female and responsible for food preparation and consumption. Meal preparation was regular, and 96% of households prepared meals daily. Most households (80.6%) had electricity and used an electric stove to prepare meals. Pearson correlations confirmed that households in this study consumed foods from most of the major food groups. More than half (54.1%) of the households did not have access to a water source. Participants in this study were most likely to buy their food from a spaza/canteen shop rather than a supermarket. Maize flour (87.1%) was the most consumed and borrowed food group in this study. The FCS was used to determine dietary diversity. The results yielded a score of 31, indicating that household consumption patterns were borderline. Respondents grew fruits, vegetables, and dairy products. People can contribute to dietary diversity by growing a greater variety of foods and vegetables.

Keywords: Food preparation, food consumption patterns, dietary diversity, food groups, grains, fruit and vegetables, dairy products, meat, food access, Food Consumption Score.

5.1 Introduction

South Africa continues to experience poverty, unemployment, increased food prices, and energy tariffs despite the economic and political advances made since 1994 (Musemwa *et al*., 2013). These challenges have placed low-income households who struggle to meet their basic household needs, in an even more vulnerable state (Labadarios *et al*., 2009). Research shows that more than 70% of people living in Sub-Saharan Africa, reside in informal settlements[1], and about one in five people in South Africa occupies a shack[2] of which most are clustered in informal settlements (Gallaher *et al*., 2013; Turok, 2015). The livelihoods of people residing in informal settlements are threatened by food insecurity and poverty due to the expected increase in the number and sizes of informal settlements in the future (Soma *et al*., 2022). People from low-income households, residing in informal settlements, have been consistently associated with poor-quality dietary intake compared to those with a higher income (French *et al*., 2019). Individuals from low-income households consume less fruit and vegetables, resulting in an overall lower diet quality compared to individuals with a high household income (French *et al*., 2019). Household food purchases may be an important tool in examining household food consumption/dietary patterns[3]. Lower-income households purchase food of lower nutritional value compared to the purchases of higher-income households. These lower-quality food purchases may be due to higher food prices (Wang *et al*., 2014; French *et al*., 2019).

A healthy dietary or consumption pattern consists of nutrient-dense foods and is based on the seven different food groups of South Africa (WHO, 2012). The FBDGs formulated seven food groups that should be eaten regularly by each South African. The seven food groups are as follow: vegetables and fruits; starchy foods; legumes; milk and dairy products; meat, fish, and eggs; and water (WHO, 2012). South African diets have shifted towards more kilojoules per day as it includes more sugar-

[1] Informal settlements are defined as: "areas where groups of housing units have been constructed on land that the occupants have no legal claim to or occupy illegally" or as: "unplanned settlements and areas where housing is not in compliance with current planning and building regulations (unauthorized housing" (Glossary of Environment Statistics, 1997).

[2] A shack can be defined as: "a very simple and small building made from pieces of wood, metal, or other materials" (Cambridge Dictionary, 2022).

[3] Food consumption/dietary patterns are defined as: "the quantities, proportions, variety or combination of different foods, drinks, and nutrients (when available) in diets and the frequency with which they are consumed" (Millen, 2016).

sweetened beverages, processed foods, sweets, and savoury snacks (Ronquest-Ross *et al*., 2015). The main foods that South Africans consume are cornmeal, wheat products, milk, potatoes, white and brown bread, margarine, chicken, tea, sugar, and leafy greens (Steyn *et al*., 2003). Foods such as milk, meat, fish, and eggs sold to the poor in Africa generally come from informal markets; therefore, these markets contribute to food security (Glatzel, 2017). Informal markets (spaza stores, street vendors, sidewalk vendors) in townships tend to be located near low-income households and serve as the main source of food purchases for many poor households (Resnick, 2017).

Inequalities in accessibility to fresh food and food products can negatively affect consumption patterns and hinder food preparation (Kearney, 2010). The factors that influence food consumption behaviour are consumer choice, accessibility, and availability (Eufic, 2006). Consumer food choices are in turn influenced by geography, demographics, disposable income, education, marketing, globalisation, urbanisation, ethnicity, culture, and religion (Kearney, 2010; BFAP, 2011; Wenhold *et al*., 2012). Determining food consumption patterns provides researchers with valuable tools for identifying food and eating pattern trends, which are necessary for assembling and calculating food baskets, creating nutritional profiles, analysing trends for the food industry, addressing food insecurity, and monitoring progress toward compliance with dietary guidelines (Kearney, 2010; Serra-Majem *et al*., 2003; Faber *et al*., 2013).

According to FAO (2003b), the responsibility for providing safe and nutritious food lies with all factors in the food chain, such as production, processing/preparation, trade, and consumption. The most conspicuous activities in the informal sector are food production, processing/preparation, transportation, and retail sales of fresh or prepared food. Responsibility extends to the end consumer, who must ensure that food is prepared and properly stored in a hygienic and safe environment (FAO, 2003b). Women tend to be the most skilled in food preparation and have the necessary cooking equipment and utensils at home (FAO, 2003a; FAO, 2003b). Women in the household most often do the food shopping; price is the most important criterion when choosing a food product. At the same time, after price, nutritional content, taste, health, hygiene, safety, and ease of preparation are considered (Shisana *et al*., 2013).

Transportation plays an important role in access to food prepared in a household. Research shows that the availability of public transportation affects access to grocery stores (Widener *et al*., 2017). They mentioned that households that do not own a car must use public transportation for grocery shopping if grocery stores are not within walking distance. When public transportation is not available, consumers are more likely to purchase food items such as snacks at convenience stores or tuckshops, which can increase food insecurity and malnutrition (Cafiero, 2013). Another negative effect for households that do not own a car is that they may have to spend more money on public transportation to buy food at a grocery store, which may cause households to cut back on meals. Since poor people are less likely to own a car, a lack of public transportation may cause these households to run out of money and food faster than those who own a vehicle or have adequate access to public transportation (Baek, 2014).

Safe, clean water is necessary to prepare healthy and nutritious food (Rahman & Akter, 2020). No human being can survive without water; therefore, water services' availability and safety are critical to promoting the quality of human life (Khan, 2013). The integration of access to safe water is critical to a country's social-economic development (Stats SA, 2017). Clean, safe drinking water can is defined as "water of such consistent quality, posing no significant health risk, that a reasonable, accurately informed consumer need have no health concerns sufficient to justify seeking alternatives" (Hrudey *et al*., 2012). The United Nations states, "The human right to water entitles everyone to sufficient, safe, acceptable, physically accessible, and affordable water for personal and domestic uses" (United Nations General Assembly, 2010). The South African Bill of Rights, the cornerstone of democracy in South Africa, declares that access to safe water is a fundamental human right and improves every person's welfare (Danti, 2018). Informal settlements in South Africa do not have adequate access to safe water due to the absence of proper infrastructure or non-operational water supply structures. The unresolved issues with inadequate access to clean water can lead to water-borne diseases, unsafe living conditions, and food preparation practices (Danti, 2018).

This study investigates the consumption patterns and dietary diversity of the households in Grassland Phase 4 informal settlement by looking at the consumption and food preparation methods used, household income, transport, and access to

water. This study used a descriptive research approach to identify the participating households' demographic, socio-economic characteristics, and dietary diversity profiles.

5.2 Material and methods

This study used a quantitative research approach combined with a descriptive and exploratory approach to determine the food consumption patterns and dietary diversity of Grassland Phase 4 informal settlement. Quantitative research is used to discover patterns and relationships and make predictions (Thomas, 2020; Bhandari, 2020). Therefore, a quantitative approach was ideal for this study whereby numerical data and statistics were used to determine patterns and relationships about the food security situation of Grassland Phase 4. A descriptive and exploratory approach is practical when little is known or can be identified about a specific topic or situation. The problems encountered can be solved or improved through descriptions, observation, and analysis (Koh & Owen, 2000; McCombes, 2019).

5.2.1 Population and sampling

5.2.1.1 Population

The targeted population for this research study was from an informal settlement, named Grassland Phase 4 (informally referred to as Khayelitsha) in Bloemfontein. Bloemfontein is one of the three urban centres of the Mangaung Metropolitan Municipality and is the capital city of the Free State Province of South Africa, also known as one of the seven largest cities in South Africa (Mphambukeli, 2015). Grassland Phase 4 is a small informal settlement that was developed in the 1990s and was previously a privately owned agricultural small-holding area with about 2500 to 6000 plus households ((Mphambukeli, 2014).

5.2.1.2 Sampling

This study used non-probability purposive sampling to select the sample of respondents. This sampling technique is applied when one uses their judgement and thoroughly thinks about selecting the respondents to participate in the research survey (Alchemer, 2021). Purposive sampling is prone to bias due to using one's judgement and is vulnerable to errors (Saunders *et al*., 2012; Nikolopoulou, 2022).

The sample size for this research study, compensating for incomplete or non-usable questionnaires, was determined at 300 households based on a 95% level of significance and 0.05 margin of error (Wessa, 2018). A sample size of 300 was drawn from 2500 to 6000 established households. Grassland Phase 4 was divided into strata A, B, and C. Each stratum was separated into two sections: point 1 and point 2 for strata A, 3 and 4 for strata B, and 5 and 6 for strata C. At each point, 50 randomly selected respondents were asked to complete the questionnaire. Three hundred questionnaires were evenly distributed in predetermined locations (strata A, B, C) using cold canvassing until reaching the intended number.

5.2.2 Data collecting instruments

The data was gathered through a structured, standardised questionnaire (Appendix A). The questionnaire consists of both closed and open-ended questions. EvaSys© software program was used to compile and generate the questionnaire for this research study. Due to this study's explorative aspect (limited research on this topic), the questionnaire consisted of questions from already existing and validated questionnaires based on the FCS. The demographic questions were based on the food surveys by Sustainable food places.org (2020) and newly formed questions by the researcher based on literature and observations from the pilot questionnaire. The data was collected over three months, from February 2021 to April 2021, and each questionnaire took about 25 to 40 minutes to complete. The questionnaires were physically administered using a tablet (electronic device) by two trained field workers. The field workers adhered to the Covid-19 protocol set by the Government of the Republic of South Africa during data collection (Appendix E). The face-to-face interaction allowed the questionnaire to be completed more thoroughly and made the respondents feel more at ease if they needed clarification. The researcher

administered 300 questionnaires, and the respondents completed 298 questionnaires in this study. Two respondents started with the questionnaire but did not complete it due to a loss of interest. Participation in this study was voluntary, and respondents received no incentive. All signed consent forms (Appendix D) were separated from the questionnaires once the data collection was completed to protect the anonymity of the respondents.

5.2.3 Method used to determine the dietary diversity of the households in this study

The FCS was used to determine dietary diversity and measure food access. The HDDS was not applicable because this method uses twelve food groups, whereas the questionnaire used in this study focused on eight to seven food groups. The FCS method is based on eight food groups. The FCS can be defined as "a composite score based on dietary diversity, food frequency, and relative nutritional importance of different food groups" (WFP, 2008). The WFP developed the FCS in 1996, aggregating dietary diversity data and the frequency of food groups consumed over seven days. The FCS uses eight different food groups, which are weighted according to the relative nutritional value of the consumed food groups (INDDEX Project, 2018). The weights are assigned according to the nutritional density of the food group; for instance, animal products are given greater weight than those containing less nutritionally dense foods, such as tubers. The FCS can be used for population-level targeting, program monitoring, and evaluation (WFP, 2008; INDDEX Project, 2018).

The FCS conveys information about a household's diet and helps track a household's food security across a specific (INDDEX Project, 2018). A 30-day recall period was used in this study to ensure that most food products did show a significant difference in consumption. The FCS is designed to capture the quality (nutrient adequacy) and quantity (energy) of foods consumed (Kennedy *et al*., 2010; INDDEX Project, 2018). The FCS requires that respondents answer a short questionnaire about the frequency of their household's consumption based on the eight food groups shown in Table 5.1. The FCS is calculated by multiplying the frequencies by the standardised food group weight (Table 5.1). The consumption frequencies were measured by using a five-point category scale (from 0 to 4) and code in descending order as follows: (0) never, (1) occasionally/a few times a year, (2) monthly/once a month, (3) weekly/once a week,

(4) daily. The five-point scale was applied to the data in Table 5.11. The household's food consumption status is then determined using the following thresholds: acceptable - >35, borderline - 21.5-35, or poor - 0-21. Poor food consumption means that a household cannot eat basic staples and vegetables daily, whereas borderline means a household can consume some major food groups like staples, vegetables, and meat. An acceptable food consumption status indicates that a household incorporates essential food groups into its diet (INDDEX Project, 2018).

The formula for calculating the FCS is as follows (INDDEX Project, 2018):

FCS = *sum* (weighted food group X consumption frequencies)

Table 5.1: The eight food groups and corresponding weights used to calculate the FCS of Grassland Phase 4 (WFP, 2008).

	Food consumption group	Food group	Weight (definitive)
1	Maize, maize porridge, rice, sorghum, millet, pasta, bread and other cereals	Main staples	2
	Cassava, potatoes and sweet potatoes, other tubers, plantains		
2	Beans, peas, groundnuts and cashew nuts	Pulses	3
3	Vegetables, leaves	Vegetables	1
4	Fruits	Fruit	1
5	Beef, goat, poultry, pork, eggs and fish	Meat and fish	4
5	Milk, yogurt and other dairy	Milk	4
6	Sugar and sugar products, honey	Sugar	0.5
7	Oils, fats and butter	Oil	0.5
8	Spices, tea, coffee, salt, fish power and small amounts of milk for tea.	Condiments	0

5.3 Statistical analysis

The statistical analysis was carried out by a statistician at the Department of Mathematical Statistics and Actuarial Science: Statistical Consultation Unit of the University of the Free State. The data collected through the standardised questionnaire was exported from the EvaSys© software to SPSS version 25. SPSS was used to do basic descriptive statistics. Data were presented as frequencies and percentages in tables and graphs for each categorical question. R statistical software was used to determine Cronbach's alpha (α) to test the reliability of the questionnaire. The Pearson and Spearman correlation coefficients were calculated using the scale data. The correlation matrix/graphs (Figures 5.3 & 5.5) were discussed based on the correlation data in Appendix G & H. Correlation measures the strength of association between two variables and the direction of the relationship. The value of the correlation coefficient varies between +1 and -1. A value of ± 1 indicates a perfect degree of association between the two variables. As the correlation coefficient value goes toward 0, the relationship between the two variables will be weakened (Chen & Popovich, 2002). Positive (+) correlation means that if one variable increases, so do the other variable and moves in the same direction. A negative (-) correlation means that if one variable increases the other variable decreases and moves in the opposite direction of one another (Nurse Killam, 2014).

5.4 Results and discussion

5.4.1 Demographic characteristics of the respondents

The following section presents findings on the demographic characteristics of the respondents in this study.

Table 5.2: Demographic characteristics of the respondents

Demographic characteristics	Label/Item	n	%
Person purchasing the food in Household	Head of the household - support household financially	*236*	*79.7*
	Head of household - do not support household financially	*1*	*0.3*
	Related to head of household - purchase food	*51*	*17.2*
	Not related to head of household but purchase food	*8*	*2.7*
	Total	*298*	*100*
Age of household head/person responsible for food purchases	60 years and older	*63*	*21.2*
	36 - 59 years	*144*	*48.5*
	21 - 35 years	*90*	*30.3*
	18 - 20 years	*1*	*0.3*
	Total	*298*	*100*
Number of dependants per age group	Younger than one year	*33*	*11.1*
	Between one and five years	*139*	*46.6*
	Between six and 18 years	*208*	*69.8*
	Between 19 and 64 years	*180*	*60.4*
	65 years and older	*70*	*23.5*
Gender of respondents	Male	*138*	*46*
	Female	*160*	*54*
	Total	*298*	*100*
Home language	Sesotho	*275*	*92.3*
	IsiXhosa	*36*	*12.1*
	Afrikaans	*35*	*11.7*
	Setswana	*1*	*0.3*
	IsiZulu, English, other	*0*	*0*
Highest level of education	Attended grade 8 -12 but did not complete matric	*101*	*33.9*
	Never attended school	*23*	*7.7*
	Attended tertiary education but did not finished	*1*	*0.3*
	Did not attend school past grade 7	*90*	*30.2*
	Completed matric	*83*	*27.9*
	Total	*298*	*100*
Occupancy status	Live in a shack that head of household built	*220*	*73.8*
	Live in shack that head of household rent	*23*	*7.7*
	Live in brick house that head of household built	*48*	*16.1*
	Live n brick house that head of household rent	*6*	*2*
	Live in a RDP government house	*1*	*0.3*
	Total	*298*	*100*

Table 5.2 indicates that the head of the household is responsible for the majority (97.7%) of household food purchases, and about 17% of people related to the head of the household were responsible for purchasing food. This finding implies that the head of the household is not always responsible for the food purchases alone but has support from other people. The results show that 21.2 % of the respondents were above 60 years, implying that elderly adults in some households possibly relied on their pension from SASSA to supply the household with food. Most (69.8%) dependants are between the ages of six to eight, indicating that these households have dependants that cannot contribute financially to the household. Table 5.2 shows that the majority (54%) of respondents in this study were female, implying that most females were responsible for food purchases. A third (33.9%) of the respondents attended secondary school but needed to complete matric. The majority (73.8%) of respondents indicated that they occupied a shack, implying that these people do not have access to proper food preparation areas and probably do not have access to proper food storage facilities.

5.4.1.8 Main sources of household income

A large portion (+/- 50%) of the respondents' income is from social grants (51.4%), old-age pensions (45.5%), and monthly salaries (30.3%), according to Table 5.3. Roughly 45.6% of respondents in Table 5.3 received a small portion (10-25%) of their income from cash loans from family/friends or neighbours, and 1.4% received it as the only source of income. Stats SA (2019) indicated that the most popular sources of income for households are salaries (62.2%) and grants (46.2%). South African households receiving social grants increased from 30.8% in 2003 to 45.6% in 2019 (Stats SA, 2019). Table 5.3 shows that only a few households receive an income from salaries, implying that many households rely primarily on the government for financial support and loans (Altman & Ngandu, 2010).

Table 5.3: Main sources of household income of Grassland Phase 4

		Not at all	Small portion (10-25%)	Some extent (+/-25%)	Large portion (+/-50%)	Only source	Total
Social Grants	n	*101*	*30*	*3*	*152*	*10*	*296*
	%	*34.1*	*10.1*	*1*	*51.4*	*3.4*	*100*
Old-age pension	n	*150*	*5*	*2*	*135*	*5*	*297*
	%	*50.5*	*1.7*	*0.7*	*45.5*	*1.7*	*100*
Monthly salary	n	*156*	*20*	*1*	*90*	*30*	*297*
	%	*52.5*	*6.7*	*0.3*	*30.3*	*10.1*	*100*
Piece jobs	n	*192*	*34*	*4*	*39*	*27*	*296*
	%	*64.9*	*11.5*	*1.4*	*13.2*	*9.1*	*100*
Self-employment	n	*284*	*0*	*0*	*0*	*11*	*295*
	%	*96.3*	*0*	*0*	*0*	*3.7*	*100*
Cash loans from family, friends or neighbours	n	*137*	*135*	*7*	*13*	*4*	*296*
	%	*46.3*	*45.6*	*2.4*	*4.4*	*1.4*	*100*
Cash loans from financial institution	n	*214*	*62*	*0*	*11*	*11*	*298*
	%	*71.8*	*20.8*	*0*	*3.7*	*3.7*	*100*
Student bursary money	n	*272*	*4*	*0*	*8*	*11*	*295*
	%	*92.2*	*1.4*	*0*	*2.7*	*3.7*	*100*
Other	n	*267*	*0*	*0*	*0*	*13*	*280*
	%	*95.4*	*0*	*0*	*0*	*4.6*	*100*

5.4.1.9 Combined monthly household income of the respondents

Figure 5.1 indicates that almost half of this study's households (43.3%) earned a combined income of R3331 to R5000. The income is low relative to the cost of living, which could contribute to decreased dietary diversity and food access (Altman & Ngandu, 2010). About 4.7% of households earned a combined income of less than R1000 per month, close to the food poverty line (R663 per person per month), implying that these households are vulnerable to inadequate food consumption patterns.

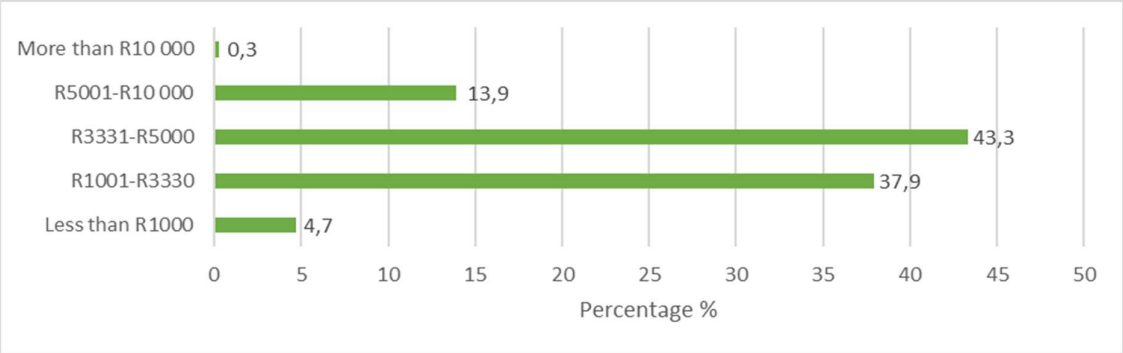

Figure 5.1: Combined monthly household income of the respondents (n=298).

5.4.2 Food preparation methods used in this study

This section of the study provided information about the frequency of meal preparations, the presence of household appliances to prepare meals, the specific locations for meal preparation, and the type of energy source used to prepare meals.

5.4.2.1 Frequency of meal preparation at home

Figure 5.2 indicates that 96% (n=285) of this study's households prepared meals daily, and only 4% (n=13) did not regularly prepare meals. Frequent meal preparation can provide information on how food secures a household is. Frequent home meal preparation improves nutritional intake and increases life expectancy (Larson, 2006; Chen *et al*., 2012).

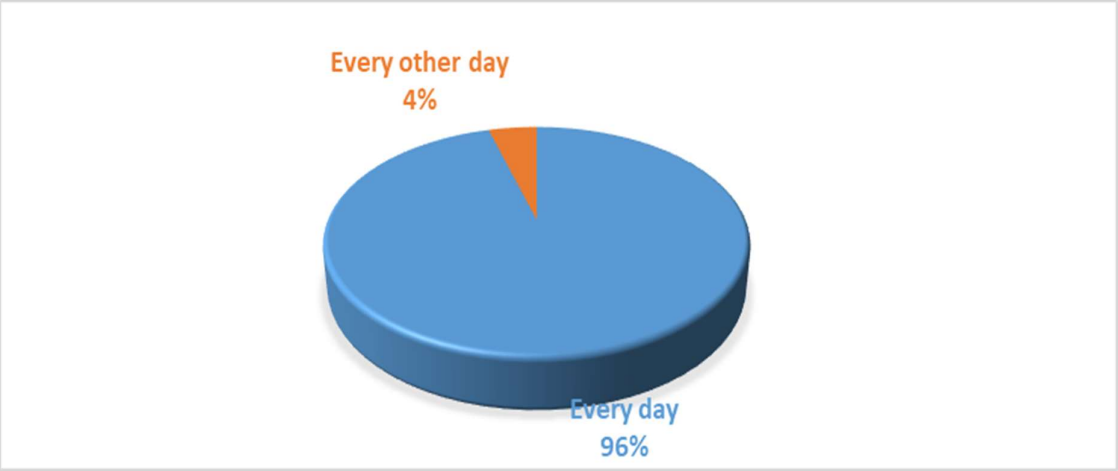

Figure 5.2: Frequency of meal preparation at home (n=298).

5.4.2.2 Location used to prepare meals by the respondents

Table 5.4 shows that 100% (n=297) of the households in this study cooked their meals inside their house, indicating that they have the necessary cooking equipment and space to prepare meals inside their homes instead of outside. Although all the respondents prepared meals inside their houses, some also prepared meals outdoors (17.3%), and 5.9% of these households sometimes prepared meals at their neighbour's house (Table 5.4).

Table 5.4: Location used to prepare meals by the households of Grassland Phase 4

		Always	Often	Sometimes	Rarely	Never	Total
Inside the house	***n***	*297*	*0*	*0*	*0*	*0*	*297*
	%	*100*	*0*	*0*	*0*	*0*	*100*
Separate building close to the house	***n***	*0*	*0*	*7*	*1*	*275*	*283*
	%	*0*	*0*	*2.5*	*0.3*	*97.2*	*100*
Neighbour's house	***n***	*0*	*1*	*17*	*4*	*265*	*287*
	%	*0*	*0.3*	*5.9*	*1.4*	*92.3*	*100*
A community venue	***n***	*0*	*0*	*0*	*4*	*280*	*284*
	%	*0*	*0*	*0*	*1.4*	*98.6*	*100*
Outside the house (outdoors)	***n***	*0*	*0*	*51*	*22*	*221*	*294*
	%	*0*	*0*	*17.3*	*7.5*	*75.2*	*100*
Other	***n***	*0*	*0*	*0*	*0*	*274*	*274*
	%	*0*	*0*	*0*	*0*	*100*	*100*

5.4.2.3 Availability of household appliances and facilities among the respondents

Table 5.5 displays the household appliances owned and facilities used by the respondents to prepare their meals. Although the income status of most respondents is low (Figure 5.1), respondents owned several electrical appliances and had facilities to prepare meals. Most households (98.3%) have cooking utensils and space explicitly reserved for meal preparation.

Table 5.5: Availability of household appliances and facilities among the households of Grassland phase 4

		Yes	No	Total
Refrigerator	n	*204*	*92*	*296*
	%	*68.9*	*31.1*	*100*
Freezer	n	*170*	*127*	*297*
	%	*57.2*	*42.8*	*100*
Electricity	n	*237*	*57*	*294*
	%	*80.6*	*19.4*	*100*
Space for food preparation only	n	*289*	*5*	*294*
	%	*98.3*	*1.7*	*100*
Cooking utensils	n	*290*	*5*	*295*
	%	*98.3*	*1.7*	*100*
Stove or oven (electric, gas, coal, etc.)	n	*238*	*59*	*297*
	%	*80.1*	*19.9*	*100*
Electric kettle	n	*157*	*139*	*296*
	%	*53.0*	*47*	*100*
Microwave oven	n	*89*	*207*	*296*
	%	*30.1*	*69.9*	*100*

Most of the respondents (80.6%) in Table 5.5 had electricity in their dwellings, while 19.4% did not, and 80.1% of respondents had a stove or oven, whereas 19.9% did not. According to Stats SA (2019), the number of households with access to electricity has increased from 76.7% to 85% from 2002 to 2019. Roughly two-thirds (68.9%) owned a refrigerator, while 31.1% did not 57.2% owned a freezer, and 42.8% did not. Not having a fridge available could make it challenging for respondents to keep food fresh for a long or store food safely. At least half of the respondents (53%) own a kettle, whereas 47% did not. Most respondents did not possess a microwave (69.9%), with only 30.1% owning one.

5.4.2.4 Sources used by respondents to prepare their meals

Data from Table 5.6 show that most (70%) of the respondents owned a portable electric stove which they always use. Some (24.7%) respondents always used a paraffin stove, while 40.2% used it sometimes for cooking. Table 5.6 also indicates that wood was sometimes (18.6%) or rarely (6.2%) used to prepare meals. Charcoal was used sometimes by 3.5% of respondents, while 94.4% never used it. Only one (0.3%) respondent often used animal dung. A gas stove was the least (1%) used. Only nine (3.1%) of respondents always used an electric stove and oven combination according to Table 5.6.

Table 5.6: Sources used to prepare meals by households of Grassland Phase 4

		Always	Often	Sometimes	Rarely	Never	Total
Wood	n	*0*	*0*	*54*	*18*	*219*	*291*
	%	*0*	*0*	*18.6*	*6.2*	*75.3*	*100*
Charcoal	n	*0*	*0*	*10*	*6*	*271*	*287*
	%	*0*	*0*	*3.5*	*2.1*	*94.4*	*100*
Animal dung	n	*0*	*1*	*0*	*0*	*289*	*290*
	%	*0*	*0.3*	*0*	*0*	*99.7*	*100*
Paraffin stove (portable)	n	*73*	*23*	*119*	*8*	*73*	*296*
	%	*24.7*	*7.8*	*40.2*	*2.7*	*24.7*	*100*
Gas stove (portable)	n	*3*	*0*	*0*	*0*	*286*	*289*
	%	*1*	*0*	*0*	*0*	*99*	*100*
Electric stove (portable)	n	*208*	*19*	*5*	*0*	*65*	*297*
	%	*70*	*6.4*	*1.7*	*0*	*21.9*	*100*
Electric stove and oven combination	n	*9*	*2*	*3*	*1*	*275*	*290*
	%	*3.1*	*0.7*	*1*	*0.3*	*94.8*	*100*
Other	n	*0*	*0*	*0*	*0*	*278*	*278*
	%	*0*	*0*	*0*	*0*	*100*	*100*

5.4.2.5 Pearson's correlation analysis of the food preparation methods used by the respondents

Pearson's correlation graph is used to measure a linear negative (-) or positive (+) relationship in descriptive statistics. It is used to measure the strength and direction of a relationship (Turney, 2022).

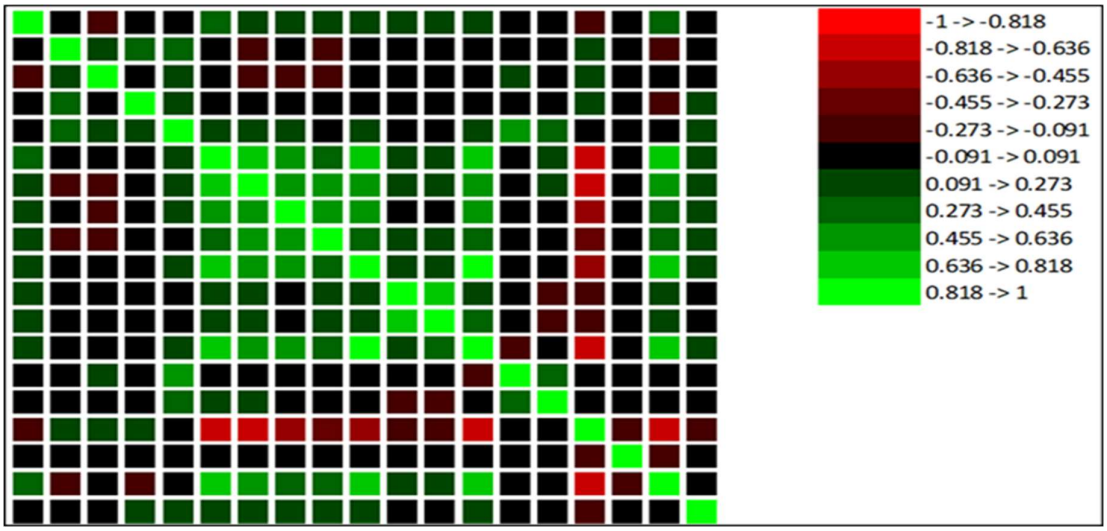

Figure 5.3: Food preparation correlation graph/matrix of Grassland Phase 4.

In Figure 5.3, 'refrigerator' shows a strong positive significant ($p < 0.001$) correlation of $r = 0.798$ with 'freezer,' a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.542$ with 'electric kettle,' and a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.414$ with 'microwave oven,' a strong positive significant ($p < 0.001$) correlation of $r = 0.663$ with 'stove or oven (electric gas coal),' a strong positive significant ($p < 0.001$) correlation of $r = 0.726$ with 'electricity,' and a strong positive significant ($p < 0.001$) correlation of $r = 0.83$ with 'electric stove (portable).' The correlations indicate that when a household possesses a refrigerator, they are more likely to own a freezer, electric kettle, microwave oven, stove or oven, electricity, and a portable electric stove.

'Microwave oven' shows a weak positive significant ($p < 0.001$) correlation of $r = 0.336$ with 'electricity' and a weak negative significant ($p < 0.001$) correlation of $r = -0.392$ with 'paraffin stove (portable).' The negative correlations indicate that when there is an increased use of a microwave, there is an increased use of electricity in the household and a decrease in the use of a paraffin stove.

'Stove or oven (electric gas coal)' in Figure 5.3 shows a very strong positive significant ($p < 0.001$) correlation of $r = 0.884$ with 'electricity,' a strong positive significant ($p < 0.001$) correlation of $r = 0.732$ with 'electric stove (portable),' and a strong negative significant ($p < 0.001$) correlation of $r = -0.620$ with 'paraffin stove (portable).' These positive correlations indicate that the household uses electricity and an electric stove more often than a stove or oven is used. The strong negative correlation indicates that when the use of a stove or oven decreases, the use of a paraffin stove increases.

5.4.2.6 Time spent on transportation to purchase food

Table 5.7 indicates that most respondents (99%) walk for 15 minutes or less to a tuck/ spaza shop or a street vendor to purchase food because these vendors are within walking distance from their homes. The primary goods sold at these stores are bread, maize flour, rice, milk, grain staples, sugar, salt, canned products, sweets and snacks, toiletries and hair products, chicken, beef, cool drinks, soap, cigarettes, and alcohol (Chipunza & Phalatsi, 2019).

Table 5.7 shows that 93.3% of the respondents drive for 30-60 minutes to purchase groceries at a supermarket since there are no supermarkets in Grassland Phase 4. According to Hood (2005), when there is a lack of supermarkets in any location/neighbourhood, the residents have limited access to nutritious foods, thus contributing to food insecurity.

Table 5.7: Time spent on transportation to purchase food by Grassland Phase 4

		Walk: 0-15 min	Walk: 16-30 min	Walk: 30-60 min	Drive: 30-60 min	Drive: 60 min+	Total
Tuck/spaza shop	n	*294*	*3*	*0*	*0*	*0*	*297*
	%	*99*	*1*	*0*	*0*	*0*	*100*
Supermarket	n	*1*	*0*	*19*	*278*	*0*	*298*
	%	*0.3*	*0*	*6.4*	*93.3*	*0*	*100*
Street vendor	n	*290*	*3*	*0*	*0*	*1*	*294*
	%	*98.6*	*1*	*0*	*0*	*0.3*	*100*

5.4.2.7 Transport methods for grocery purchases by respondents

According to the data in Table 5.8, walking and minibus taxis are the most common transportation methods used by the inhabitants of Grassland Phase 4. Table 5.8 shows that 89.3% of the respondents in this study used a minibus taxi at least once or twice a month to purchase groceries, and 84.8% walked once or twice a week for food purchases. Only about 1.3% of the respondents walk and use a taxi bus daily, and only one (0.3%) respondent indicated that they used a bus for grocery purchases. A bicycle was also not a popular form of transportation, as five (1.7%) respondents only used it. Only 3.7% used their vehicle for food purchases. About 5.1% of respondents used their friend's or relative's vehicle for grocery shopping. Table 5.8 shows that 100% of the respondents never used a metered taxi, possibly because they could not afford it.

Table 5.8: Transport methods used by Grassland phase 4 for grocery purchases

		Daily	Every other day	Once or twice a week	Once or twice a month	Never	Total
Walking	n	*4*	*18*	*252*	*23*	*0*	*297*
	%	*1.3*	*6.1*	*84.8*	*7.7*	*0*	*100*
Mini taxi bus	n	*4*	*2*	*16*	*266*	*10*	*298*
	%	*1.3*	*0.7*	*5.4*	*89.3*	*3.4*	*100*
Metered taxi	n	*0*	*0*	*0*	*0*	*296*	*296*
	%	*0*	*0*	*0*	*0*	*100*	*100*
Bicycle	n	*0*	*0*	*0*	*5*	*291*	*296*
	%	*0*	*0*	*0*	*1.7*	*98.3*	*100*
Own vehicle	n	*0*	*0*	*5*	*6*	*284*	*295*
	%	*0*	*0*	*1.7*	*2*	*96.3*	*100*
Friend/relative's vehicle	n	*0*	*0*	*0*	*15*	*280*	*295*
	%	*0*	*0*	*0*	*5.1*	*94.9*	*100*
Bus	n	*0*	*0*	*0*	*1*	*294*	*295*
	%	*0*	*0*	*0*	*0.3*	*99.7*	*100*
Other	n	*0*	*0*	*0*	*2*	*279*	*281*
	%	*0*	*0*	*0*	*0.7*	*99.3*	*100*

5.4.2.8 Portion of the household's income spent on transportation per month

Data from Figure 5.4 show that 66.8% of the respondents spent only a small portion (10-25%) of their monthly income on public transport to purchase groceries, and 9.7% of respondents spent a large portion (+/-50%) of their income on transportation. Mvelashe (2020) indicates that 23.5% to 47% of South African households spend 10% to 20% of their income on public transport.

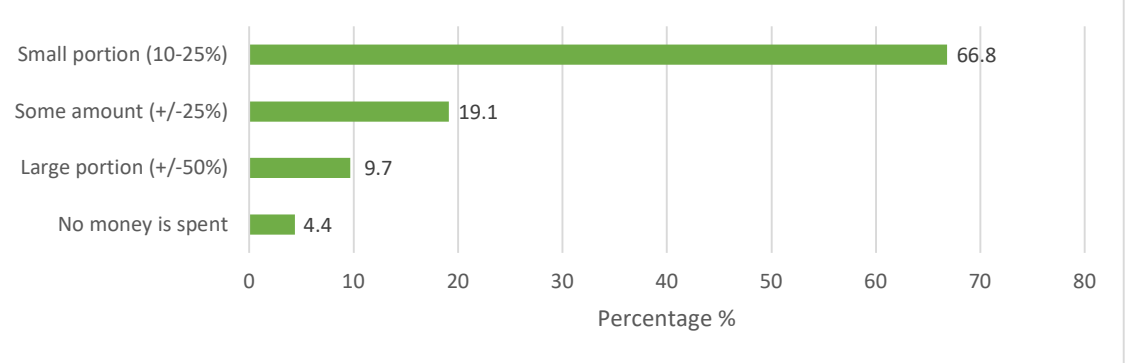

Figure 5.4: Portion of monthly income spent on transportation by Grassland Phase 4 (n=298).

5.4.2.9 Type of water sources available for cooking by the respondents

The World Health Organization (WHO) states that 50 to 100 litres of water are needed per person to meet the most basic needs. For food preparation, most people need about two litres of safe water per day (WHO, 2003).

Table 5.9: Type of water sources available to Grassland Phase 4 for cooking

		Always	Often	Sometimes	Rarely	Never	Total
Municipal water (tap inside the house)	***N***	*1*	*0*	*0*	*0*	*291*	*292*
	%	*0.3*	*0*	*0*	*0*	*99.7*	*100*
Municipal water (tap outside the house)	***N***	*135*	*0*	*0*	*0*	*160*	*295*
	%	*45.8*	*0*	*0*	*0*	*54.2*	*100*
Municipal water from a communal tap	***N***	*1*	*0*	*0*	*0*	*287*	*288*
	%	*0.3*	*0*	*0*	*0*	*99.7*	*100*
Water from a neighbour's tap insode their yard	***N***	*159*	*0*	*0*	*0*	*135*	*294*
	%	*54.1*	*0*	*0*	*0*	*45.9*	*100*
Other	***N***	*0*	*0*	*0*	*0*	*283*	*283*
	%	*0*	*0*	*0*	*0*	*100*	*100*

According to Table 5.9, about half of the respondents in Grassland Phase 4 (54.1%) always use water from a neighbour's tap or someone nearby who has access to a water tap. Respondents using water from a neighbour's house possibly indicates that most of the residents of Grassland Phase 4 do not have access to a water source in their yards or dwelling. Table 5.9 also shows that 45.3% of the respondents have access to a water tap outside their houses in their yards, and only 0.3% had a tap inside their houses. This data may indicate that most respondents do not have adequate water infrastructure to support a tap inside the dwellings. Not having access to fresh water negatively affects the households in this study because, to cook nutritious and safe food and practice good personal hygiene, every person needs optimal access to a clean and easily accessible water supply (Ray & Smith, 2021).

5.4.3 Food consumption characteristics of the respondents

5.4.3.1 Frequency of purchasing food at certain vendors

Most respondents (96%) buy groceries at least once a month, and only 1% buy them at least every week at supermarkets (Table 5.10). More than half (65.8%) of the respondents buy from a spaza/tuck shop every second week, and 30.2% buy every week. Half (50.8%) of the respondents indicated that they purchase food every second week from a street vendor and about 18.2% purchase every week from a street vendor.

Table 5.10: Frequency of food purchased by Grassland Phase 4 at certain vendors

		Every week	Every second week	Once a month	Once or twice a year	Never	Total
Supermarket	n	*3*	*5*	*286*	*4*	*0*	*298*
	%	*1*	*1.7*	*96*	*1.3*	*0*	*100*
Spaza shops or tuck shops	n	*90*	*196*	*12*	*0*	*0*	*298*
	%	*30.2*	*65.8*	*4*	*0*	*0*	*100*
Street vendors	n	*54*	*151*	*49*	*19*	*24*	*297*
	%	*18.2*	*50.8*	*16.5*	*6.4*	*8.1*	*100*
Other	n	*0*	*1*	*1*	*0*	*278*	*280*
	%	*0*	*0.4*	*0.4*	*0*	*99.3*	*100*

5.4.3.2 Different varieties of food consumed by the respondents based on the eight FCS food groups in the past 30 days

Data from a survey by Ronquest-Ross (2016) shows that the most consumed foods by South African households are maize flour, wheat flour, milk, sugar, potatoes, margarine, chicken, and vegetables.

Table 5.11: Different varieties of food consumed by Grassland Phase 4 based on the eight FCS food groups in the past 30 days

		Daily	Weekly	Monthly	Few times a year	Never	Total
Grains (maize flour, samp, bread, rice)	n	3	62	233	0	0	298
	%	1	20.8	78.2	0	0	100
Roots and tubers (potatoes, beetroot, carrots, etc.)	n	3	139	153	1	0	296
	%	1	47	51.7	0.3	0	100
Legumes (beans, peas, peanuts)	n	0	17	252	16	11	296
	%	0	5.7	85.1	5.4	3.7	100
Fruit and green vegetables	n	0	94	199	1	4	298
	%	0	31.5	66.8	0.3	1.3	100
Red meat (beef, mutton, pork)	n	0	8	282	2	6	298
	%	0	2.7	94.6	0.7	2	100
Chicken	n	3	96	196	0	3	298
	%	1	32.2	65.8	0	1	100
Fish	n	0	1	212	61	22	296
	%	0	0.3	71.6	20.6	7.4	100
Processed meat (polony and viennas)	n	0	3	221	58	15	297
	%	0	1	74.4	19.5	5.1	100
eggs	n	0	8	281	6	2	297
	%	0	2.7	94.6	2	0.7	100
Offal and organ meat (liver, heart, stomach, etc.)	n	0	41	245	7	5	298
	%	0	13.8	82.2	2.3	1.7	100
Oil, fat, and margarine	n	0	7	288	1	2	298
	%	0	2.3	96.6	0.3	0.7	100
Milk and milk products	n	2	51	239	1	3	296
	%	0.7	17.2	80.7	0.3	1	100
Prepared foods (fat cakes, dagwood, chips and russian)	n	2	13	211	63	9	298
	%	0.7	4.4	70.8	21.1	3	100

Table 5.11 indicates that most of the different foods are purchased monthly. All the foods in Table 5.11 were popular amongst the respondents, with most of the foods

purchased weekly and monthly. Grains mainly (78.2%) were purchased monthly, with about 21% of respondents purchasing weekly. Half (51.7%) of respondents indicated purchasing roots and tubers monthly, and 47% purchasing them weekly. Most (85.1%) of respondents purchased legumes monthly, and 3.7% indicated that they never purchased them. Fruit and green vegetables (66.8%) were purchased monthly, with about 32% of fruit and vegetables purchased weekly. Some (1.3%) respondents indicated they never purchased fruit or green vegetables.

The majority (94.6%) of the red meat purchases in Table 5.11 occurred monthly, and 2% of respondents indicated that they never purchased red meat. More than half (65.8%) of the respondents showed that they bought chicken monthly, and 32.2% weekly. Fish (71.6%) and processed meat (74.4%) were mainly purchased monthly and only a few times a year. About 7.4% of respondents indicated that they never purchase fish, and 5.1% never purchase processed meat. Eggs (94.6%), oil, fat, and margarine (96.6%) were purchased monthly. The majority (82.2%) of respondents showed that they purchased offal and organ meat monthly, and about 14% purchased this meat weekly. Milk and milk products were primarily purchased (80.7%) monthly, and 17.2% purchased milk and milk products weekly. Prepared foods (70.8%) were purchased monthly, and 21.1% of respondents only purchased this food group a few times a year.

5.4.3.3 Calculating the FCS of the households

Table 5.12 shows the application of the eight food groups, frequencies, and weights assigned (Table 5.1) to the food groups in Table 5.11 that were used in this study's questionnaire. The frequency of consumption (Table 5.12) was determined by selecting the frequency (Table 5.11) with the most respondents (the highest frequency of respondents was "monthly" = 2 in Table 5.11 for all food groups).

The FCS was calculated by multiplying each food group frequency (A) by each food group weight (B) and then summing these scores into one composite score, as shown in Table 5.12. The total composite score is 31 for the households in this study, which falls within the threshold of 21.5-35, indicating that the food consumption status for Grassland Phase 4 is borderline (households incorporate some of the major food groups into their diets). The total composite score is calculated as a percentage by

dividing 31 by the total households used in this survey (298) and multiplying the answer by 100. Thus, 31/298 x 100 = 10.4%.

Table 5.12: The eight food groups used to calculate the FCS of the households in Grassland Phase 4 in this study

Eight Food groups	Food groups used in this study	Frequency (A)	Weight (B)	Score = A x B
Main staples	Grains (maize flour, bread, rice) and roots and tubers (potatoes, beetroot, etc.)	*2*	*2*	*4*
Pulses	Legumes (beans, peas, peanuts)	*2*	*3*	*6*
Vegetables	Green vegetables	*2*	*1*	*2*
Fruit	Apples, oranges, bananas, peaches, grapes, berries, etc.	*2*	*1*	*2*
Meat/fish	Red meat (beef, mutton, pork) Chicken, eggs, fish, processed meat, offal and organ meat,	*2*	*4*	*8*
Milk	Milk and milk products	*2*	*4*	*8*
Sugar	N/A	*0*	*0*	*0*
Oil	Oil, fat, and margarine Prepared foods (fat cakes, chips)	*2*	*0.5*	*1*
TOTAL COMPOSITE SCORE				***31***

5.4.3.4 Different types of grains consumed by the respondents

Table 5.13 shows the variety of grains consumed among the households in this study. Most (87.1%) households consumed maize flour daily, and 2.7% of households only once in seven days. Most (76.4%) households indicated that they consumed rice only once in seven days, with only 2% consuming rice daily and 12.5% never consuming rice. Bread was consumed on average (37.2%) daily and every second day and about 15% consumed bread once in seven days. Oats are one of the grains that were not very popular as the majority (83.5%) of households indicated that they never consumed oats, and only 16.2% indicated that they ate oats once in seven days. Sorghum was the most unpopular grain because about 94% of households showed they never consumed it, and only 4.8% consumed it once in seven days. Half (52.9%) of the households never consumed samp and 46.8% of households indicated that they consumed samp once in seven days. Most (71.6%) households never consumed pasta, and only 28% consumed pasta once in seven days. Most households (88.1%) never consumed whole corn (sweet corn), and only 11.6% ate whole corn once in seven days.

Table 5.13: Different types of grains consumed by the Grassland Phase 4

		Daily	Every second day	Twice in 7 days	Once in 7 days	Never	Total
Maize flour	n	*257*	*26*	*4*	*8*	*0*	*295*
	%	*87.1*	*8.8*	*1.4*	*2.7*	*0*	*100*
Rice	n	*6*	*2*	*25*	*226*	*37*	*296*
	%	*2*	*0.7*	*8.4*	*76.4*	*12.5*	*100*
Bread	n	*106*	*115*	*21*	*43*	*12*	*297*
	%	*35.7*	*38.7*	*7.1*	*14.5*	*4*	*100*
Oats	n	*0*	*1*	*0*	*48*	*248*	*297*
	%	*0*	*0.3*	*0*	*16.2*	*83.5*	*100*
Sorghum	n	*1*	*1*	*2*	*14*	*276*	*294*
	%	*0.3*	*0.3*	*0.7*	*4.8*	*93.9*	*100*
Samp	n	*1*	*0*	*0*	*138*	*156*	*295*
	%	*0.3*	*0*	*0*	*46.8*	*52.9*	*100*
Pasta	n	*1*	*0*	*0*	*83*	*212*	*296*
	%	*0.3*	*0*	*0*	*28*	*71.6*	*100*
Whole corn	n	*1*	*0*	*0*	*34*	*258*	*293*
	%	*0.3*	*0*	*0*	*11.6*	*88.1*	*100*

5.4.3.5 Frequency of purchasing major food items throughout the year from a spaza/tuck shop and a supermarket

According to Table 5.14, bread (35.4%) and maize flour (12.2%) were the most frequent purchases from a spaza/tuck shop on a weekly, with rice (5.8%) being the least purchased. Dairy products (42%) and bread (39.7%) were mostly purchased every second week, and rice (7.5%) was the least purchased. Rice (64.1%) and meat (60.3%) were the most popular purchases at least once a month, and bread (23.9%) was the least purchased monthly. Once or twice a year, the most purchased items were rice (14.9%) and maize flour (10.1%) from a spaza/tuck shop, with bread (0.3%) and dairy products (1.4%) being the least purchased once or twice a year. According to Table 5.14, most major food items were purchased monthly from a supermarket. Most (94.3%) households purchased maize flour once a month, and 3.7% only bought maize flour once or twice a year from a supermarket. Bread was purchased from a supermarket by 91.6% of households once a month, and 2% indicated that they never purchased bread. Rice was primarily purchased (94%) by the households once a month, and 4.4% of households only purchased rice once or twice a year from a supermarket. Dairy products were purchased by 92.6% of the households, and about 3% bought rice every second week. The majority (93.6%) of households purchased meat once a month from a supermarket. Fruit was purchased by 90.2% of households once a month, and 6.4% bought fruit once or twice a year. Most (92.9%) households purchased vegetables once a month, and 2.7% bought vegetables every second week from a supermarket.

Table 5.14: The purchasing of major food items throughout the year from a tuck/spaza shop and a supermarket located in or near Grassland Phase 4

			Weekly	Every second week	Once a month	Once or twice a year	Never	Total
Major food items purchased from a spaza/tuck shop	Maize flour	n	36	41	173	30	16	296
		%	12.2	13.9	58.4	10.1	5.4	100
	Bread	n	105	118	71	1	2	297
		%	35.4	39.7	23.9	0.3	0.7	100
	Rice	n	17	22	189	44	23	295
		%	5.8	7.5	64.1	14.9	7.8	100
	Dairy products	n	30	124	122	4	15	295
		%	10.2	42	41.4	1.4	5.1	100
	Meat	n	20	49	178	21	27	295
		%	6.8	16.6	60.3	7.1	9.2	100
	Fruit	n	20	45	177	22	33	297
		%	6.7	15.2	59.6	7.4	11.1	100
	Vegetables	n	26	94	145	10	21	296
		%	8.8	31.8	49	3.4	7.1	100
Major food items purchased from a supermarket	Maize flour	n	2	3	280	11	1	297
		%	0.7	1	94.3	3.7	0.3	100
	Bread	n	3	4	273	12	6	298
		%	1	1.3	91.6	4	2	100
	Rice	n	1	2	280	13	2	298
		%	0.3	0.7	94	4.4	0.7	100
	Dairy products	n	3	8	276	10	1	298
		%	1	2.7	92.6	3.4	0.3	100
	Meat	n	3	6	279	9	1	298
		%	1	2	93.6	3	0.3	100
	Fruit	n	2	5	268	19	3	297
		%	0.7	1.7	90.2	6.4	1	100
	Vegetables	n	3	8	275	9	1	296
		%	1	2.7	92.9	3	0.3	100

5.4.3.6 Food items cultivated/produced by the respondents themselves

Only three products, namely dairy products (milk from cows and eggs from poultry they own), fruit, and vegetables, were cultivated or produced by the respondents (Table 5.15). Only 1% of vegetables were grown in large portions, with 8.8% of households cultivating some amount/portion of vegetables. A small number of vegetables were cultivated by 15.5% of the households, and 74.7% never cultivated vegetables. Dairy products were produced by 0.3% of households in tiny quantities,

and 99.7% did not produce any dairy products. 2.7% of households cultivated tiny amounts of fruit, and 97.3% did not grow any fruit. Table 5.15 shows that many people need help producing food even though it could be easy and economical for them. It could improve food and nutrition insecurity by providing access to a greater diversity of food.

5.4.3.7 Food items borrowed and received by households from relatives or neighbours in the past year

Table 5.15 shows that about 20% of the households borrowed maize flour in large portions, and a tiny portion was borrowed by 35.4% of households in the past year. Half (42.4%) of households did not borrow maize flour from relatives or neighbours. Bread was borrowed in tiny portions by 21.5% of households. Only 1.3% borrowed bread in large quantities, with 77.1% of households never borrowed from neighbours and relatives. Very few portions of rice were borrowed by 25.4% of households, with 7.8% borrowing rice in large quantities and 66.1% never borrowing rice from their relatives or neighbours in the past year. About 23.1% of households borrowed dairy products in very small portions, with 2% borrowing in large portions and 74.9% never borrowing dairy products. Meat was borrowed by 24% of households in tiny portions, with only 4.7% borrowing meat in large portions, and 70.9% never borrowed meat from relatives/neighbours in the past year. Fruit was borrowed by 20.6% of households in tiny portions, and most (77.7%) households did not borrow any fruit. Almost half (45.5%) of households borrowed vegetables in tiny portions. About 4.7% of households borrowed ‘some portion’ of vegetables, with 5.4% borrowing vegetables in large quantities. Only 44.4% of households did not borrow any vegetables in the past year.

This data shows that the inhabitants of Grassland Phase 4 practice “Ubuntu” among one another since they help each other in times of food shortage to help alleviate food insecurity. Ubuntu is a Nguni word defined as behaving well toward others or acting in ways that benefit the community (Thompsell, 2019).

Table 5.15: Proportion of food cultivated and borrowed from neighbours or relatives in Grassland Phase 4

			None	Very little	Some portion	Large portion	All of it	Total
Proportion of food cultivated by the respondents	Maize flour	*n*	*296*	*0*	*0*	*0*	*0*	*296*
		%	*99.7*	*0*	*0*	*0*	*0*	*100*
	Bread	*n*	*298*	*0*	*0*	*0*	*0*	*298*
		%	*100*	*0*	*0*	*0*	*0*	*100*
	Rice	*n*	*298*	*0*	*0*	*0*	*0*	*298*
		%	*100*	*0*	*0*	*0*	*0*	*100*
	Dairy products	*n*	*297*	*1*	*0*	*0*	*0*	*297*
		%	*99.7*	*0.3*	*0*	*0*	*0*	*100*
	Meat	*n*	*295*	*0*	*0*	*0*	*0*	*295*
		%	*100*	*0*	*0*	*0*	*0*	*100*
	Fruit	*n*	*289*	*8*	*0*	*0*	*0*	*297*
		%	*97.3*	*2.7*	*0*	*0*	*0*	*100*
	Vegetables	*n*	*222*	*46*	*26*	*3*	*0*	*297*
		%	*74.7*	*15.5*	*8.8*	*1*	*0*	*100*
Major food items borrowed from relatives/neighbours	Maize flour	*n*	*126*	*105*	*7*	*59*	*0*	*297*
		%	*42.4*	*35.4*	*2.4*	*19.9*	*0*	*100*
	Bread	*n*	*229*	*64*	*0*	*4*	*0*	*297*
		%	*77.1*	*21.5*	*0*	*1.3*	*0*	*100*
	Rice	*n*	*195*	*75*	*2*	*23*	*0*	*295*
		%	*66.1*	*25.4*	*0.7*	*7.8*	*0*	*100*
	Dairy products	*n*	*221*	*68*	*0*	*6*	*0*	*295*
		%	*74.9*	*23.1*	*0*	*2*	*0*	*100*
	Meat	*n*	*210*	*71*	*1*	*14*	*0*	*296*
		%	*70.9*	*24*	*0.3*	*4.7*	*0*	*100*
	Fruit	*n*	*230*	*61*	*3*	*2*	*0*	*296*
		%	*77.7*	*20.6*	*1*	*0.7*	*0*	*100*
	Vegetables	*n*	*132*	*135*	*14*	*16*	*0*	*297*
		%	*44.4*	*45.5*	*4.7*	*5.4*	*0*	*100*

5.4.3.8 Pearson's correlation analysis of the food consumption patterns used by the respondents

A negative (-) or positive (+) relationship can be determined between two or more variables by using Pearson's correlation (Nettleton, 2014).

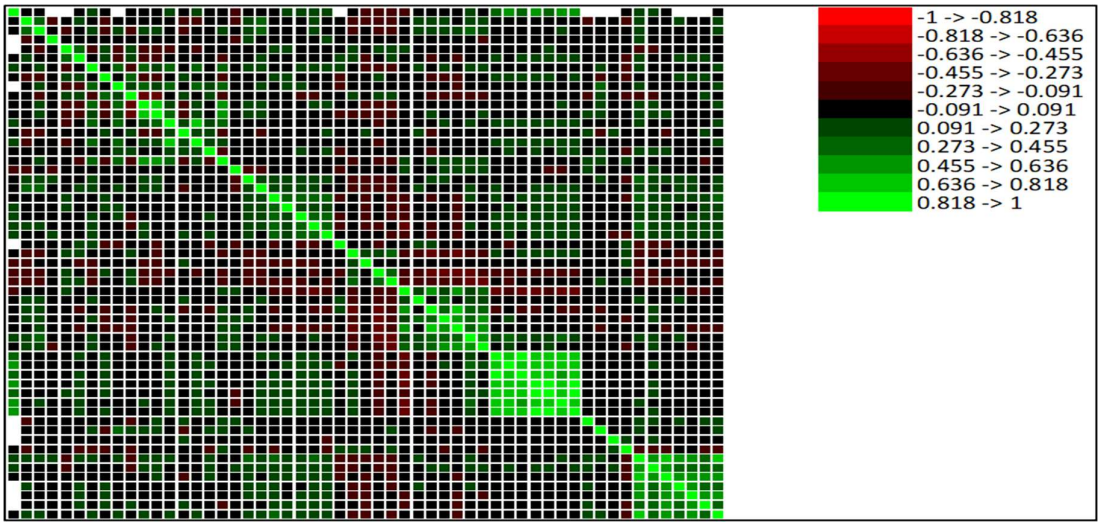

Figure 5.5: Food consumption correlation graph/matrix of Grassland Phase 4.

In Figure 5.5, 'supermarkets' shows a weak positive significant ($p < 0.001$) correlation of $r = 0.323$ with 'maize flour' and 'rice,' and a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.531$ with 'bread,' a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.555$ with 'dairy products,' a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.454$ with 'meat,' a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.500$ with 'fruit,' and a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.577$ with 'vegetables.' The positive correlations indicate that when households purchase at a supermarket, they most likely purchase maize flour, rice, bread, dairy products, meat, fruit and vegetables.

'Spaza shops or tuck shops' shows a weak positive significant ($p < 0.001$) correlation of $r = 0.391$ with 'street vendors' and a weak positive significant ($p < 0.001$) correlation of $r = 0.366$ with 'bread.' The correlations indicate that when people purchase at a spaza/tuck shop, they also purchase at a street vendor, and bread is the most popular food purchase. 'Fruit and green vegetables' show a weak positive significant ($p < 0.001$) correlation of $r = 0.339$ with 'chicken,' indicating that when a household consumes fruit and vegetables, they also consume chicken. 'Red meat' shows a weak

positive significant ($p < 0.001$) correlation of $r = 0.310$ with 'egg' and a weak positive significant ($p < 0.001$) correlation of $r = 0.353$ with 'dairy products,' indicating that when red meat is consumed, eggs and dairy products are consumed as well.

'Eggs' shows a strong positive significant ($p < 0.001$) correlation of $r = 0.675$ with "fat oil and margarine," indicating that when eggs are consumed, oil, fat and margarine are consumed.

'Samp' shows a weak positive significant ($p < 0.001$) correlation of $r = 0.398$ with 'pasta,' indicating that when samp is consumed, households also consume pasta. 'Pasta' in Figure 5.7 shows a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.452$ with 'whole corn,' which indicates that when pasta is consumed, whole corn is consumed.

'Dairy products' shows a weak positive significant ($p < 0.001$) correlation of $r = 0.328$ with 'vegetables,' indicating that when dairy products are consumed, vegetables are also consumed. 'Dairy products' shows a weak negative significant ($p < 0.001$) correlation of $r = -0.318$ with 'rice,' indicating that when the consumption of dairy products decreases, the consumption of rice increases. 'Fruit' in Figure 5.5 shows a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.416$ with 'vegetables,' indicating that when the fruit is consumed, vegetables are consumed.

'Maize flour' shows a strong positive significant ($p < 0.001$) correlation of $r = 0.631$ with 'rice,' a strong positive significant ($p < 0.001$) correlation of $r = 0.609$ with 'meat,' a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.412$ with 'vegetables.' These correlations indicate that meat, rice, and vegetables are consumed with maize flour.

'Dairy products' shows a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.457$ with 'meat,' a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.430$ with 'fruit,' and a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.508$ with 'vegetables.' The positive correlations indicate that meat, fruit, and vegetables are consumed when dairy products are consumed (Figure 5.5).

'Meat' shows a weak positive significant ($p < 0.001$) correlation of $r = 0.327$ with 'fruit' and a moderately strong positive significant ($p < 0.001$) correlation of $r = 0.478$ with 'vegetables.' The correlations indicate that fruit and vegetables are consumed when meat is consumed.

'Bread' shows a strong positive significant ($p < 0.001$) correlation of $r = 0.659$ with 'rice,' a strong positive significant ($p < 0.001$) correlation of $r = 0.736$ with 'dairy

products,' a strong positive significant ($p < 0.001$) correlation of $r = 0.717$ with 'meat,' a strong positive significant ($p < 0.001$) correlation of $r = 0.649$ with 'fruit,' and a strong positive significant ($p < 0.001$) correlation of $r = 0.764$ with 'vegetables.' The correlations indicate that rice, dairy products, meat, fruit, and vegetables are also consumed when bread is consumed (Figure 5.5).

'Rice' shows a strong positive significant ($p < 0.001$) correlation of $r = 0.710$ with 'dairy products,' a strong positive significant ($p < 0.001$) correlation of $r = 0.767$ with 'meat,' a strong positive significant ($p < 0.001$) correlation of $r = 0.625$ with 'fruit,' and a strong positive significant ($p < 0.001$) correlation of $r = 0.737$ with 'vegetables.' These correlations indicate that dairy products, meat, fruit, and vegetables are consumed with rice (Figure 5.5).

5.4.3.9 Obstacles to adequate food access according to the respondents

According to the respondents in Figure 5.6, the main obstacles to adequate food access were low income (71.5%) and increased food prices (13.1%). About 10% of respondents indicated that they must pay off loans which prevents them from having enough money to purchase adequate food. Respondents (4%) reported that having 'no South African citizenship' caused them not to be able to access adequate food. Some respondents (1.3%) reported that piece jobs caused them not to have enough income for good food purchases, and 1.3% indicated that unemployment was the cause of not having access to adequate food. Only 0.3% showed that giving food to neighbours is the reason for not having adequate access to food, and 4.4% reported they did not experience any obstacles.

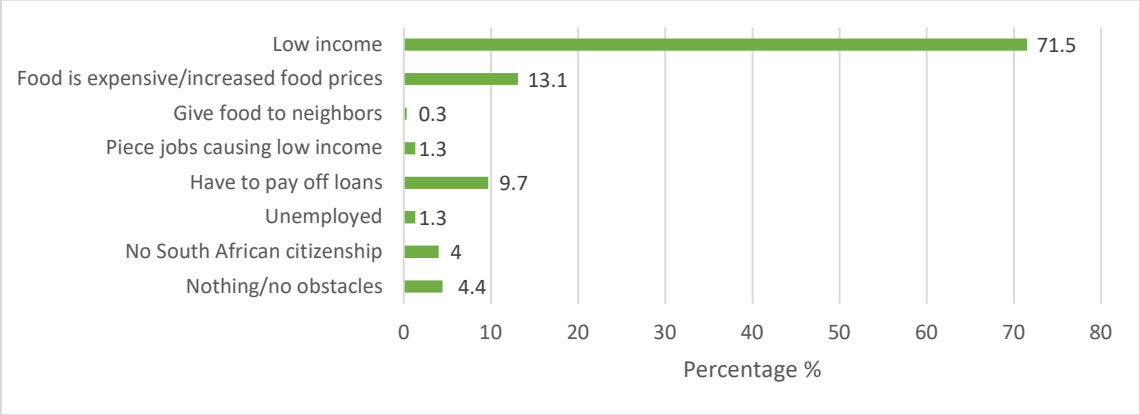

Figure 5.6: Obstacles to inadequate food access according to Grassland Phase 4. (n=298).

5.5 Conclusion

In conclusion, the demographic result from this study shows that the majority (54%) of respondents were female, indicating that in many households, females were responsible for the household's food consumption and preparation patterns. The results concluded that 21.2 % of the respondents were above 60 years, implying that in some households, the older adult was responsible for food purchases, possibly by using their old-age pension. Only 27.9% of the respondents completed their matric qualification and might have better work opportunities to break the poverty cycle and improve their food consumption patterns. Social grants (51.4%) and Old-age pensions (45.5%) contributed to the largest portion of income, indicating that most of the households in Grassland Phase 4 depend on the government for financial support. About 73.8% of respondents occupied a shack and possibly did not have adequate access to proper food preparation and storage facilities.

Data from the food preparation results conclude that most (96%) households in Grassland Phase 4 were able to prepare meals every day, implying that there is an attempt to provide adequate nutrition to the household members. All (100%) of the households in this study indicated that they could prepare meals inside and may suggest that they can afford the necessary cooking equipment to prepare meals inside the house instead of outside. Not all (19.4%) households have access to electricity compared to the 80.6%, which implies that these households cannot possess other electrical equipment, such as a refrigerator, to keep food fresh for extended periods. Only 30.1% of households owned a microwave, indicating that most households need

a quick and easy method to warm up food. This study shows that although 70% of households owned an electric stove, a few (24.7%) always use a paraffin stove, implying that these households either do not have access to electricity or try to save on electricity by reverting to a paraffin stove. Pearson's correlation matrix concludes that households owning at least one electrical appliance are likelier to possess other electrical appliances, easing food preparation. The correlation indicates a decreased use of a paraffin stove when a household possesses an electric stove or microwave, indicating that a microwave and electric stove provides more convenience in food preparation.

Most households are located within 15 minutes from a spaza/tuck shop or street vendor compared to a supermarket 30-60 minutes away. This location of households implies that spaza shops or street vendors are the more popular choice for a food store. Whenever respondents must travel to a supermarket, the popular choice of transport is a minibus taxi, and about 66.8% of respondents used only a tiny portion of their income on transportation. This study indicated that many (54.1%) households did not have access to a water source for cooking and had to obtain water from a neighbour's tap. The absence of a water source implies that these households are unable to prepare meals effectively and with ease.

The food consumption results conclude that the respondents in this study purchase more frequently at a spaza shop/tuck shop or street vendor. Literature indicates that tuck/shops and street vendors do not always stock adequately nutritious food, which may put the households in this study at risk of inadequate food access and nutrition. The most popular tuck/spaza shop purchases were bread (35.4%) and maize flour (12.2%). The data from this study show that the respondents consumed food from the major food groups, and most purchases occurred monthly. The most popular food choices consumed were as follows: maize flour, wheat meal, milk, sugar, potatoes, margarine, chicken, and vegetables, with maize flour (87.1%) being the most popular grain consumed. Respondents spent most of their food income on grains among the eight major food groups. The respondents in this study indicated that they cultivated some food products (vegetables, fruit, dairy products). Households in this study borrowed food from all five major food groups from their neighbours and relatives, with maize flour being borrowed in large quantities.

The correlations from Pearson's correlation matrix conclude that when respondents purchase at a supermarket, they are more likely to buy a variety of food from the eight

major food groups. The correlations confirmed that bread was the most popular purchase choice from a tuck/spaza shop. The correlations indicate that the households in Grassland Phase 4 tend to eat a balanced diet by consuming chicken, fruit and vegetables, red meat, eggs, dairy products, oil, fat, margarine, samp, pasta, maize flour, rice, and bread. The respondents in this study indicated that the obstacles that mostly prevented them from accessing food were low income (71.5%), and 13.1% indicated that increased food prices made it difficult to purchase adequate food.

The FCS calculated in this study shows a score of 31, which indicates that the food consumption patterns in Grassland Phase 4 are borderline. Therefore, the households in this study need to improve their food consumption patterns by consuming a variety of food from all the eight food groups used to determine the FCS, thus moving to more acceptable consumption patterns.

5.6 Recommendation

Households in Grassland Phase 4 can be guided through food programs to educate them about the benefits of dietary diversity to achieve acceptable consumption patterns. A process like nixtamalization that increases the bioavailability of nutrients in maize (the most popular grain consumed in this study) can be introduced through food programs to encourage people to consume products that have been nixtamalized such as tortillas and other maize-based products.

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CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

The main aim of this research study was to investigate the food security situation and consumption patterns of the inhabitants of Grassland Phase 4 informal settlement in Bloemfontein. Factors such as household income, transport, food consumption patterns, food preparation, access to water, the location where food is bought, and the coping strategies which influenced the physical access to food were investigated and the results were presented in tables and graphs, analysed, and discussed in Chapter 4 and 5. The results were obtained by utilising a questionnaire that provided a clear picture of the food security status, consumption patterns, social and economic status of the Grassland Phase 4 community. The following chapter discusses the summary of the main findings and provides conclusions and recommendations, future studies, and limitations for this research study.

6.2 SUMMARY OF MAIN RESULTS AND CONCLUSIONS

Findings from the socio-demographic questionnaire used in this study revealed that more than half (54%) of the respondents were female. Many respondents attended school but still needed to complete matric. Only 27.9% completed their matric qualifications and, therefore, may secure better access to food through better work opportunities. Many (73.8%) of the respondents indicated that they occupy a shack/dilapidated housing.

Almost half (43.3%) of respondents earned an income of R3331 – R5000, therefore many households in Grassland Phase 4 can afford the food items from the household food basket. A few (4.7%) households lived on less than R1000 per month, indicating that these households possibly live below the poverty line and are considered poor. More than half of the respondents (51.4%) indicated that their primary source of income was social grants, indicating a high reliance on government support to relieve hunger and reduce the stress of low income-in vulnerable households.

The results of the food preparation methods used by the respondents showed that most (96%) households prepared meals every day. Everyday meal preparation implies that many households in Grassland Phase 4 have access to food (purchased or

borrowed). About 19.4% of Grassland Phase 4 does not have electricity, which might put these households in a compromising situation. With electricity, these households can use electrical equipment necessary for food preparation and storage, i.e., refrigerator, microwave, and electric stove. Pearson's correlation matrix data concludes that when there is a decreased use of an electric stove (possibly due to the absence of electricity), there is an increased use of a paraffin stove for food preparation.

The results indicated that more than 50% of the households in Grassland Phase 4 do not possess their water tap and rely on a neighbour for their water needs. The households (45.3%) with a water tap had one outside and not inside the house. Only 0.3% of households indicated that they had a water tap inside their house. The households in this study may not have the proper infrastructure to support a tap inside their yard or house.

Results indicated that it is faster and more convenient for the respondents to buy their food from a tuck/spaza shop as it is within walking distance (5-to-15-minute walk) from their homes, and therefore did not need to spend money on transport. Taxi busses were the most common form of transport used to travel to supermarkets for grocery purchases which usually only happens once a month.

Results from the descriptive statistics indicated that maize flour (87.7%) and bread (35.7%) were the most consumed daily. Rice (76.4%) and samp (46.8%) were mainly consumed once in seven days. The least consumed grains were oats, pasta, sorghum, and whole corn. The least consumed grains are whole grains which health experts recommend because they are high in fibre and should replace refined grains. The results conclude that maize flour was the most popular choice of grain for the households of Grassland Phase 4. The food consumption correlation results indicated that maize flour (as a mealie meal) is the preferred grain mostly consumed with other food groups such as meat and vegetables.

Results from the food consumption patterns in the Grassland Phase 4 community showed that the respondents purchased groceries more frequently at a spaza/tuck shop than at a supermarket. As indicated by the literature, tuck shops need more diversity of food groups found at supermarkets. The most consumed food group by the respondents was grains, mainly maize which suggests that maize was the most affordable and easiest form of food to dull hunger pains and increase satiety. Results indicate that some respondents had to borrow food from their neighbours, mainly

maize, because of needing more food available in the household or needing more money. Only a few respondents cultivated certain food groups to help sustain themselves through low food levels. Pearson's correlation matrix results concluded that bread was the most popular purchase choice at a spaza/tuck shop, and the five major food groups were the most popular purchase at a supermarket. The FCS calculation confirms that the food consumption patterns in Grassland Phase 4 are neither poor nor acceptable. The FCS indicated a threshold of 31 which shows that the consumption patterns used in Grassland Phase 4 can be considered borderline. A borderline FCS indicates that a household consumes major food groups, but not all.

What do the coping strategies show about the level of food insecurity experienced by the households?

The study findings suggest that almost half (49.9%) of the households in this study experienced food insecurity, with 17.8% experiencing severe food insecurity, as indicated by the HFIAP category. The use of the HFIAS, HFIAP, and CSI scales indicated that the households of Grassland Phase 4 experienced moderate levels of food insecurity with the HFIAS score determined at 3.32 and the CSI score at 41.8. Some households had to use severe coping strategies, i.e., cutting down on meals, going a whole day without meals, going to bed hungry, and restricting consumption by adults to ensure more food is available for the children. An inadequate diet results in poor health status and makes the human body vulnerable to disease. Food insecurity and a lack of resources force people to choose unhealthy food. This results in improper food preparation and consumption patterns, thus attributing to the food system not functioning optimally in poor communities like Grassland Phase 4. Significant consideration needs to be given to improving dietary intake. It can only be done when nutritious food is available and easily accessible, and people can make good food choices. This study concludes that Grassland Phase 4 experience food insecurity and practice poor dietary patterns due to a lack of important resources.

6.3 RECOMMENDATIONS

Together, the government and private sector can develop an alternative source of income by creating employment opportunities for disadvantaged communities and investing in the development of small businesses. Income distribution programmes could be incorporated into policies to assist people in coping better when unemployed.

The importance of education is paramount for any individual or community as education and skills development can improve employment possibilities. The South African government does have nutrition education programmes in place, but they often need to reach the intended audience. Instead of government employees coming into the community to educate and improve skills in different sectors, individuals from the community should be selected to be the pioneers of the initiatives, thereby facilitating community ownership of the program and subsequent access to the resources. Food distribution programmes should be needs-based. A nutritional program that explains the process of nixtamalization might be very beneficial for the households of Grassland Phase 4 since nixtamalization improves the nutritional quality and health benefits of maize flour because maize flour is the most consumed grain in this study.

Nutritional information about the recommended daily dietary intake, food from all the major food groups, and the importance of eating whole grains is freely available at any government clinic or hospital. It can assist the community in planning nutritious, healthy meals within their limited budgets. A nutritional program that explains the process of nixtamalization might be very beneficial for the households of Grassland Phase 4 since nixtamalization improves the nutritional quality and health benefits of maize flour because maize flour is the most consumed grain in this study. Implementing a program such as nixtamalization with the basic cooking skills of the community can make a big difference in providing more nutritious food to the community of Grassland Phase 4. Developing and enhancing small-scale food production and agro-processing by providing technical support can promote economic growth and sustainable development in Grassland Phase 4 informal settlement.

6.4 FUTURE STUDIES

The prevalence of food insecurity, poverty, and malnutrition in the world indicates the urgent need for introspection, and this can only be done through investment in education and research. Policies must be implemented and institutionalised across all sectors to ensure consistency in protecting and promoting human health. The food insecurity problem must be addressed using interrelated policy mechanisms to boost small farmers' agricultural productivity, build community resilience, and promote empowerment in marginalised groups. Teaching gardening skills to the residents might enable them to secure an additional food source during low food stores.

Research about nutrition education on balanced diets, healthier methods of preparing food, and physical activity are required to address food insecurity in informal settlements such as Grassland Phase 4.

6.5 LIMITATIONS OF THE STUDY

Data collection took longer than expected due to several residents who needed extra explanations about the questions in the questionnaire. The high crime rate and visible alcohol use in the area have resulted in fear among residents, and they are reluctant to open their doors to strangers. Some respondents were under the impression that the research was an investigation from the government, which resulted in them expecting immediate government interference to alleviate their poor conditions. This assumption may have led to under and over-reporting, which could have impacted the results.

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APPENDIX A: Research questionnaire

EvaSys	Investigation of the ability of the food system to provide proper access to adequate	Electric Paper
University of the Free State	MSc	
Consumer Science	Investigating the access to adequate food in informal	

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. Demographic information

1.1 Point/section number:

Respondent composition

1.2 Are you...

- ☐ The head of the household who supports the household financially and is responsible for food purchases.
- ☐ Related to the members of the household and supports the household financially and purchase food.
- ☐ Not related to the members of the household but living with the household, supports the household financially and is responsible for food purchases.
- ☐ The head of the household and is responsible for food purchases, but does not support the household financially.
- ☐ Other

1.3 If other, please explain:

1.4 What is your age?

- ☐ 18 to 20 years
- ☐ 21 to 35 years
- ☐ 36 to 59 years
- ☐ 60 years and older

Please indicate how many household members (excluding you) are:

		0	1	2	3	4	5 and more
1.5	Younger than 1 year of age	☐	☐	☐	☐	☐	☐
1.6	Between 1 and 5 years old	☐	☐	☐	☐	☐	☐
1.7	Between 6 and 18 years old	☐	☐	☐	☐	☐	☐
1.8	Between 19 and 64 years	☐	☐	☐	☐	☐	☐
1.9	65 years and older	☐	☐	☐	☐	☐	☐

1.10 What gender do you identify with?

- ☐ Female
- ☐ Male
- ☐ Other

1.11 What language is most often spoken at home with other members of the household?

- ☐ Sesotho
- ☐ IsiXhosa
- ☐ IsiZulu
- ☐ Setswana
- ☐ Afrikaans
- ☐ English
- ☐ Other

1.12 What is your highest level of schooling/education?

- ☐ Never attended school
- ☐ Did not attend school past Grade 7
- ☐ Attended Grade 8-12 but did not complete matric
- ☐ Completed matric
- ☐ Obtained tertiary education
- ☐ Attended tertiary education but did not complete qualification

F7671U0P1PL0V0 01.11.2022, Page 1/8

1. Demographic information [Continue]

1.13 What is your present occupancy status?

- ☐ We live in a government (RDP) house
- ☐ We live in a brick house that we built and paid for ourselves
- ☐ We live in a brick house that we are renting
- ☐ We live in a brick house that we are paying a mortgage on
- ☐ We live in an informal dwelling ('shack') that we built and paid for ourselves
- ☐ We live in an informal dwelling ('shack') that we are renting
- ☐ Other

2. Food preparation

2.1 How often do you prepare meals at home?

- ☐ Every day
- ☐ Every other day
- ☐ Once or twice a week
- ☐ Once or twice a month
- ☐ Never

When you cook at home, how often do you cook food in each of the following areas?

		Always	Often	Sometimes	Rarely	Never
2.2	Inside the house	☐	☐	☐	☐	☐
2.3	In a separate building close to the house	☐	☐	☐	☐	☐
2.4	At a neighbour's house	☐	☐	☐	☐	☐
2.5	At a community venue	☐	☐	☐	☐	☐
2.6	Outside of the house (outdoors)	☐	☐	☐	☐	☐
2.7	Other	☐	☐	☐	☐	☐
2.8	If other, please explain					

Please indicate whether your household has the following appliances and facilities inside your house or yard:

		Yes	No
2.9	Refrigerator	☐	☐
2.10	Freezer	☐	☐
2.11	Electric kettle	☐	☐
2.12	Microwave oven	☐	☐
2.13	Stove or oven (electric, gas, coal, etc.)	☐	☐
2.14	Cooking utensils (pots, pans, spoons, knives and forks)	☐	☐
2.15	Space specifically for food preparation only	☐	☐
2.16	Electricity	☐	☐

How often do you use the following when preparing food in your household?

		Always	Often	Sometimes	Rarely	Never
2.17	Wood	☐	☐	☐	☐	☐
2.18	Charcoal	☐	☐	☐	☐	☐
2.19	Animal dung	☐	☐	☐	☐	☐
2.20	Paraffin stove (portable)	☐	☐	☐	☐	☐
2.21	Gas stove (portable)	☐	☐	☐	☐	☐
2.22	Electric stove (portable)	☐	☐	☐	☐	☐
2.23	Electric stove and oven combination	☐	☐	☐	☐	☐
2.24	Other	☐	☐	☐	☐	☐

2. Food preparation [Continue]

2.25 If other, please explain

3. Transport

How close to your house are the following facilities?

		Walk: 0 - 15 min	Walk: 16 - 30 min	Walk: 30 - 60 min	Drive: 30 - 60 min	Drive: 60 min +
3.1	Tuck/spaza shop	☐	☐	☐	☐	☐
3.2	Supermarket	☐	☐	☐	☐	☐
3.3	Street vendors	☐	☐	☐	☐	☐

How often do you make use of the following transport methods for grocery purchases?

		Daily	Every other day	Once or twice a week	Once or twice a month	Never
3.4	Walking	☐	☐	☐	☐	☐
3.5	Taxi bus	☐	☐	☐	☐	☐
3.6	Bus	☐	☐	☐	☐	☐
3.7	Metered taxi	☐	☐	☐	☐	☐
3.8	Bicycle	☐	☐	☐	☐	☐
3.9	Own vehicle (car/motorcycle)	☐	☐	☐	☐	☐
3.10	Friend or relative's vehicle (car/motorcycle)	☐	☐	☐	☐	☐
3.11	Other	☐	☐	☐	☐	☐

3.12 If other, please explain

3.13 How much of the household's income is spent on transportation per month?

☐ No money is spent ☐ A small portion (10-25%) ☐ Some (+/- 25%)
☐ Large portion (+/- 50%) ☐ Most (+/- 80% or more)

4. Water access

How regularly does your household make use of the following sources of water for cooking?

		Always	Often	Sometimes	Rarely	Never
4.1	Municipal water (tap water inside the house)	☐	☐	☐	☐	☐

4. Water access [Continue]

4.2	Municipal water (tap water outside the house in the yard)	☐	☐	☐	☐	☐
4.3	Municipal water from a communal tap near the house	☐	☐	☐	☐	☐
4.4	Municipal water from a neighbour's tap inside their yard or house	☐	☐	☐	☐	☐
4.5	Other	☐	☐	☐	☐	☐

4.6 If other, please explain

4.7 To what extent do you consider the water used for cooking safe to drink?

☐ Completely safe ☐ Safe, if boiled ☐ Safe to a certain extent
☐ Not safe at all

5. Food security

To what extent do each of the following statements reflect your household's access to food in the past year?

		☐ Never	☐ Once or twice during the year	☐ Once every two months	☐ Monthly	☐ Once a week or more often
5.1	Our household ran out of money to buy food	☐	☐	☐	☐	☐
5.2	Our household had to cut the size of our meals/or ate less because there was not enough food	☐	☐	☐	☐	☐
5.3	Our household skipped all three meals in a day because there was no food in the house	☐	☐	☐	☐	☐
5.4	Our household had to eat a smaller variety of food than we usually do	☐	☐	☐	☐	☐
5.5	The children (under 18s) had to eat less than what they usually eat because of a lack of food in the house	☐	☐	☐	☐	☐
5.6	The children (under 18s) had to skip more than one meal per day because there was no food to eat in the house.	☐	☐	☐	☐	☐
5.7	The children (under 18s) in the household complained because they were constantly hungry from not having food in the household	☐	☐	☐	☐	☐

To what extent did your household use the following strategies to cope with food issues during the past 30 days?

		☐ Every day	☐ At least once a week	☐ Once every two weeks	☐ Once during these 30 days	☐ Never
5.8	Asked neighbours for food	☐	☐	☐	☐	☐
5.9	Relied on less expensive food	☐	☐	☐	☐	☐
5.10	Relied on less preferred food	☐	☐	☐	☐	☐
5.11	Sent household members to beg for food or money	☐	☐	☐	☐	☐
5.12	Gathered wild food	☐	☐	☐	☐	☐

5. Food security [Continue]

5.13	Restricted consumption by adults for small children to eat	☐	☐	☐	☐	☐
5.14	Restricted consumption by small children for adults to eat	☐	☐	☐	☐	☐
5.15	Obtained vegetables from your own garden as food	☐	☐	☐	☐	☐
5.16	Received vegetables from other people's vegetable gardens	☐	☐	☐	☐	☐
5.17	Sold some belongings in order to get money to buy food	☐	☐	☐	☐	☐
5.18	Received food from welfare or church organizations	☐	☐	☐	☐	☐
5.19	Went to the local soup kitchen for a meal	☐	☐	☐	☐	☐
5.20	Contributed to a food stokvel to ensure food over a scarce period	☐	☐	☐	☐	☐
5.21	Did small/piece jobs for food/money to buy food with	☐	☐	☐	☐	☐

6. Food consumption (grains, vegetables, meat, dairy products)

How frequently do you buy food from each of the following places?

		☐ Every week	☐ Every second week	☐ At least once a month	☐ Once or twice a year	☐ Never
6.1	Supermarkets	☐	☐	☐	☐	☐
6.2	Spaza shops or tuck shops	☐	☐	☐	☐	☐
6.3	Street vendors	☐	☐	☐	☐	☐
6.4	Other	☐	☐	☐	☐	☐

6.5 If other, please explain

In the past 30 days, how frequently did you buy any of the following food items?

		☐ Daily	☐ Weekly	☐ Monthly	☐ A few time a year	☐ Never
6.6	Grains (maize flour, samp, bread, rice)	☐	☐	☐	☐	☐
6.7	Roots and tubers (potatoes, sweet potatoes, beetroot, carrots)	☐	☐	☐	☐	☐
6.8	Legumes (Beans, peas, peanuts)	☐	☐	☐	☐	☐
6.9	Fruit and green vegetables	☐	☐	☐	☐	☐
6.10	Red meat (beef, mutton, pork)	☐	☐	☐	☐	☐
6.11	Chicken	☐	☐	☐	☐	☐
6.12	Fish	☐	☐	☐	☐	☐
6.13	Processed meat (polony and viennas)	☐	☐	☐	☐	☐
6.14	Eggs	☐	☐	☐	☐	☐
6.15	Offal and organ meat (liver, heart, stomach etc.)	☐	☐	☐	☐	☐
6.16	Oil, fat, margarine	☐	☐	☐	☐	☐
6.17	Milk and milk products (fresh milk, cheese, amasi milk, yoghurt)	☐	☐	☐	☐	☐
6.18	Prepared foods (Magwinya/ fat cakes, dagwood, Russian and chips, braai meat and pap)Prepared foods (Magwinya/ fat cakes, dagwood, Russian and chips, braai meat and pap)	☐	☐	☐	☐	☐

6. Food consumption (grains, vegetables, meat, dairy products) [Continue]

How frequently did your household prepare and eat the following grains at home during the past 7 days?

	Daily	Every second day	Twice in the 7 days	Once in the 7 days	Never
6.19 Maize flour	☐	☐	☐	☐	☐
6.20 Rice	☐	☐	☐	☐	☐
6.21 Bread	☐	☐	☐	☐	☐
6.22 Oats	☐	☐	☐	☐	☐
6.23 Sorghum (Maltabella porridge)	☐	☐	☐	☐	☐
6.24 Samp	☐	☐	☐	☐	☐
6.25 Pasta	☐	☐	☐	☐	☐
6.26 Whole corn	☐	☐	☐	☐	☐

How much of your household's money do you spend monthly on the following products?
Where a small portion is 10-25%; Some amount is +/- 25%; a large portion is +/- 50%; Most of the money is +/- 80%

	No money is spent	A small portion	Some amount	A large portion	Most of the money
6.27 Grains (maize, rice, bread, etc.)	☐	☐	☐	☐	☐
6.28 Dairy products	☐	☐	☐	☐	☐
6.29 Meat	☐	☐	☐	☐	☐
6.30 Fruit	☐	☐	☐	☐	☐
6.31 Vegetables	☐	☐	☐	☐	☐

How often do you buy the following products at a spaza shop or tuck shop?

	Weekly	Every second week	At least once a month	Once or twice a year	Never
6.32 Maize flour	☐	☐	☐	☐	☐
6.33 Bread	☐	☐	☐	☐	☐
6.34 Rice	☐	☐	☐	☐	☐
6.35 Dairy products	☐	☐	☐	☐	☐
6.36 Meat	☐	☐	☐	☐	☐
6.37 Fruit	☐	☐	☐	☐	☐
6.38 Vegetables	☐	☐	☐	☐	☐

6. Food consumption (grains, vegetables, meat, dairy products) [Continue]

How often do you buy the following products at a supermarket?

		Weekly	Every second week	At least once a month	Once or twice a year	Never
6.39	Maize flour	☐	☐	☐	☐	☐
6.40	Bread	☐	☐	☐	☐	☐
6.41	Rice	☐	☐	☐	☐	☐
6.42	Dairy products	☐	☐	☐	☐	☐
6.43	Meat	☐	☐	☐	☐	☐
6.44	Fruit	☐	☐	☐	☐	☐
6.45	Vegetables	☐	☐	☐	☐	☐

How much of the following products do you cultivate/produce yourself?

		None	Very little	Some	Large portion	All of it
6.46	Maize flour	☐	☐	☐	☐	☐
6.47	Bread	☐	☐	☐	☐	☐
6.48	Rice	☐	☐	☐	☐	☐
6.49	Dairy products	☐	☐	☐	☐	☐
6.50	Meat	☐	☐	☐	☐	☐
6.51	Fruit	☐	☐	☐	☐	☐
6.52	Vegetables	☐	☐	☐	☐	☐

How much of the following products did you get from relatives or neighbours in the past year?

		None	Very little	Some	Large portion	All of it
6.53	Maize flour	☐	☐	☐	☐	☐
6.54	Bread	☐	☐	☐	☐	☐
6.55	Rice	☐	☐	☐	☐	☐
6.56	Dairy products	☐	☐	☐	☐	☐
6.57	Meat	☐	☐	☐	☐	☐
6.58	Fruit	☐	☐	☐	☐	☐
6.59	Vegetables	☐	☐	☐	☐	☐

7. Income

To what extent does your household rely on the following sources of income?
Where a small portion is 10-25%; Some amount is +/- 25%; a large portion is +/- 50%

		Not at all	Small portion	Some extent	Large portion	Only source
7.1	Social Grants	☐	☐	☐	☐	☐
7.2	Old-age pension	☐	☐	☐	☐	☐
7.3	Monthly salary	☐	☐	☐	☐	☐
7.4	Piece jobs	☐	☐	☐	☐	☐
7.5	Self-employment	☐	☐	☐	☐	☐
7.6	Cash loans from family/ friends or neighbours	☐	☐	☐	☐	☐
7.7	Cash loans from financial institution	☐	☐	☐	☐	☐
7.8	Student bursary money	☐	☐	☐	☐	☐
7.9	Other	☐	☐	☐	☐	☐

7.10 If other, please explain

7.11 What is the estimated combined monthly income for your household?

☐ Less than R 1000
☐ R 1001-R 3330 (minimum wage)
☐ R 3331 – R 5000
☐ R 5001 – R 10 000
☐ More than R10 000
☐ Choose not to answer

7.12 Can you please share what you think the biggest obstacles are that stand in the way of you providing food to your household?

Thank you for your participation.
We appreciate your time and effort.

APPENDIX B: Therapist letter

To whom it may concern; 17-June-2020

Re: Research study-Miss M Louw: Investigation of the ability of the food system to provide access to nutritious food to inhabitants of informal settlements in Mangaung

I am willing to be of assistance to the Principal Investigator in providing counselling service to the subjects involved in the above-mentioned study based on the following:

- Counselling services will be provided for cases where emotional stress is indicated as a direct cause, due to the above-mentioned research study.
- The counselling service will be offered free of charge for the duration of the study.
- Traveling of the subject(s) to counselling sessions will be the responsibility of the Research team involved.

I trust you find the above to be in order.

BELINDA KING

NEUROHEALTH
NEUROFEEDBACK & BIOFEEDBACK TRAINING
Concentration • Stress • Anxiety • Learning Disorders

33 Alba Bouwerstreet
Langenhovenpark
Bloemfontein
Mobile : 082 374 5102 www.neurofeedbackbfn.co.za
belinda@neurofeedbackbfn.co.za

Reg. No. CCSA – CO20678

Member of Biofeedback Association of South Africa
Biofeedback Association of South Africa

APPENDIX C: Ethical clearance

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

GENERAL/HUMAN RESEARCH ETHICS COMMITTEE (GHREC)

10-Jul-2020

Dear Miss Malessa Louw

Application Approved

Research Project Title:
Investigation of the ability of the food system to provide access to nutritious food to inhabitants of informal settlements in Mangaung.

Ethical Clearance number:
UFS-HSD2020/0517/1007

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

Adri du Plessis
2020.07.10
16:36:06
+02'00'

205 Nelson Mandela Drive
Park West
Bloemfontein 9301
South Africa

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Tel: +27 (0)51 401 9337
duplessisA@ufs.ac.za
www.ufs.ac.za

APPENDIX D: Consent form

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

UFS NATURAL AND AGRICULTURAL SCIENCES

RESEARCH PROJECT:

Dear respondent

I am an MSc student at the University of the Free State, conducting a research study on the investigation of the ability of the food system to provide proper access to adequate foods to the inhabitants of the informal settlement Grassland Phase 4 in Mangaung. The aim is to to investigate the factors that influence physical food access in the households of Grassland Phase 4 informal settlement in Mangaung and to investigate what is causing these households to be food insecure.

Your participation is highly valued to achieve the objectives of the study. Your identity will remain anonymous and confidential by ensuring that the questionnaire do not include any identifying information that can link the respondent to this specific questionnaire. The data gathered from this questionnaire will also be aggregated. The researcher will also ensure that any identifying characteristics will be removed especially where open-ended responses are used. Kindly spare your time and energy to complete the questionnaire. Please express your personal views as honestly as you can.

This research received ethical clearance approval.

Ethical Clearance number:

UFS-HSD2020/0517/1007

In case you have any inqueries regarding this research project, you are welcome to contact my supervisors:

Dr Albie Du Toit, DuToitA1@ufs.ac.za. or Dr Natasha Cronje, CronjeN@ufs.ac.za. or Prof Johan van Niekerk, vNiekerkJA@ufs.ac.za.

Thank you for your participation.

Email: 2011011026@ufs4life.ac.za
Name: Malessa Louw

APPENDIX E: Government gazette of Covid-19 protocols

DEPARTMENT OF CO-OPERATIVE GOVERNANCE

NO. R. 152 **28 February 20212**

DISASTER MANAGEMENT ACT, 2002: AMENDMENT OF REGULATIONS ISSUED IN TERMS OF SECTION 27(2)

I, Dr Nkosazana Dlamini Zuma, Minister of Cooperative Governance and Traditional Affairs, designated under section 3 of the Disaster Management Act, 2002 (Act No. 57 of 2002), having declared a national state of disaster published by Government Notice No. 313 of 15 March 2020, and extended by Government Notices Nos. 646 of 5 June 2020, 765 of 13 July 2020, 889 of 15 August 2020, 995 of 14 September 2020, 1090 of 14 October 2020,1225 of 14 November 2020, No.1341 of 11 December 2020, No. R. 15 of 13 January 2021 and No. R. 86 of 11 February 2021 hereby in terms of section 27(2) of the Disaster Management Act, 2002, after consultation with the relevant Cabinet members, make the Regulations in the Schedule.

NC Zuma

DR NKOSAZANA DLAMINI ZUMA, MP
MINISTER OF COOPERATIVE GOVERNANCE AND TRADITIONAL AFFAIRS
DATE: 28 02 2021

SCHEDULE

Definitions

1. In these Regulations, "the Regulations" means the regulations published by Government Notice No. R. 480 of 29 April 2020 as amended by Government Notices Nos. R. 608 of 28 May 2020, R. 714 of 25 June 2020, R.763 of 12 July 2020, R. 846 of 31 July 2020 R. 891 of 17 August 2020, No. 999 of 18 September 2020, No. 1011 of 20 September 2020, No. 1053 of 1 October 2020, No. 1104 of 21 October 2020, No. 1199 of 11 November 2020, No. 1290 of 3 December 2020, No. 1346 of 15 December 2020, No.1370 of 17 December 2020, No. 1421 of 24 December 2020, No. 1423 of 29 December 2020, No 1435 of 29 December 2020, No. R. 11 of 11 January 2021, No. R. 69 of 1 February 2021, No. R. 92 of 13 February 2021 and No. R. 93 of 13 February 2021.

Amendment of the Classification of the Regulations

2. The Classification of the Regulations is hereby amended by the substitution for Chapter 6 of the following Chapter:

CHAPTER 6
ALERT LEVEL 1

65. Application of Alert Level
66. Notification by district municipalities

(i) whether the party applying for such an order has taken reasonable steps in good faith, to make alternative arrangements with all affected persons, including but not limited to payment arrangements that would preclude the need for any relocation during the national state of disaster.

(3) A court hearing an application to authorise an eviction or demolition may, where appropriate and in addition to any other report that is required by law, request a report from the responsible member of the executive regarding the availability of emergency accommodation or quarantine or isolation facilities pursuant to these Regulations.

Rental housing

74. (1) During the national state of disaster, the Rental Housing Tribunals established under the Rental Housing Act, 1999 (Act No. 50 of 1999)—

(a) must determine fair procedures for the urgent hearing of disputes; or

(b) may grant an urgent *ex parte* spoliation order including to restore the occupation of a dwelling or access to services provided that an affected party may, on 24 hours' notice, require that a hearing be promptly convened.

(2) During the national state of disaster and without derogating from the protections afforded by the Rental Housing Act, 1999 or any provincial unfair practice regulation in place or the duty to consider the interests of both the landlord and tenant on a just and equitable basis, the following conduct is presumed to be an unfair practice for purposes of the Act:

(a) The termination of services in circumstances where—

(i) the landlord has failed to provide reasonable notice and an opportunity to make representations;

(ii) the landlord has failed, reasonably and in good faith, to make the necessary arrangements including to reach an agreement regarding alternative payment arrangements, where applicable; or

(iii) no provision has been made for the ongoing provision of basic services during the national state of disaster.

(b) The imposition of any penalty for the late payment of rental where the default is caused by the disaster, whether or not the penalty takes the form of an administrative charge or any other form other than interest.

(c) The failure of a landlord or tenant to engage reasonably and in good faith to make arrangements to cater for the exigencies of the disaster.

(d) Any other conduct prejudicing the ongoing occupancy of a place of residence, prejudicing the health of any person or prejudicing the ability of any person to comply with the applicable restrictions on movement that is unreasonable or oppressive having regard to the prevailing circumstances.

(3) Where the protections afforded by any Unfair Practice Regulations in force in any province are greater than those provided in this regulation, the provisions of the provincial Unfair Practice Regulations shall apply.

(4) The Cabinet member responsible for human settlements must, after consulting with the Rental Housing Tribunals, issue directions disseminating information about the manner in which the Tribunals will conduct

Substitution of Chapter 6 of the Regulations

3. Chapter 6 of the Regulations is hereby substituted for the following Chapter:

"CHAPTER 6
ALERT LEVEL 1

Application of Alert Level

65. The regulations set out in this Chapter apply during Alert Level 1.

Notification by district municipalities

66. All district municipalities must, after consultation with its local municipalities in its area—

(a) alert communities within that district of the increasing number of infections that could lead to that district being declared a hotspot;

(b) publish on their websites and in the local media, areas with high infection rates within the district; and

(c) update the information as and when it becomes available.

Compliance officers

67. (1) Industries, businesses and entities, both private and in the public sector, must—

(a) designate a COVID-19 compliance officer who must oversee—

(i) the implementation of the plan referred to in paragraph *(b)*; and

(ii) strict adherence to the standards of hygiene and health protocols relating to COVID-19 at the workplace;

(b) develop a plan containing measures to ensure that the workplace meets the standards of health protocols, adequate space for employees and social distancing measures for the public and service providers, as required; and

(c) retain a copy of the plan for inspection, which plan must also contain the details of the COVID-19 compliance officer.

(2) A person in control of a retail store or institution must—

(a) take steps to ensure that customers keep a distance of at least one and a half metres from each other and that all directions in respect of health protocols and social distancing measures are strictly adhered to; and

(b) designate a compliance officer to ensure that safety controls are strictly adhered to and display the name of the compliance officer prominently in the store or institution in a visible area.

Movement of persons

68. (1) Every person is confined to his or her place of residence from 00H00 until 04H00 daily, unless a person—

(a) has been granted permission through directions issued by the relevant Cabinet member or a permit, which corresponds with Form 7 of Annexure A, to perform a service other than a service related to an activity listed under Table 4;

(b) is attending to a security or medical emergency; or

(c) arrives on a flight or is travelling to or from an airport which necessitates travelling during restricted hours of movement. Provided that the person traveling is in possession of a valid boarding pass as proof of flight or a copy of the airline ticket.

(2) Any person who fails to abide by the curfew referred to in subregulation (1) commits an offence and is, on conviction, liable to a fine or a period of imprisonment not exceeding six months, or to both such fine and imprisonment.

(3) Closing time for the following establishments, whether indoors or outdoors, is 23H00:

(a) cinemas;
(b) theatres;
(c) casinos;
(d) museums, galleries and archives;
(e) public swimming pools;
(f) beaches and public parks;
(g) game parks, botanical gardens, aquariums and zoos;
(h) gyms and fitness centres;
(i) restaurants;
(j) venues hosting auctions;
(k) venues hosting professional sport; and
(l) venues hosting faith-based, religious, social, political and cultural gatherings.

Opening and closure of schools

69. The Cabinet member responsible for basic education may by direction contemplated in regulation 4(3), determine the dates on which schools may be opened or closed, as defined in the South African Schools Act, 1996 (Act No.84 of 1996) and any matter related to the management of schools in the basic education sector, to address, prevent and combat the spread of COVID-19 in all schools.

Mandatory protocols when in a public place

70. (1) For the purposes of these Regulations, a **'face mask'** means a cloth face mask or a homemade item that covers the nose and mouth, or another appropriate item to cover the nose and mouth.

(2) The wearing of a face mask is mandatory for every person when in a public place, excluding a child under the age of six years, and any person who fails to comply with a verbal instruction by an enforcement officer to wear a face mask, commits an offence and is, on conviction, liable to a fine or a period of imprisonment not exceeding six months, or to both such fine and imprisonment.

(3) No person will be allowed to—

(a) use, operate, perform any service on any form of public transport;

(b) enter or be in a building, place or premises, including government buildings, places or premises, used by the public to obtain goods or services; or

(c) be in any public open space,

if he or she is not wearing a face mask.

(4) The prohibition in subregulation (3)*(c)* shall not apply to a person who undertakes vigorous exercise in a public place, provided that the person maintains a distance of at least one and a half metres from any other person.

(5) An employer may not allow any employee to perform any duties or enter the employment premises if the employee is not wearing a face mask while performing his or her duties.

(6) Every business premises, including, but not limited to, a supermarket, shop, grocery store, retail store, wholesale produce market or pharmacy shall—

(a) determine their area of floor space in square metres;

(b) based on the information contemplated in paragraph *(a)*, determine the number of customers and employees that may be inside the premises in order to comply with the limitation as provided for in regulation 72(5)*(c)* of the Regulations and subject to strict adherence to all health protocols and social distancing measures;

(c) take steps to ensure that persons queuing inside or outside the premises are able to maintain a distance of one and a half metres from each other;

(d) provide hand sanitisers for use by the public and employees at the entrance to the premises; and

(e) assign, in writing, an employee or any other suitable person, as the compliance employee, who must ensure—

(i) compliance with the measures provided for in paragraphs *(a)* to *(d)*; and

(ii) that all directions in respect of hygienic conditions and limitation of exposure to persons with COVID-19 are adhered to.

(7) Any business whose premises exceeds the maximum number of customers and employees determined in subregulation (6) commits an offence and is, on conviction, liable to a fine or to imprisonment for a period not exceeding six months or to both such fine and imprisonment.

(8) All employers must, adopt measures to promote physical distancing of employees, including—

(a) enabling employees to work from home or minimising the need for employees to be physically present at the workplace;

(b) the provision for adequate space;

(c) restrictions on face to face meetings;

(d) special measures for employees with known or disclosed health issues or comorbidities, or with any condition which may place such employees at a higher risk of complications or death if they are infected with COVID-19; and

(e) special measures for employees above the age of 60 who are at a higher risk of complications or death if they are infected with COVID-19.

(9) The requirements as set out in subregulation (6) applies with the necessary changes, to any other building that is not provided for by subregulation (6).

(10) All courier and delivery services shall provide for minimal personal contact during delivery.

(11) All banks as defined in the Banks Act, 1990 (Act No. 94 of 1990) and financial institutions as defined in the Financial Sector Regulation Act, 2017 (Act No. 9 of 2017), must—

(a) ensure that all automated teller machines of that bank or financial institution, if any in the case of a financial institution, that is not a bank, have hand sanitisers for use by the public at each automated teller machine; and

(b) take steps to ensure that persons queuing at the automated teller machine maintain a distance of one and a half metres from each other.

Attendance of funerals

71. (1) Attendance of a funeral is limited to 100 persons or less and if the venue is too small to hold the prescribed number of persons observing a distance of at least one and a half metres from each other, then not more than 50 percent of the capacity of the venue may be used, subject to strict adherence to all health protocols and all persons maintaining a distance of one and a half metres from each other.

(2) Night vigils are not allowed.

(3) After-funeral gatherings, including "after-tears" gatherings, are not allowed.

(4) During a funeral, a person must wear a face mask and adhere to all health protocols and social distancing measures.

(5) The duration of a funeral is restricted to a maximum of two hours.

Gatherings

72. (1) Every person, when attending a gathering and in order to limit exposure to COVID-19, must—

(a) wear a face mask;
(b) adhere to all health protocols;
(c) maintain a distance of at least one and a half metres from each other;
(d) adhere to the curfew hours as provided for in regulation 68; and
(e) adhere to any other health protocols and social distancing measures as provided for in directions issued by the relevant Cabinet member after consultation with the Cabinet member responsible for health.

(2) An owner or operator of any indoor or outdoor facility where gatherings are held must display the certificate of occupancy which sets out the maximum number of persons the facility may hold.

(3) All faith-based, religious, social, political and cultural gatherings are permitted but limited to 100 persons or less for indoor venues and 250 persons or less for outdoor venues and if the venue is too small to hold the prescribed number of persons observing a distance of at least one and a half metres from each other, then not more than 50 percent of the capacity of the venue may be used, subject to strict adherence to all health protocols and social distancing measures.

(4) Gatherings at a workplace for work purposes are allowed, subject to strict adherence to all health protocols and social distancing measures.

(5) *(a)* Hotels, lodges, bed and breakfasts, timeshare facilities, resorts and guest houses are allowed full capacity of the available rooms for accommodation, with patrons observing a distance of at least one and a half metres from each other when in common spaces.

(b) Conferencing, dining and entertainment facilities are subject to a limitation of a maximum of 100 persons or less for indoor venues and 250 persons or less for outdoor venues and if the venue is too small to hold 100 persons indoors or 250 persons outdoors observing a distance of at least one and a half metres from each other, then not more than 50 percent of the capacity of the venue may be used.

(c) Every business premises, including but not limited to supermarkets, shops, grocery stores, produce markets and pharmacies, are subject to a limitation of 50 percent of the floor space, which includes customers and employees, and subject to strict adherence to all health protocols, social distancing measures.

(6) Sporting activities, including both professional and non-professional matches, by recognised sporting bodies are allowed, subject to strict adherence to the times of operation as provided for in regulation 33(3) and the following:

(a) Directions for sports matches issued by the Cabinet member responsible for sport after consultation with the Cabinet member responsible for health;
(b) only journalists, radio, television crew, security personnel, emergency medical services, and the necessary employees employed by the owners of the venue of the sport match, are allowed at the venue of the sport match;
(c) only the required number of players, match officials, support staff and medical crew required for the sport match, are allowed at the venue of the sport match;
(d) no spectators are allowed at the venue of the sports match; and
(e) international sport events involving countries with a low or medium COVID-19 infection and transmission rate are allowed.

(7) An enforcement officer must, where a gathering in contravention of the regulations takes place—
(a) order the persons at the gathering to disperse immediately; and
(b) if the persons refuse to disperse, take appropriate action, which may, subject to the Criminal Procedure Act, 1977 (Act No. 51 of 1977), include the arrest and detention of any person at the gathering.

Eviction and demolition of places of residence

73. (1) A person may not be evicted from his or her land or home or have his or her place of residence demolished for the duration of the national state of disaster unless a competent court has granted an order authorising the eviction or demolition.

(2) A competent court may suspend or stay an order for eviction or demolition contemplated in subregulation (1) until after the lapse or termination of the national state of disaster unless the court is of the opinion that it is not just or equitable to suspend or stay the order having regard, in addition to any other relevant consideration, to—
(a) the need, in the public interest for all persons to have access to a place of residence and basic services to protect their health and the health of others and to avoid unnecessary movement and gathering with other persons;
(b) any restrictions on movement or other relevant restrictions in place at the relevant time in terms of these Regulations;
(c) the impact of the disaster on the parties;
(d) the prejudice to any party of a delay in executing the order and whether such prejudice outweighs the prejudice of the persons who will be subject to the order;
(e) whether any affected person has been prejudiced in their ability to access legal services as a result of the disaster;
(f) whether affected persons will have immediate access to an alternative place of residence and basic services;
(g) whether adequate measures are in place to protect the health of any person in the process of a relocation;
(h) whether any occupier is causing harm to others or there is a threat to life; and

ANNEXURE A: Substitution of Form 7 of the Regulations

6. Form 7 of the Regulations is hereby substituted for the following Form:

"FORM 7

PERMIT TO TRAVEL TO PERFORM A SERVICE

Regulation 68

- *Please note that the person to whom the permit is issued must at all times present a form of identification together with this permit. If no identification is presented, the person to whom the permit is issued will have to return to his or her place of residence.*

I, being the head of institution, with the below mentioned details,

Surname				
Full names				
Identity number				
Contact details	**cell nr.**	**tel nr(w)**	**tel nr(h)**	**e-mail address**
Physical Address of Institution				

hereby certify that the below mentioned official/employee is performing services in my institution

Surname	
Full names	
Identity number	
Place of residence of employee	

Signed at _____, on this the _____ day of _____ 2021.

_____

Signature of Head of Institution

Official stamp of Institution

their proceedings during the national state of disaster including, but not limited to—

(a) the manner in which Tribunals will facilitate expeditious access to any aggrieved person; and

(b) the convening of remote hearings or the convening of hearings at any suitable place.

Places and premises closed to the public

75. (1) Night clubs are closed to the public.

(2) The Cabinet member responsible for cooperative governance and traditional affairs may, by directions, determine a place or premises that must be closed, if there is a risk of any members of the public being exposed to COVID-19 at such a place or premises.

Initiation practices

76. (1) Initiation practices are permitted, subject to the submission of a risk adjusted plan for the conducting of initiation practices to the relevant Cabinet members by the provincial executive responsible for traditional affairs and strict adherence to all health protocols and social distancing measures as provided for in directions issued by the relevant Cabinet member after consultation with the Cabinet member responsible for health.

(2) Post-initiation celebrations ("*imigidi*") are permitted, subject to a limitation of 100 persons or less for indoor venues and 250 persons or less for outdoor venues and if the venue is too small to hold the prescribed number of persons observing a distance of at least one and a half metres from each other, then not more than 50 percent of the capacity of the venue may be used.

Controlled visits by members of the public

77. (1) All visits by members of the public to—

(a) correctional centres;

(b) remand detention facilities;

(c) police holding cells;

(d) military detention facilities;

(e) health establishments and facilities, except to receive treatment or medication, subject to strict adherence to health protocols; and

(f) older persons' residential facilities,

are permitted to the extent and in the manner directed by the relevant Cabinet member.

(2) The Independent Electoral Commission will be allowed to visit the institutions referred to in subregulation (1), where required for the purposes of voter registration, or special voting, to the extent and in the manner set out in Directions by the relevant Cabinet member.

Partial re-opening of borders

78. (1) The 20 land borders which are fully operational, will remain as such and the 33 land borders which were closed, will remain closed.

(2) Traveling to and from the Republic is allowed, subject to subregulation (3).

(3) Daily commuters from neighbouring countries who attend or teach at a school in the Republic, and who are allowed entry into and exit from the Republic, are subject to compliance with protocols relating to—

(a) screening for COVID-19 and quarantine or isolation, where necessary;
(b) the wearing of a face mask;
(c) transportation; and
(d) sanitisation and social distancing measures as per the relevant health protocols on safety and prevention of the spread of COVID-19.

(4) *(a)* International air travel is restricted to the following airports—

(i) OR Tambo International Airport;
(ii) King Shaka International Airport;
(iii) Cape Town International Airport;
(iv) Lanseria International Airport; and
(v) Kruger Mpumalanga International Airport.

(b) Long-haul flight departures and landings at the airports listed in paragraph *(a)* are permitted during the hours of curfew as provided for in regulation 68(1).

(c) All international travellers arriving at the airports listed in paragraph *(a)* must provide a valid certificate of a negative COVID-19 test, recognised by the World Health Organisation, which was obtained not more than 72 hours before the date of travel.

(d) In the event of the traveller's failure to submit a certificate as proof of a negative COVID-19 test, the traveller will be required to do an antigen test on arrival at his or her own cost and in the event of a traveller testing positive for COVID-19, he or she will be required to isolate him or herself at his or her own cost, for a period of 10 days.

(5) All commercial seaports will remain open and small crafts will be allowed entry into seaports, in-line with all health and border law enforcement protocols.

Transportation of cargo

79. (1) Rail, ocean, air and road transport is permitted for the movement of cargo to and from other countries and within the Republic, subject to national legislation and any directions issued in terms of subregulation (2), for the transportation of goods for export and for import.

(2) The Cabinet member responsible for trade, industry and competition may, after consultation with the Cabinet members responsible for transport and finance, issue directions that provide for the management, administration and prioritisation of exports or imports, taking into account the

need to prevent and limit the spread of COVID-19 and to deal with the destructive and other effects of the COVID-19 pandemic.

(3) The Cabinet member responsible for transport may, after consultation with the Cabinet members responsible for cooperative governance and traditional affairs, trade, industry and competition, health, justice and correctional services, finance and public enterprises, issue directions relating to health protocols applicable to sea cargo operations and air freight operation.

Public transport

80. (1) For purposes of this regulation "long distance travel" is a trip of 200 km or more.

(2) The Cabinet member responsible for transport must, after consultation with the Cabinet members responsible for cooperative governance and traditional affairs, health, police, trade, industry and competition, and justice and correctional services, issue directions for the resumption of different modes of public transport to cater for the gradual return to work of people, in respect of—

(a) domestic air travel;
(b) rail, bus services, taxi services;
(c) e-hailing services; and
(d) private vehicles.

(3) Bus and taxi services—

(a) may not carry more than 70 percent of the licensed capacity for long distance travel; and
(b) may carry 100 percent of the licensed capacity for any trip not regarded as long distance travel in terms of subregulation (1).

(4) A driver, owner or operator of public transport may not allow any member of the public who is not wearing a face mask, to board or be conveyed in a public transport owned or operated by him or her.

(5) The directions to be issued by the Cabinet member responsible for transport must set out the health protocols that must be adhered to and the steps to be followed for the limitation of the exposure of members of the public using public transport to COVID-19.

Sale, dispensing and transportation of liquor

81. (1) The sale of liquor—

(a) by a licensed premises for off-site consumption, is permitted during licenced trading hours, subject to the laws governing such licences; and
(b) by a licensed premises for on-site consumption is permitted, subject to strict adherence to the curfew contemplated in regulation 68(3).

(2) The transportation of liquor is permitted.

(3) The consumption of liquor in public places, except in licensed on-site consumption premises, is not permitted.

(4) The sale and consumption of liquor in contravention of subregulation (1)*(b)* and (3), is an offence.

Operation of economic sector

82. (1) Businesses may operate except for those set out in Table 4.

(2) Relevant health protocols and social distancing measures for persons employed in private residences must be adhered to.

(3) Relevant health protocols and social distancing measures set out in directions must be adhered to, in addition to the occupational health and safety directions issued by the Cabinet member responsible for employment and labour, and applicable labour legislation.

(4) *(a)* Firms must adhere to any sector-specific health protocols intended to limit the spread of COVID-19 in the sector concerned.

(b) Sector-specific health protocols may address matters such as work rotation, staggered working hours, shift systems, remote working arrangements, special measures affecting persons with greater vulnerabilities or similar measures, in order to achieve social distancing, protect employees or limit congestion in public transport and at the workplace.

(c) Sector-specific health protocols where these are still to be developed, must be developed and issued by Cabinet members responsible for a sector in consultation with the Cabinet member responsible for health.

Offences and penalties

83. (1) For the duration of the national state of disaster, any person who hinders, interferes with, or obstructs an enforcement officer in the exercise of his or her powers, or the performance of his or her duties in terms of these Regulations, is guilty of an offence and, on conviction, liable to a fine or to imprisonment for a period not exceeding six months or to both such fine and imprisonment.

(2) For the purposes of this Chapter, any person who fails to comply with or contravenes a provision of regulations 68(1) and (3), 70(2), (3) and (7); 80(3)*(a)*, 81(1)*(b)* and 81(3) of these Regulations commits an offence and is, on conviction, liable to a fine or to imprisonment for a period not exceeding six months or to both such fine and imprisonment.".

Substitution of Table 4 of the Regulations

4. Table 4 of the Regulations is hereby substituted for the following Table:

"TABLE 4
ALERT LEVEL 1

All persons who are able to work from home must do so. However, persons will be permitted to perform any type of work outside the home, and to travel to and from work and for work purposes under Alert Level 1, subject to—

(a) strict compliance with health protocols and social distancing measures;

(b) the return to work being phased-in in order to put in place measures to make the workplace COVID-19 ready;

(c) the return to work being done in a manner that avoids and reduces risks of infection; and

(d) the work not being listed under the specific economic exclusions in this Table.

	SPECIFIC EXCLUSIONS
1.	Night vigils.
2.	After-funeral gatherings including "after-tears" gatherings.
3.	Night clubs.
4.	The land borders that remain closed, excluding the land borders contemplated in regulation 78(1).
5.	Passenger ships for international leisure purposes, excluding small crafts, in line with health and border law enforcement.
6.	Attendance of any sporting event by spectators.
7.	Exclusions relating to public transport services as set out in the directions issued by the Cabinet member responsible for transport.
8.	Exclusions relating to education services as set out in the directions issued by the Cabinet members responsible for education.".

Commencement

5. This amendment to the Regulations will come into operation on publication in the *Gazette*.

APPENDIX F: Food security correlation data

Correlation matrix (Spearman):

Variables	"Our household ran out of money	"Our household had to cut the size	"Our household skipped all three	"Our household had to eat a smal	"The children (under 18s) had to	"The children (under 18s) had to	"The children (under 18s) in the h	"Asked neighbours for food"	"Relied on less expensive food"	"Relied on less preferred food"	"Sent household members to beg	"Gathered wild food"	"Restricted consumption by adult	"Restricted consumption by small	"Obtained vegetables from your	"Received vegetables from other	"Sold some belongings in order t	"Received food from welfare or c	"Went to the local soup kitchen f	"Contributed to a food stokvel to	"Did small/piece jobs for food/m
"Our household ran out of money	**1**	**0.763**	**0.693**	**0.765**	**0.596**	**0.467**	**0.562**	**-0.736**	**-0.170**	**-0.440**	**-0.612**	**-0.509**	**-0.695**	-0.039	0.105	**-0.511**	**-0.595**	-0.091	**-0.252**	0.022	**-0.369**
"Our household had to cut the siz	**0.763**	**1**	**0.575**	**0.946**	**0.492**	**0.369**	**0.493**	**-0.628**	**-0.235**	**-0.496**	**-0.510**	**-0.487**	**-0.595**	0.024	0.090	**-0.475**	**-0.515**	-0.054	**-0.193**	0.016	**-0.378**
"Our household skipped all three	**0.693**	**0.575**	**1**	**0.578**	**0.658**	**0.582**	**0.634**	**-0.662**	-0.052	**-0.254**	**-0.643**	**-0.380**	**-0.537**	-0.060	0.025	**-0.509**	**-0.524**	**-0.125**	**-0.380**	-0.078	**-0.389**
"Our household had to eat a smal	**0.765**	**0.946**	**0.578**	**1**	**0.539**	**0.415**	**0.528**	**-0.637**	**-0.243**	**-0.492**	**-0.519**	**-0.476**	**-0.603**	0.019	0.097	**-0.484**	**-0.498**	-0.016	**-0.205**	0.015	**-0.398**
"The children (under 18s) had to	**0.596**	**0.492**	**0.658**	**0.539**	**1**	**0.609**	**0.784**	**-0.600**	-0.107	**-0.286**	**-0.577**	**-0.458**	**-0.598**	-0.040	0.053	**-0.516**	**-0.552**	0.027	**-0.225**	-0.059	**-0.292**
"The children (under 18s) had to	**0.467**	**0.369**	**0.582**	**0.415**	**0.609**	**1**	**0.683**	**-0.490**	-0.074	**-0.178**	**-0.557**	**-0.282**	**-0.469**	-0.073	0.052	**-0.351**	**-0.368**	0.054	**-0.222**	0.047	**-0.277**
"The children (under 18s) in the h	**0.562**	**0.493**	**0.634**	**0.528**	**0.784**	**0.683**	**1**	**-0.603**	-0.091	**-0.260**	**-0.620**	**-0.438**	**-0.602**	-0.109	0.011	**-0.479**	**-0.534**	0.025	**-0.171**	0.051	**-0.258**
"Asked neighbours for food"	**-0.736**	**-0.628**	**-0.662**	**-0.637**	**-0.600**	**-0.490**	**-0.603**	**1**	**0.160**	**0.341**	**0.674**	**0.563**	**0.674**	0.066	**-0.123**	**0.554**	**0.665**	**0.181**	**0.289**	-0.013	**0.345**
"Relied on less expensive food"	**-0.170**	**-0.235**	-0.052	**-0.243**	-0.107	-0.074	-0.091	**0.160**	**1**	**0.470**	0.109	**0.136**	**0.159**	0.034	-0.018	**0.133**	0.069	0.030	0.089	-0.060	0.106
"Relied on less preferred food"	**-0.440**	**-0.496**	**-0.254**	**-0.492**	**-0.286**	**-0.178**	**-0.260**	**0.341**	**0.470**	**1**	**0.236**	**0.335**	**0.415**	0.068	-0.066	**0.335**	**0.269**	0.060	**0.149**	-0.107	**0.191**
"Sent household members to beg	**-0.612**	**-0.510**	**-0.643**	**-0.519**	**-0.577**	**-0.557**	**-0.620**	**0.674**	0.109	**0.236**	**1**	**0.469**	**0.588**	0.105	-0.059	**0.453**	**0.551**	**0.174**	**0.349**	-0.020	**0.308**
"Gathered wild food"	**-0.509**	**-0.487**	**-0.380**	**-0.476**	**-0.458**	**-0.282**	**-0.438**	**0.563**	**0.136**	**0.335**	**0.469**	**1**	**0.664**	0.065	0.036	**0.530**	**0.560**	0.099	0.032	0.078	**0.149**
"Restricted consumption by adult	**-0.695**	**-0.595**	**-0.537**	**-0.603**	**-0.598**	**-0.469**	**-0.602**	**0.674**	**0.159**	**0.415**	**0.588**	**0.664**	**1**	0.109	0.024	**0.543**	**0.650**	0.080	**0.136**	-0.031	**0.213**
"Restricted consumption by smal	-0.039	0.024	-0.060	0.019	-0.040	-0.073	-0.109	0.066	0.034	0.068	0.105	0.065	0.109	**1**	**0.160**	0.015	0.051	**0.215**	0.046	0.046	0.046
"Obtained vegetables from your	0.105	0.090	0.025	0.097	0.053	0.052	0.011	**-0.123**	-0.018	-0.066	-0.059	0.036	0.024	**0.160**	**1**	**0.149**	-0.014	0.100	**-0.136**	0.031	**-0.137**
"Received vegetables from other	**-0.511**	**-0.475**	**-0.509**	**-0.484**	**-0.516**	**-0.351**	**-0.479**	**0.554**	**0.133**	**0.335**	**0.453**	**0.530**	**0.543**	0.015	**0.149**	**1**	**0.538**	**0.153**	**0.266**	0.056	**0.217**
"Sold some belongings in order t	**-0.595**	**-0.515**	**-0.524**	**-0.498**	**-0.552**	**-0.368**	**-0.534**	**0.665**	0.069	**0.269**	**0.551**	**0.560**	**0.650**	0.051	-0.014	**0.538**	**1**	**0.205**	**0.185**	0.055	**0.251**
"Received food from welfare or c	-0.091	-0.054	**-0.125**	-0.016	0.027	0.054	0.025	**0.181**	0.030	0.060	**0.174**	0.099	0.080	**0.215**	0.100	**0.153**	**0.205**	**1**	**0.255**	**0.157**	**0.153**
"Went to the local soup kitchen f	**-0.252**	**-0.193**	**-0.380**	**-0.205**	**-0.225**	**-0.222**	**-0.171**	**0.289**	0.089	**0.149**	**0.349**	0.032	**0.136**	0.046	**-0.136**	**0.266**	**0.185**	**0.255**	**1**	**0.123**	**0.417**
"Contributed to a food stokvel to	0.022	0.016	-0.078	0.015	-0.059	0.047	0.051	-0.013	-0.060	-0.107	-0.020	0.078	-0.031	0.046	0.031	0.056	0.055	**0.157**	**0.123**	**1**	-0.089
"Did small/piece jobs for food/m	**-0.369**	**-0.378**	**-0.389**	**-0.398**	**-0.292**	**-0.277**	**-0.258**	**0.345**	0.106	**0.191**	**0.308**	**0.149**	**0.213**	0.046	**-0.137**	**0.217**	**0.251**	**0.153**	**0.417**	-0.089	**1**

Values in bold are different from 0 with a significance level alpha=0.05

p-values (Spearman):

Variables	"Our household ran out of money	"Our household had to cut the size	"Our household skipped all three	"Our household had to eat a smal	"The children (under 18s) had to	"The children (under 18s) had to	"The children (under 18s) in the h	"Asked neighbours for food"	"Relied on less expensive food"	"Relied on less preferred food"	"Sent household members to beg	"Gathered wild food"	"Restricted consumption by adult	"Restricted consumption by small	"Obtained vegetables from your	"Received vegetables from other	"Sold some belongings in order t	"Received food from welfare or c	"Went to the local soup kitchen f	"Contributed to a food stokvel to	"Did small/piece jobs for food/m
"Our household ran out of money	**0**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0.005**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.518	0.080	**<0.0001**	**<0.0001**	0.130	**<0.0001**	0.717	**<0.0001**
"Our household had to cut the siz	**<0.0001**	**0**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.690	0.135	**<0.0001**	**<0.0001**	0.366	**0.001**	0.786	**<0.0001**
"Our household skipped all three	**<0.0001**	**<0.0001**	**0**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.392	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.317	0.677	**<0.0001**	**<0.0001**	**0.038**	**<0.0001**	0.196	**<0.0001**
"Our household had to eat a smal	**<0.0001**	**<0.0001**	**<0.0001**	**0**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.755	0.108	**<0.0001**	**<0.0001**	0.793	**0.001**	0.808	**<0.0001**
"The children (under 18s) had to	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0**	**<0.0001**	**<0.0001**	**<0.0001**	0.075	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.502	0.379	**<0.0001**	**<0.0001**	0.660	**0.000**	0.331	**<0.0001**
"The children (under 18s) had to	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0**	**<0.0001**	**<0.0001**	0.219	**0.003**	**<0.0001**	**<0.0001**	**<0.0001**	0.226	0.392	**<0.0001**	**<0.0001**	0.366	**0.000**	0.432	**<0.0001**
"The children (under 18s) in the h	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0**	**<0.0001**	0.131	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.070	0.853	**<0.0001**	**<0.0001**	0.677	**0.004**	0.393	**<0.0001**
"Asked neighbours for food"	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0**	**0.008**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.273	**0.041**	**<0.0001**	**<0.0001**	**0.003**	**<0.0001**	0.824	**<0.0001**
"Relied on less expensive food"	**0.005**	**<0.0001**	0.392	**<0.0001**	0.075	0.219	0.131	**0.008**	**0**	**<0.0001**	0.071	**0.023**	**0.008**	0.578	0.765	**0.027**	0.254	0.619	0.138	0.322	0.077
"Relied on less preferred food"	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0.003**	**<0.0001**	**<0.0001**	**<0.0001**	**0**	**<0.0001**	**<0.0001**	**<0.0001**	0.261	0.271	**<0.0001**	**<0.0001**	0.316	**0.013**	0.075	**0.001**
"Sent household members to beg	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.071	**<0.0001**	**0**	**<0.0001**	**<0.0001**	0.080	0.327	**<0.0001**	**<0.0001**	**0.004**	**<0.0001**	0.739	**<0.0001**
"Gathered wild food"	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0.023**	**<0.0001**	**<0.0001**	**0**	**<0.0001**	0.278	0.545	**<0.0001**	**<0.0001**	0.101	0.592	0.193	**0.013**
"Restricted consumption by adult	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0.008**	**<0.0001**	**<0.0001**	**<0.0001**	**0**	0.070	0.690	**<0.0001**	**<0.0001**	0.182	**0.024**	0.606	**0.000**
"Restricted consumption by smal	0.518	0.690	0.317	0.755	0.502	0.226	0.070	0.273	0.578	0.261	0.080	0.278	0.070	**0**	**0.008**	0.802	0.394	**0.000**	0.446	0.446	0.444
"Obtained vegetables from your	0.080	0.135	0.677	0.108	0.379	0.392	0.853	**0.041**	0.765	0.271	0.327	0.545	0.690	**0.008**	**0**	**0.013**	0.823	0.097	**0.024**	0.610	**0.022**
"Received vegetables from other	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0.027**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.802	**0.013**	**0**	**<0.0001**	**0.011**	**<0.0001**	0.355	**0.000**
"Sold some belongings in order t	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.254	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.394	0.823	**<0.0001**	**0**	**0.001**	**0.002**	0.359	**<0.0001**
"Received food from welfare or c	0.130	0.366	**0.038**	0.793	0.660	0.366	0.677	**0.003**	0.619	0.316	**0.004**	0.101	0.182	**0.000**	0.097	**0.011**	**0.001**	**0**	**<0.0001**	**0.009**	**0.011**
"Went to the local soup kitchen f	**<0.0001**	**0.001**	**<0.0001**	**0.001**	**0.000**	**0.000**	**0.004**	**<0.0001**	0.138	**0.013**	**<0.0001**	0.592	**0.024**	0.446	**0.024**	**<0.0001**	**0.002**	**<0.0001**	**0**	**0.041**	**<0.0001**
"Contributed to a food stokvel to	0.717	0.786	0.196	0.808	0.331	0.432	0.393	0.824	0.322	0.075	0.739	0.193	0.606	0.446	0.610	0.355	0.359	**0.009**	**0.041**	**0**	0.139
"Did small/piece jobs for food/m	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.077	**0.001**	**<0.0001**	**0.013**	**0.000**	0.444	**0.022**	**0.000**	**<0.0001**	**0.011**	**<0.0001**	0.139	**0**

APPENDIX G: Food preparation correlation data

Correlation matrix (Spearman):

Variables	"How often do	"In a separate	"At a neighbou	"At a communi	"Outside of the	"Refriger ator"	"Freezer"	"Electric kettle"	"Microwa ve oven"	"Stove or oven	"Cooking utensils	"Space specifical	"Electrici ty"	"Wood"	"Charcoal "	"Paraffin stove	"Gas stove	"Electric stove	"Electric stove
"How ofte	**1**	0.040	-0.100	0.024	0.076	**0.281**	**0.218**	**0.153**	0.104	**0.151**	0.102	0.102	**0.248**	-0.068	-0.030	**-0.230**	0.020	**0.283**	0.049
"In a sepa	0.040	**1**	**0.128**	**0.399**	**0.326**	0.076	**-0.207**	0.042	-0.117	0.041	0.025	0.025	0.038	-0.052	-0.042	**0.175**	-0.016	-0.099	-0.040
"At a neig	-0.100	**0.128**	**1**	-0.028	0.112	0.005	-0.100	-0.105	**-0.132**	0.056	-0.081	-0.081	0.052	0.119	0.016	0.102	-0.023	-0.015	-0.057
"At a comi	0.024	**0.399**	-0.028	**1**	**0.212**	-0.002	-0.052	0.034	-0.071	-0.030	0.015	0.015	-0.033	0.014	-0.025	0.092	-0.010	-0.094	**0.151**
"Outside (	0.076	**0.326**	0.112	**0.212**	**1**	**0.260**	**0.128**	**0.133**	0.071	**0.136**	0.078	0.078	**0.146**	**0.620**	**0.351**	-0.075	-0.049	0.054	**0.198**
"Refrigera	**0.281**	0.076	0.005	-0.002	**0.260**	**1**	**0.798**	**0.542**	**0.414**	**0.663**	**0.143**	**0.143**	**0.726**	0.030	0.121	**-0.674**	0.061	**0.683**	**0.154**
"Freezer"	**0.218**	**-0.207**	-0.100	-0.052	**0.128**	**0.798**	**1**	**0.494**	**0.478**	**0.514**	0.106	0.106	**0.576**	0.051	**0.127**	**-0.644**	-0.013	**0.593**	**0.192**
"Electric k	**0.153**	0.042	-0.105	0.034	**0.133**	**0.542**	**0.494**	**1**	**0.532**	**0.466**	0.032	0.088	**0.510**	-0.059	0.012	**-0.491**	-0.002	**0.427**	**0.181**
"Microwa	0.104	-0.117	**-0.132**	-0.071	0.071	**0.414**	**0.478**	**0.532**	**1**	**0.282**	0.092	0.092	**0.336**	-0.054	0.007	**-0.392**	-0.058	**0.296**	**0.261**
"Stove or	**0.151**	0.041	0.056	-0.030	**0.136**	**0.663**	**0.514**	**0.466**	**0.282**	**1**	**0.198**	**0.198**	**0.884**	-0.041	0.037	**-0.620**	0.047	**0.732**	0.117
"Cooking (	0.102	0.025	-0.081	0.015	0.078	**0.143**	0.106	0.032	0.092	**0.198**	**1**	**0.796**	**0.204**	0.004	-0.098	**-0.129**	0.013	**0.146**	0.031
"Space spe	0.102	0.025	-0.081	0.015	0.078	**0.143**	0.106	0.088	0.092	**0.198**	**0.796**	**1**	**0.273**	-0.067	-0.098	**-0.171**	0.013	**0.165**	0.031
"Electricit	**0.248**	0.038	0.052	-0.033	**0.146**	**0.726**	**0.576**	**0.510**	**0.336**	**0.884**	**0.204**	**0.273**	**1**	-0.094	0.075	**-0.670**	0.046	**0.799**	0.115
"Wood"	-0.068	-0.052	0.119	0.014	**0.620**	0.030	0.051	-0.059	-0.054	-0.041	0.004	-0.067	-0.094	**1**	**0.369**	0.059	-0.047	-0.041	0.039
"Charcoal"	-0.030	-0.042	0.016	-0.025	**0.351**	0.121	**0.127**	0.012	0.007	0.037	-0.098	-0.098	0.075	**0.369**	**1**	0.019	-0.021	0.085	-0.051
"Paraffin s	**-0.230**	**0.175**	0.102	0.092	-0.075	**-0.674**	**-0.644**	**-0.491**	**-0.392**	**-0.620**	**-0.129**	**-0.171**	**-0.670**	0.059	0.019	**1**	-0.122	**-0.650**	**-0.206**
"Gas stove	0.020	-0.016	-0.023	-0.010	-0.049	0.061	-0.013	-0.002	-0.058	0.047	0.013	0.013	0.046	-0.047	-0.021	-0.122	**1**	**-0.145**	-0.020
"Electric s	**0.283**	-0.099	-0.015	-0.094	0.054	**0.683**	**0.593**	**0.427**	**0.296**	**0.732**	**0.146**	**0.165**	**0.799**	-0.041	0.085	**-0.650**	**-0.145**	**1**	-0.027
"Electric s	0.049	-0.040	-0.057	**0.151**	**0.198**	**0.154**	**0.192**	**0.181**	**0.261**	0.117	0.031	0.031	0.115	0.039	-0.051	**-0.206**	-0.020	-0.027	**1**

Values in bold are different from 0 with a significance level alpha=0.05

p-values (Spearman):

Variables	"How often do	"In a separate	"At a neighbou	"At a communi	"Outside of the	"Refriger ator"	"Freezer"	"Electric kettle"	"Microwa ve oven"	"Stove or oven	"Cooking utensils	"Space specifical	"Electrici ty"	"Wood"	"Charcoal "	"Paraffin stove	"Gas stove	"Electric stove	"Electric stove
"How ofte	**0**	0.526	0.109	0.700	0.228	**<0.0001**	**0.000**	**0.014**	0.098	**0.016**	0.103	0.103	**<0.0001**	0.281	0.630	**0.000**	0.754	**<0.0001**	0.433
"In a sepa	0.526	**0**	**0.041**	**<0.0001**	**<0.0001**	0.224	**0.001**	0.508	0.062	0.518	0.686	0.686	0.549	0.404	0.508	**0.005**	0.800	0.112	0.526
"At a neig	0.109	**0.041**	**0**	0.654	0.075	0.932	0.109	0.092	**0.035**	0.372	0.196	0.196	0.409	0.058	0.801	0.103	0.715	0.810	0.362
"At a comi	0.700	**<0.0001**	0.654	**0**	**0.001**	0.973	0.406	0.591	0.259	0.631	0.807	0.807	0.603	0.825	0.688	0.142	0.878	0.133	**0.016**
"Outside (	0.228	**<0.0001**	0.075	**0.001**	**0**	**<0.0001**	**0.041**	**0.034**	0.258	**0.030**	0.216	0.216	**0.020**	**<0.0001**	**<0.0001**	0.230	0.437	0.385	**0.002**
"Refrigera	**<0.0001**	0.224	0.932	0.973	**<0.0001**	**0**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0.022**	**0.022**	**<0.0001**	0.632	0.052	**<0.0001**	0.327	**<0.0001**	**0.014**
"Freezer"	**0.000**	**0.001**	0.109	0.406	**0.041**	**<0.0001**	**0**	**<0.0001**	**<0.0001**	**<0.0001**	0.092	0.092	**<0.0001**	0.415	**0.042**	**<0.0001**	0.841	**<0.0001**	**0.002**
"Electric k	**0.014**	0.508	0.092	0.591	**0.034**	**<0.0001**	**<0.0001**	**0**	**<0.0001**	**<0.0001**	0.615	0.160	**<0.0001**	0.343	0.851	**<0.0001**	0.974	**<0.0001**	**0.004**
"Microwa	0.098	0.062	**0.035**	0.259	0.258	**<0.0001**	**<0.0001**	**<0.0001**	**0**	**<0.0001**	0.143	0.143	**<0.0001**	0.387	0.917	**<0.0001**	0.358	**<0.0001**	**<0.0001**
"Stove or	**0.016**	0.518	0.372	0.631	**0.030**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0**	**0.001**	**0.001**	**<0.0001**	0.518	0.557	**<0.0001**	0.454	**<0.0001**	0.061
"Cooking (	0.103	0.686	0.196	0.807	0.216	**0.022**	0.092	0.615	0.143	**0.001**	**0**	**<0.0001**	**0.001**	0.946	0.116	**0.039**	0.842	**0.020**	0.618
"Space spe	0.103	0.686	0.196	0.807	0.216	**0.022**	0.092	0.160	0.143	**0.001**	**<0.0001**	**0**	**<0.0001**	0.288	0.116	**0.006**	0.842	**0.008**	0.618
"Electricit	**<0.0001**	0.549	0.409	0.603	**0.020**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0.001**	**<0.0001**	**0**	0.132	0.231	**<0.0001**	0.465	**<0.0001**	0.067
"Wood"	0.281	0.404	0.058	0.825	**<0.0001**	0.632	0.415	0.343	0.387	0.518	0.946	0.288	0.132	**0**	**<0.0001**	0.344	0.452	0.514	0.535
"Charcoal"	0.630	0.508	0.801	0.688	**<0.0001**	0.052	**0.042**	0.851	0.917	0.557	0.116	0.116	0.231	**<0.0001**	**0**	0.761	0.744	0.177	0.414
"Paraffin s	**0.000**	**0.005**	0.103	0.142	0.230	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0.039**	**0.006**	**<0.0001**	0.344	0.761	**0**	0.052	**<0.0001**	**0.001**
"Gas stove	0.754	0.800	0.715	0.878	0.437	0.327	0.841	0.974	0.358	0.454	0.842	0.842	0.465	0.452	0.744	0.052	**0**	**0.021**	0.754
"Electric s	**<0.0001**	0.112	0.810	0.133	0.385	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0.020**	**0.008**	**<0.0001**	0.514	0.177	**<0.0001**	**0.021**	**0**	0.666
"Electric s	0.433	0.526	0.362	**0.016**	**0.002**	**0.014**	**0.002**	**0.004**	**<0.0001**	0.061	0.618	0.618	0.067	0.535	0.414	**0.001**	0.754	0.666	**0**

APPENDIX H: Food consumption correlation matrix