

Profiling the determinants of food insecurity in households keeping livestock in the Limpopo Province

by

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Declaration

I, **Mamphasha Phina Mdaka** I hereby declare that the thesis I have submitted to the University of Pretoria for the MSc (Agric) Animal Science: Livestock Production degree is my original work and has not been submitted to another university for a different degree.



08.05.2023

Dedication

I dedicate this research to my siblings, Keletso Israel Mdaka, Lindaokuhle Dimpho Mdaka and Jabu Junior Mdaka. You always looking up to me has motivated me to push myself even in times I felt tired to do anything.

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Abstract

South African smallholder farmers help reduce rural poverty and famine. Smallholder farmers in remote places have several obstacles that limit their growth and food security contributions compared to commercial farmers. Land, funds, infrastructure, and markets are some of these obstacles. About 50 to 80% of rural South African households face food insecurity. Households keeping livestock were also included in the definition of smallholder farmers based on economic variables, thus, the study examined livestock-keeping households' food availability. The study analysed data from 600 families in Limpopo's Capricorn, Mopani, Sekhukhune, Vhembe, and Waterberg districts. To achieve each objective, House Dietary Diversity Score and Household Food Insecurity Access Scale scores were used to assess food insecurity. Food insecure households were characterized using a 2-step cluster analysis, Analysis of Variance, and t-tests. Multilinear regression determined household food insecurity factors. Food security indicators for the Province of Limpopo were calculated using data collected from a sample of 301 households (those who kept livestock and poultry). The results in this study shows that in Sekhukhune District, a greater proportion of households are food secure compared to other districts, whereas in Waterberg District, a greater proportion of households are food insecure. Only 29.3 % of residents in Fetakgomo, a municipality in the district of Sekhukhune, are food secure. Yet, in Mookgopong, a municipality in the Waterberg district, only 10.3% of households appear to be food secure. Moreover, it is demonstrated that 67.2% of households in Mookgopong are highly food insecure. A municipality in the Mopani district, Maruleng, also has a significant proportion of severely food insecure households (65%). The majority of livestock smallholders depend on animals for food and revenue. However, lack of land, funding, and infrastructure hampers livestock smallholder expansion in Limpopo province. Thus, the department of agriculture and other government and non-government organization initiatives must create and implement programs to provide smallholder farmers with facilities, advanced technology, land, and other livestock outputs.

Key words: Food security; Livestock-keeping; Household; Limpopo Province

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List of Abbreviations

ANOVA	Analysis of Variance
BFAP	Bureau for Food and Agricultural Policy
DALRRD	Department of Agriculture, Land Reform and Rural Development
DIAAS	Digestible Indispensable Amino Acid Score
FANTA	Food and Nutritional Technical Assistance
FAO	Food and Agriculture Organization
FP	Food Poverty
GHS	Global Harmonized System
HDDS	Household Dietary Diversity Score
HFIAS	Household Food Insecurity Access Scale
HH	Head of Household
IES	Inverse Efficiency Score
IFFS	Integrated Food Security Strategy for South Africa
MAHFP	Months of Adequate Household Food Provisioning
MDG	Millennium Development Goals
NAMC	National Agricultural Marketing Council
LEA	Low Energy Availability
R	South African Rand
SA	South Africa
SADC	South African Development Community
SDG	Sustainable Development Goal
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
SRD	Social Relief of Distress grant
USAID	United States Agency for International Development

WFP World Food Programme

WHO World Health Organization

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Chapter 1: Introduction

1.1. Introduction

There is still a long way to go before the world achieves the Sustainable Development Goals for hunger and malnutrition by 2030 (Gebre, 2021; Jesson, 2021; Foini *et al.*, 2021). The global hunger rate has been slowly rising since 2014 (FAO, 2019), after decades of steady decline. Since 2014, there has been a rise in both moderate and severe food insecurity, meaning more individuals are going hungry and/or having to make do with less nutritious food (FAO, 2019). The projections for 2030 serve as a warning that current efforts are insufficient to end hunger by the end of the forecast period of seven years. If nutrition is considered, there is progress in reducing childhood undergrowth and poor birthweight, as well as promoting exclusive breastfeeding for the first six months (Mkhize & Sibanda, 2020). Yet, the incidence of undernourishment is far higher than the targets, in almost all regions of the world, both childhood and adult obesity rates are on the rise (Akindola, 2020; Pretorius *et al.*, 2021). It is anticipated that the after effects of COVID-19 will amplify these tendencies, placing already vulnerable people in an even poorer situation.

The present-day economic, political, and social situation is even more susceptible to climate change and other environmental disasters, and the negative effects of the COVID-19 pandemic prevents countries from achieving the SDG targets (Clapp & Moseley, 2021; Olaimat *et al.*, 2022). To guarantee that all people, regardless of income, can afford healthy diets that take sustainability into account, governments in developing countries have a limited time in which to identify and execute policies and invest in adjustments that can alter present food systems (Chapman *et al.*, 2021). The most vulnerable members of society, the impoverished, require immediate assistance. Studies have shown that not all households in South Africa are food secure (Drammeh *et al.*, 2019), and it is unclear if livestock smallholder farmers are nutrition secure. The factors that influence their access and decisions to consume the available livestock is equally unclear.

Therefore, it is necessary to determine these factors and provide a comprehensive understanding of how livestock in smallholder farms contribute to food security. To better understand the scope of the problem, this study was conducted in the Limpopo Province of South Africa to investigate the determining factors of food insecurity in households keeping livestock in regions that are not within the urban area of the Limpopo Province. This study presents the findings and investigates the degree to which households in five different regions of the Province are secure in their access to food containing the nutrients required to sustain them.

1.2. Aim and objectives

A number of studies have been conducted on food security and the role of smallholder livestock producers in economic development (Lima, 2021). From these studies, it has been observed that 50 to 80% of South African rural households are in danger of being food insecure (Wahbeh *et al.*, 2022). Some of the factors determining the success of keeping livestock and or practicing subsistence farming include adequate infrastructure, supplementary feeding and market access (Stroebel *et al.*, 2011). Despite the ownership of livestock, it is not clear if smallholder livestock farmers/household are food secure, with regards to the essential nutrients. Therefore, the aim of the study was to investigate the access of households keeping livestock to essential nutrients for their families as an indication and extent of food security.

The following objectives were set:

- 1.2.1. To describe the household patterns of essential nutrient consumption using historical data by:
 - 1.2.1.1. Analysing characteristics of food-insecure households.
 - 1.2.1.2. Assessing the level of food insecurity in the rural areas.
 - 1.2.1.3. Determining the factors associated with household food insecurity.
- 1.2.2. To identify the constraints for livestock smallholder producers with regard to access to food availability.
- 1.2.3. Make recommendations to overcome constraints.

Chapter 2: Literature Review

2.1. Introduction

The seriousness of food insecurity as a cause of ill health has been highlighted recently, especially in Sub-Saharan Africa. With the goal to achieve food security for all by 2030, managing food insecurity has been recognized as a top priority by the Sustainable Development Goals (Vyas-Doorgapersaa, 2020). The first goal of the SDGs is to eliminate poverty in all its forms everywhere, whereas the second goal seeks to put an end to hunger (Militao *et al.*, 2022), by ensuring enough food supplies, boosting nutrition awareness, and supporting long-term agricultural practices. During the 1996 World Food Summit, the following definition of food security was presented by the Food and Agriculture Organization: Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (Janssen *et al.*, 2022; Gebre, 2021; Sihlangu and Odeku, 2022). The above concept of food security encompasses its four core components: accessibility, availability, use, and stability. If this is correct, then there should be no point in a person's life when they are ever hungry or without access to food.

Around 795 million people in the world in 2010 lacked access to food that would allow them to maintain a healthy, active lifestyle. About 12.9 % were third-world citizens, with the vast majority residing in Sub-Saharan Africa (Vyas-Doorgapersaa, 2020). Extreme poverty and hunger are results of a number of factors, including a lack of resources to acquire food, a lack of income, and the effects of drought and floods brought on by climate change. Hunger, malnutrition, and chronic food insecurity have been highlighted as a global issue for the past two decades, despite the fact that they are not caused by lack of access to food and improper allocation within households, rather than a shortage on a global or national scale (Jesson *et al.*, 2021). The most prevalent form of food insecurity arises when there is not enough food to go around, which has both physiological and psychological implications. According to Sinyolo (2020), 3.7 million lives may be saved by 2025 if sufficient funds were allocated to nutrition intervention programs.

The aim of this literature review is to give a better understanding on why food insecurity still remains a problem in developing countries. It will also include an in-depth review of the food security policies, food budgets, smallholder farmers, and the constraints that restrains them from achieving food security, not only for their households, but also their communities around in South Africa and other developing countries.

2.2. Food security policies

Food security occurs when everyone is able to have steady physical and economic ability to get adequate, nutritious food that is required for the nourishment of a healthy lifestyle (Ansah *et al.*, 2019). More than 820 million people worldwide struggle from starvation and malnutrition, making it unlikely that the zero-starvation target will be reached by 2030 (FAO, 2019). Sub-Saharan Africa has the world's greatest starvation and malnutrition rates (FAO, 2021). The four most important aspects of food security are:

1. **Availability:** Food production levels, food availability, and net exports all have an important role in the food security supply side.
2. **Access:** Even if there is an abundance of food on a global or national scale, some people may still be economically or physically unable to ensure their own food security. Because of worries about limited food access, policymakers have shifted their attention to incomes, expenditures, markets, and prices as means of realizing food security goals.
3. **Food utilization:** Utilization refers to the processes by which the body extracts and uses nutrients from diet. Careful and nutritious feeding, cooking, a varied diet, and equitable distribution of food within the home all contribute to people getting the energy and nutrients they need. Individuals' nutritional status is established by the amount and quality of food they consume, in addition to their bodies' ability to efficiently use that food.
4. **Stability:** Food insecurity is defined as the danger of having an inadequate diet on a regular basis, regardless of whether or not one's current food intake is inadequate. Your capacity to access nutritious food may be threatened by natural disasters, political unrest, or economic issues (such as unemployment or increased food prices).

Food security is often measured using the following indicators as used in this study;

1. A number of researchers developed the FANTA Household Food Insecurity Access Scale to assess the level of food insecurity in homes; it consists of 9 questions (Kerr *et al.*, 2021). All the 9 questions aim to determine whether or not a household has had inadequate access to food at any point in the preceding four weeks, and if so, how often. Two indicators can be calculated from these 9 questions. Since there are three alternative answers to each of the nine items on the HFIAS, the score ranges from 0 to 27 and, in general, the food (access) insecurity the household experiences worsen when the score goes higher. Second, Households are divided into four groups by the HFIAS: the completely self-sufficient, the partially self-sufficient, the moderately self-

insufficient, and the severely self-insufficient in regard to food security (Clapp *et al.*, 2022).

2. A household Dietary Diversity Score considers how many food types are eaten regularly. Respondents were asked if they or anybody in their home had eaten something from each of nine categories of foods within the previous week. There were two categories of usage: in-home consumption and takeout preparation. A balanced diet requires a balance of nutrients, and these categories of food should reflect that. There is a 0–9 scale for the HDDS. Some HDDS alternatives consider as much as 12 categories of food (Schotte *et al.*, 2021; Bene, 2020).
3. Months of Adequate Household Food Provisioning determines the months of the previous year where the family did not have enough food. The respondents are prompted to name the months in the previous year that their family had no accessibility to enough food that met the nutritional requirements. For each participant, an MAHFP score was determined (from 0 to 12). (Bene, 2020; Clapp *et al.*, 2022).
4. Even if it may not serve as a perfect predictor of food insecurity, the share of a family's income that goes toward food was determined (Zantsi, 2019). The total monthly food expenditure was determined by adding together the costs of all food items bought during that time period. It's important to remember that various factors, such as the fluctuation in food prices and one's location, will affect one's food budget (availability of shops).
5. Low Energy Availability is defined as a residence lacking sufficient sustenance to meet the necessary energy consumption for all household members. The LEA's numerator is the total energy attainable in homes, recorded meal expenditures and the energy used per home-grown food during a course of a month. Multiplying the total prescribed daily energy consumption for every member of the family by thirty takes it to the same monthly period as the numerator. Low energy availability was defined as a ratio below 1 (Mujuru & Obi, 2020; Schotte *et al.*, 2021) for a household.
6. When a family's monthly income is less than the cost of providing its members with a minimally acceptable diet, that family is considered to be in Food Poverty. This trend is exemplified by the price of a standard grocery container relative to what the average family spends on food. The latter figure is 408R/person/month and was arrived at by

dividing the cost of the National Agricultural Marketing Council food basket (Mapiye *et al.*, 2020) by 2139.38 kcal per day. The divisor is the value of a nourishingly suitable meal for one family (Davis *et al.*, 2022; Schotte *et al.*, 2021)

Food policy is the area of government policy that deals with the manufacturing, processing, dispersion, and acquisition of food. Because of the link between food policy and public health, many governments prioritize food policy. Food policy covers an extensive spectrum of issues, and its emphasis has evolved over time. Increased production of food, intake of food containing high levels of energy, and decreased exercise have resulted in a significant rise in the incidence of overweight and obesity in persons of all ages in many industrialized and emerging countries (Popkin *et al.*, 2020).

Manufacturing of food, processing, dispersion, preparation, and intake, as well as the implications of these operations, such as socioeconomic and environmental consequences (Borsellino *et al.*, 2020), are all part of the food system, which is a collection of interconnected elements and activities. Manufacturing, preservation, dispersion, processing, packaging, sales, and markets make up what are known as food supply chains, while food environments refer to factors like food affordability, food promotion and advertising, food quality, and food safety (Figure 2.1).

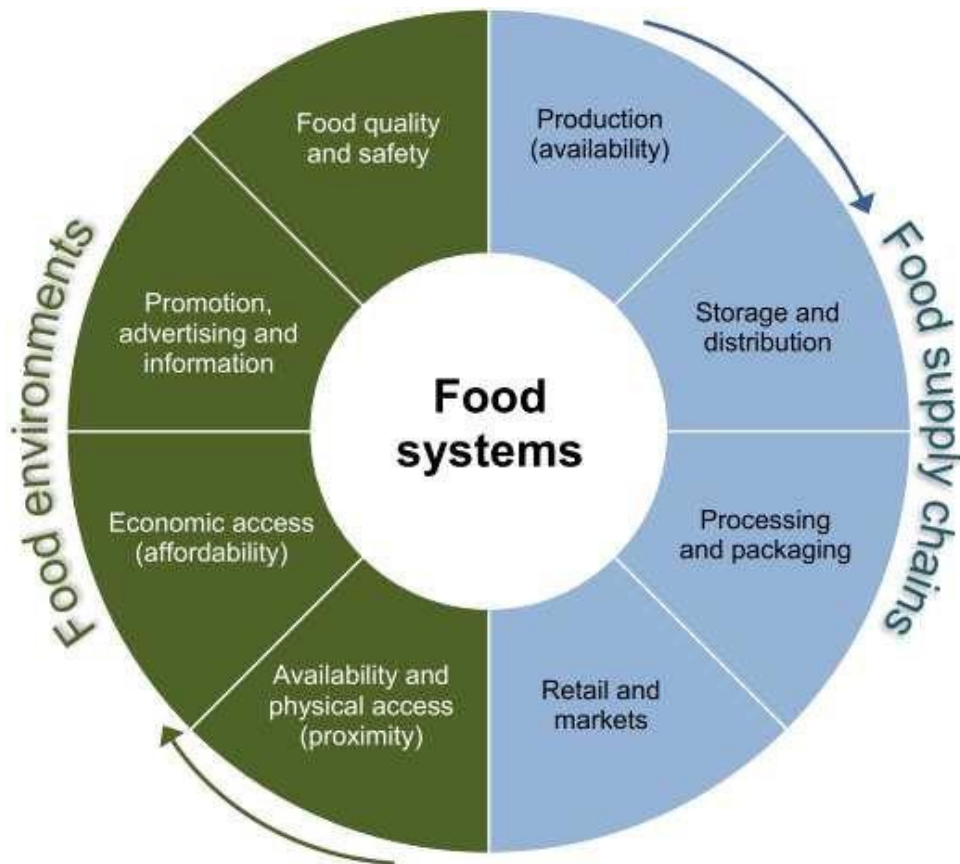


Figure 2.1: Food system diagram simplified (source: HLPE, 2017).

To standardize, unify, and integrate the various food security programs, the cabinet authorized a national Integrated Food Security Strategy in South Africa (Queenan *et al.*, 2020). South Africa is currently self-sufficient in food through a combination of its own manufacturing and food imports, and this is in addition to some development being made in several Strategy priority areas (Anderson *et al.*, 2019). There has been a decrease in both the prevalence and severity of hunger, as measured by the Global Harmonized System, which has also shown that food access has been increasing (Galappathi, 2022). Even so, everyone is not certain of having a constant and reliable supply of food. Globalization, international trade regimes, climate change, and inefficient storage and delivery undermine people's ability to reliably provide for their families' nutritional needs. More and more people may not have enough access to food, and many more may not get the nutritional benefits they need, unless there are coordinated measures (FAO, 2019).

In light of the worldwide economic downturn, rising food price volatility, and the consequences of climate change, the United States has produced a thorough National Food and Nutrition Security Policy (Stats SA, 2019). For these three reasons, South Africa needs a Food and Nutrition Security Policy right away.

1. There must first be agreement on how to define and quantify food and nutrition safety. Countries, stakeholders, academic institutions, and civil society all utilize their own conceptualizations and conceptions of "Food Security" to guide their work. Therefore, in light of Vision 2030, we require a Food and Nutrition Security Strategy to establish common ground and a common vocabulary around this concept.
2. Diet and nourishment Security is a multifaceted problem that calls for multidisciplinary solutions. This National Policy on Food Security and Nutrition is meant to provide a unifying structure for the many existing public and private efforts to boost citizens' access to healthy, affordable food.
3. When it comes to the South African Development Community's initiatives to boost regional food and nutrition security, South Africa can and should lead by example. (Queenan *et al.*, 2020). By outlining the limitations and boundaries of our international commitments, this Policy will provide a foundation for doing so.

The basic goal of food security policy is to ensure that all members of a home have ready access to an adequate food supply (Chapman *et al.*, 2021). However, this sector is often overlooked and at the point when the government looked at the issues around food security, national policies there were some misconceptions on livestock as a contributor to food security (Materchea, 2022; Queenan *et al.*, 2020). As a result, there are no strategies for achieving it, and as a result, progress has been slowed on policies and initiatives pertaining to livestock food security. Nonetheless, the government of South Africa took significant steps to better the lives of many smallholder farmers in rural areas (Giller *et al.*, 2021). One of the ways that ensure that the aim obtained is the funds given to the less fortunate every year, to help them meet some of their needs (Candel & Daugbjerg, 2020).

2.3. South African household food budget and income

The ability to buy enough food is correlated with household income (BFAP, 2020). The poorest consumers spend over 40% of their income on food, while the richest consumers spend roughly 5% of their earnings on food, as stated in the Bureau for Food and Agricultural Policy study, (2020). In the analysis carried out by BFAP, families were classified according to household income, with group 1 being the poorest and group 10 the richest. In a more detailed analysis, it was found that richer households (groups 8-10) spend most of their money abroad, while poor consumers (groups 1-3) allocate most of their food spending on bread and cereals, meat (21%), and vegetables (13%), then dairy products (8%) as well as drinks (7%) (BFAB, 2020). This information in Table 2.1 shows how important basic foods like corn meal, bread,

and rice are, as well as foods that come from animals (chicken, beef, eggs, and milk), edible oil, and sugar.

Table 2.1: The 10 most expensive food categories for different major income sources in South Africa

Low-income households:	Middle-income households:	Affluent households:
Chicken (13.5%)	Chicken (13.0%)	Beef (11.2%)
Maize meal (11.4%)	Maize meal (6.4%)	Chicken (8.6%)
Brown bread (7.8%)	Brown bread (6.0%)	Milk (5.2%)
Rice (4.7%)	Beef (8.0%)	Mutton, lamb (3.1%)
		High-sugar foods (3.1%)
Granular sugar (4.4%)	Rice (3.4%)	Brown bread (3.0%)
Beef (4.7%)	Granular sugar (3.3%)	Fish (2.9%)
Edible oil (3.4%)	White bread (4.1%)	White bread (2.6%)
White bread (3.4%)	Milk (3.9%)	Cheese (2.4%)
Potato (2.8%)	Edible oil (2.4%)	Pork (2.1%)
Milk (2.9%)		

Source: BFAB calculation of food expenditure behaviour, 2020

A household's disposable income (what's left after paying bills and taxes) rose by 63.7% in nominal terms from 2010 to 2020, but by just 1.7% when adjusted for inflation (Clapp *et al.*, 2022). While it increased from 2010 to 2017, family disposable income fell by 6.2% from 2017 to 2020 (Merchant *et al.*, 2022). Most of the 5.8% decline from 2019 to 2020 was due to the unfavourable effects of the COVID-19 pandemic (Merchant *et al.*, 2022). Using information from the 2017/2018 and 2019 Establishment Surveys to create a socioeconomic breakdown, Low-income families saw the largest increase in basic income from 2017 to 2019; middle-income families came in second, while households with high incomes saw a decline in income (BFAB, 2020). From what I can see, income inequality in South Africa has been decreasing (as measured by the Gini coefficient) from the 2017/2018 fiscal year into 2019. According to the Stats South Africa (2020) Living Conditions Survey 2018/2019, the most recent official Gini coefficient data for South Africa is 0.65, which is from 2019.

After a sudden sharp decline in employment caused by severe lockdown in the first quarter of 2020, it was predicted that there will be a sharp decrease in the employment rate till the end of year 2020, following the, bringing the total back to levels seen before the outbreak of COVID (Clapp & Moseley, 2020). The employment rate thereafter began a slow slide that wouldn't reverse until January of 2021 (Memon & Lohana, 2021). Although the employment increase affected everyone, it was most noticeable among those aged 18 to 40 who had completed

high school (or the equivalent) and were therefore in the more affluent socioeconomic bracket. It's likely that the slight decline in income inequality seen between 2017/18 and 2019 was nullified by the effects of the South African pandemic of the COVID-19. Wages and salaries were the most common source of income for South African families in 2019 (Stats SA, 2021). In the Provinces of Gauteng and Western Cape, wages and salaries played a very significant role (Stats SA, 2021). From 2018 to 2019, the proportions of revenue provided by grants, payments, and business income all increased.

Salaries and incomes will likely decline further in 2020 and 2021 because of job losses and a rise in grant dependency, especially among lower-income households, as a result of the devastating socioeconomic repercussions of the COVID-19 pandemic. In February 2021, 70% of South African grantees received child support grants, followed by grants for the elderly (20.3%) and disabled grants (5%) (SASSA, 2021). The social support grants listed in table 2.2 are child support grants, grants for the elderly, disabled grants, fostered child grants, care reliance grants, and grants for war veterans received by South African Provinces in February 2021 (SASSA, 2021).

Table 2.2: Provinces receiving social support grants (Source: SASSA, 2021)

Province	Social support grants receivers (%)
KwaZulu-Natal	21,7
Gauteng	15,9
Eastern Cape	15,4
Limpopo	13,7
Western Cape	9,5
Mpumalanga	8,2
North-West	7
Free State	5,8
Northern Cape	2,8

South African households face significant challenges in affording sufficient and nutritious food. Low-income households, rural households, and larger families are particularly vulnerable to high food costs, which can limit their ability to meet other essential needs. However, many households are creative in finding ways to stretch their food budgets, such as buying in bulk, growing their own food, and preparing meals in large quantities. It is essential to address income inequality and improve access to food markets to ensure that all South African households can afford sufficient and nutritious food.

2.5. Smallholder farmers in South Africa classified.

Barret (2021) argued that because a high-value crop can generate commercial outputs on a smaller area of ground, such as a hectare, and 500 hectares of poor-quality land someplace could produce poor outputs, it is not viable to define smallholder farmers based on the size of their land. In their definition of smallholder farmers, the authors offer a novel definition: "A small farmer is one whose scale of operation is too modest to attract the provision of the services he/she requires in order to considerably raise his/her production." Merchant (2022) proposed monetary factors such gross farm revenue, proposing a sum of R500,000 or less year as a reasonable target. Nonetheless, this only served to further complicate matters. The two new problems that Zantsi (2021) found are:

First, subsistence farmers and backyard gardeners were also included in the definition of smallholder farmers based on economic variables (farmers who simply kept up production to ensure their own families had enough to eat). Second, it altered the smallholder sector because all races were included (Sassi, 2022). Food produced by smallholder farmers not only feeds the marketplace, but also their own households (Chapot *et al.*, 2021; Candel & Daugbjec, 2020). Due to its dual role (generating income and ensuring the family's nutritional needs are met), smallholder farmers in rural areas provide an important service to their communities by growing and selling food that is in high demand. According to Queenan (2020), the South African government now prioritizes improving rural agricultural production.

As a result of smallholder farmers' contributions to food security in rural settlements, both the government and the private sector in South Africa acknowledge the vital role of the smallholder sector. However, illiteracy and land scarcity are two of the most distinguishing features of smallholder farmers, with some possessing less than one hectare of land (Hawkins *et al.*, 2022). These features, along with others like a lack of capital, make it difficult for farmers to maintain sustainable production, particularly during prolonged drought. South Africa's definition of the smallholder farmer is important to the development of effective assistance programs and policy initiatives aimed at fostering the growth of the country's smallholder farming industry (Oluwatayo, 2019).

The authors also recommend that, while creating smallholder farmers in South Africa, the various farm typologies or farming styles be considered as a means of providing direction and answers. We propose that categorizing people according to how they make their living is a more precise method. Farmers who have the means to invest in their own economic future were better able to weather the effects of drought (Fanadzo *et al.*, 2021). The literature vividly depicts the variety of smallholder farmers and the complications that come when crafting programs to aid them. The government of South Africa continues to adopt blanket approaches

to aiding smallholder farmers at times of natural calamities like droughts. Possible reasons for the latter include a misunderstanding of the requirements of smallholder farmers.

Table 2.3: Number of farmers in South Africa, 2020 (Source: Stats SA, 2020)

Number of farms and households	Medium-small	Micro	Market-oriented smallholders	Total	Householders using farm resources
Growing of cereal and other crops	2474	5698		8175	
Mixed farming (crops and animals)	4409	7237	162583	174229	975776
Farming of animals	3431	9505	123443	136379	1174696
Horticulture	1966	2028	15054	19048	176829
Agricultural services	290	474		764	
South Africa	12570	29942	301080	343592	2327301
Employment/households	284111	84097	301080	669288	2327301

This disconnect highlights the need for more research into smallholder farmers and their needs, particularly during times of drought. South Africa is home to around Including 35,000 large-scale farms, there are 2.5 million smallholder agricultural homes (Jonah and May., 2020; Zizzamia, *et al.*, 2019). Even though South Africa has a somewhat advanced agrifood system, in 2018, hunger affected almost 1 in every 11 people. (Stats SA, 2019). Especially for smallholder farmers, the agricultural value chain has significant inefficiencies and shortcomings. Smallholders suffer several common problems, including limited access to utilities, a reliance on rainfed crops, a lack of persistent policy enforcement, a scarcity of ability and expertise sharing, and the effects of climate unpredictability and change. Farmers also face issues unique to the crops, livestock, and climate they raise.

2.5.1. Livestock in South Africa

South Africa's livestock industry helps ensure the nation's food supply as well as combating famine in many rural communities (Oduniyi *et al.*, 2020). All rural households rely heavily on agriculture for their income, and it has historically been a key source of agricultural income. Livestock farming has many purposes, including providing food, accumulating money, enhancing quality of life through the application of animal by-products, and generating economic activity through direct animal sales. Consequently, the incorporation of livestock farming as a strategy to alleviate poverty and improve the Integrated Sustainable Rural

Development Strategy of 2004 aimed to decrease and possibly conclude food insecurity in rural regions of South Africa was not chosen at random (Sartorius *et al.*, 2020). It is estimated that South Africa's cattle farming industry contributes between 25% and 30% of the country's agricultural GDP annually (Mulenga, 2021).

The DALRRD reports that as of 2019, the country has an estimated herd size of 13,84 million. This number includes both imported beef and dairy breeds in addition to local varieties. Small-scale and rural farmers possess roughly 40% of the total herd (Stats SA, 2019). According to historical data. There was a decrease in numbers of beef farmers and cattle numbers following drought of 2017 to 2019 to an estimated 12,5 million cattle (Espino *et al.*, 2022; DALRRD, 2019), in the country with a total production of 1,006 million kg. Despite the potential gains, rural livestock farmers confront numerous obstacles that dampen their ability to profitably raise cattle (Zantsi, 2021). Livestock's susceptibility to disease epidemics is the most difficult of these problems. Animals' ability to reproduce is stunted during disease epidemics, as a result, meat and other animal products have become less readily available (Hawkins *et al.*, 2022).

There are more than of 30 breeds of beef cattle in South Africa which include indigenous and composites like the Afrikaner, Nguni, Drakensberg and the Bonsmara (DALRRD, 2019). There are several breeds well adapted to SA conditions originally from Europe and just as Zebu cattle such as the Brahman (DALRRD, 2019). Nevertheless, the climatic, region, and disease prevalence dictate where these breeds are farmed, and majority of the indigenous breeds are found in the sub-tropical regions of SA (Maluleke *et al.*, 2020). The indigenous type such as the Nguni are frequently found in communal systems as they tend to be hardy and with a lower maintenance need being small framed (Michalk *et al.*, 2019). Small holders often will have crossbred cattle (Zhou *et al.*, 2022).

Despite advances in animal production in Africa, South Africa's commercial pig sector is modest due to factors including expensive feed prices, imported genetic material, and sophisticated infrastructure and piggeries (DALRRD, 2019; Mushagalusa *et al.*, 2021). The country, however, has approximately thousands of subsistence and smallholder pig farmers producing pork meat for family and communal consumption (DALRRD, 2019; Abdalla *et al.*, 2021). These smallholder farmers continually experience limited proper housing facilities and feed (Mushagalusa *et al.*, 2021). Common pig breeds in South Africa include Landrace, Hampshire, Duroc, and Large black (Oduniyi *et al.*, 2020). About 1,454 million pigs were recorded in the country in 2017/18 (DALRRD, 2019). The production of pigs around the same time was 260,000 kg and the consumption were at 282,000 kg (5,0 kg/year per capita) (DALRRD, 2019).

Although goat numbers are higher than beef cattle, commercial goat production in South Africa is moderately low and it has about 3% of the African goats (Oduniyi *et al.*, 2020). One of the breeds found in the country are Boar goats, Angora goats, Saanen, and the Mbuzi. There are no records of the specific number of goats in the previous 30 years both commercially and communally (DALRRD, 2019). However, it is estimated that this represents fewer than 1% of all goats worldwide (Chapot *et al.*, 2021). Farmers in rural areas raise goats for sustenance, but stud farmers, mohair manufacturers, dairy farmers, and commercial meat processors also benefit from the industry (Espino *et al.*, 2022; DALRRD, 2019). They are as essential to religious and cultural rituals as cattle and poultry.

Poultry refers to domesticated birds such as chickens, turkey, quail, duck, geese, and guinea fowl which are mainly reared for meat, eggs, and other purposes (DALRRD, 2019; Nyoni *et al.*, 2021). The population is estimated to be 1.6 million ostriches, 31.80 million layers, and 113 million broilers (Espino *et al.*, 2020; DALRRD, 2019). South African poultry markets are dominated by chicken meat which contributes about 76 % of poultry meat, broilers being the dominant breed in urban markets, followed by 24 % of egg layers (DALRRD, 2019). Modern broiler chickens are genetically developed for meat production and can attain market weights of 1.5 to 2 kg in a short period of 35 to 42 days (DALRRD, 2019).

Other chicken meat breeds include indigenous chickens such as Venda, Boschveld, Ovambo, and naked-neck chickens which are mainly reared in rural villages by marginalized households as they require less start-up capital and their maintenance is very cheap (DALRRD, 2019; FAO, 2019). Poultry meat and eggs from indigenous chickens provide rural communities with readily available protein and energy (Espino *et al.*, 2022). Compared to other animal protein sources, poultry proteins are much more affordable to lower-income earners because their sales are in low units, for instance, eggs or whole chickens (DALRRD, 2019; Oduniyi *et al.*, 2020; FAO, 2019).

2.4. Nutritional requirement and the contribution of livestock to nutrient needs.

Having a population that is both healthy and well-nourished is crucial to the growth of a country's economy and society (Chakona & Shackleton, 2020). Those who live in cities have it better than those who live in rural settlements since cities represent a more developed society (Chakona & Shackleton, 2020) with access to shopping complexes where food containing various nutrients is provided (Mukarati *et al.*, 2020). They can even afford to buy quality food at any time of the year. This is inaccessible to rural residents, as they have a limited variety and liability of food items (FAO, 2015). Some rural communities in the developing countries depend solely on livestock and poultry production (Chakona & Shackleton, 2019; DALRRD, 2019; FAO, 2019) and their crops livestock subjected to seasonal

rainfall which makes them solely depended on livestock and poultry production (Chakona & Shackleton, 2020).

For livestock to produce nutritional products, they must be well taken cared for, well maintained, and well-fed. This is almost impossible because most smallholder farmers in rural areas do not have all the resources and equipment needed to care for animals (Gwiriri *et al.*, 2019; DALRRD, 2019). All these factors may lead to nutrient deficiencies in rural households, leading to malnutrition and diseases such as kwashiorkor (FAO, 2019). Nutritional needs for human vary with age groups, for instance, children, adults, and the elderly, regardless of where these people live (FAO, 2019). Furthermore, nutritional requirements differ according to age and physiological or health status (Barret, 2021). A pregnant woman should focus on increasing her nutrient intake due to the nutritional needs of the developing foetus (FAO, 2019).

Breastfeeding mothers need to include complete protein and energy in their diet, as these nutrients are mandatory for the suckling baby and they need to regain all the nutrients they need (Mousa *et al.*, 2019). As people get older, they tend to eat less (FAO, 2019; Mousa *et al.*, 2019). Their diet often lack all the nutrients needed (FAO, 2021). As the body ages, the body uses some of the nutrients stored in the body to maintain it (Mousa *et al.*, 2019). All these people in their different age groups and in different physiological conditions do not have the same access to satisfy all these nutritional requirements (Chakona & Shackleton, 2020).

As for infants, the need for nutrients starts from the moment the baby is born (FAO, 2019). From birth to 6 months, it is recommended to feed the baby exclusively with breast milk (Mousa *et al.*, 2019). From 6 months, solid foods can be introduced gradually. Food should be high in calcium, protein, energy, and essential fatty acids (Chakona & Shackleton, 2020). There seems to be no consensus on the best way to measure dietary diversity, although many systems have been tested over the years (FAO, 2015; Chakona & Shackleton, 2020). This makes it hard to compare studies conducted with various methods. The high incidence of several micronutrient deficiencies in South Africans is indicative of a general lack of dietary diversification (Chakona & Shackleton, 2020).

Several studies on dietary nutrition in rural communities have underlined that some important micronutrients are insufficient in the diet of schoolchildren (FAO, 2019; Raiten *et al.*, 2020). Vitamin A, vitamin B-12, riboflavin, calcium, iron and zinc are examples of these micronutrients and inadequate intake of these micronutrients can lead to death, rickets, anaemia, blindness, dysgenesis, and impaired cognitive performance (Herforth *et al.*, 2019; WHO, 2021). Countries with children who are stunted are highlighted in Figure 2.2. All of these micronutrients are abundant in animal-derived foods (DALRRD, 2019). Anaemia, vitamin A

deficiency, poor growth, and physical and cognitive development can result from consuming less animal-based diets that lack protein, iron, zinc, calcium, and vitamins A and B12. (Fernandez *et al.*, 2021). Thus, livestock and poultry are an essential part of the nutrition of the poor in developing countries (FAO, 2019; WHO, 2020).

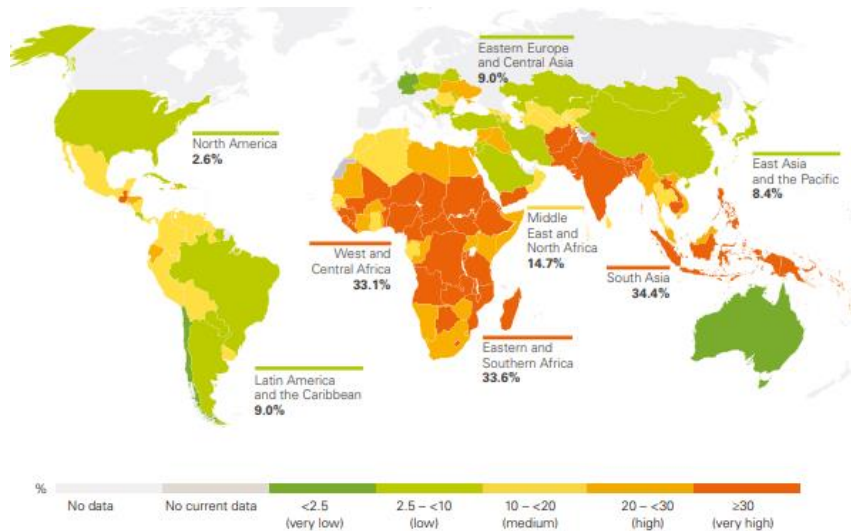


Figure 2.2: Stunted children in different countries. (Source: UNICEF, 2020)

Livestock makes a major contribution to the livelihoods of 70% of the rural communities in the world (FAO, 2021; DALRRD, 2019; FAO, 2019). Products produced by animals such as meat, milk and eggs provide about 20% of the protein in the African diet (Alonso *et al.*, 2019). Many essential micronutrients for human health are produced by livestock and poultry but are scarce in plant-based diets (FAO, 2015; WHO, 2021). This makes livestock and poultry an important part of food security (Nyoni *et al.*, 2021). Even if a food is high in calories, if it lacks essential nutrients, it can contribute to one of the five risk factors that contribute to the worldwide prevalence of disease (Pretorius *et al.*, 2021). In addition, eating a lot of saturated fat- and kilojoule-dense animal-based foods has been linked to a greater risk of obesity, heart-related diseases, and other chronic, non-communicable diseases (Fernandez *et al.*, 2021).

Throughout their entire existence, humans need a diet that provides them with the nutrients they need to grow and develop normally, satisfy their physiologic requirements, and maintain their mental, social, and physical well-being (Colonnelli and Jessica, 2022). Diets that are healthy are safe, varied, well-balanced, and focused on foods that are good. They protect against all kinds of malnutrition, such as undernutrition, lack of micronutrients, being overweight or obese, and they lower the chance of non-communicable diseases that are linked to diet. The World Health Assembly and the SDGs have both established dietary targets that

the world will not achieve by 2030 (FAO, 2023). Several crucial points, like the choice to breastfeed children for half year from when they are born, and the absence of anaemia in women of childbearing age (15–49), still have significant disparities (FAO, 2023).

One-third of all women suffer from anaemia. The world is falling behind on meeting the goal of decreasing childhood hunger by 3 percent by 2030 or preventing an increase in the number of overweight children younger than five. Of all children and adolescents in the globe, 14.6% are overweight and 4.3% are obese (WHO, 2021). In 2015, there were 14.6% of babies that were born with poor birthweight. This was only a small drop from 2012, and the goal of 10.5% is unlikely to be met. These numbers hide the fact that these public health problems are very different in different countries. Most of the time, Terrestrial Animal Source foods are related to the amount and quality of protein in a food item. There are proteins in every cell of your body. Skeletal muscle contains over 40%, while organs include 25%, and both bones and skin contain the remaining 15% (Gropper *et al.*, 2021). Proteins make up the structure of living cells and help them do many different things. Proteins can be put into groups like catalysts (like enzymes), messengers (like hormones), structural parts, immune system defenders, transporters, and buffers. (Tagawa *et al.*, 2021)

In general, eating high-quality proteins improves health over the course of a person's life, such as by making muscles bigger. But there are times in life when getting more protein is important, like when a woman is pregnant or breastfeeding, or when an older person wants to avoid sarcopenia (Mariotti and Gardner, 2019; Ganaphy and Nieves, 2020). People who are chronically or suddenly sick may also need more protein, which is not covered in this review (Phillips *et al.*, 2020). People around the world eat milk and dairy goods from many kinds of animals, such as cattle, sheep and buffalos. The milk coming from these different species is made up of different parts. Animal milk is made when a mother gives birth with the biological purpose of feeding the baby. It is full of nutrients and bioactive substances and contains a lot of them (Mozaffarian, 2019). Animal milk has nutrients that work together to improve digestion, like lactose and casein, which help the body absorb more calcium (McClements and Grossmann, 2021).

Meat is a good source of energy, just like eggs and milk. Geiker *et al.* (2021) found that meat from muscle tissue is a good source of protein and amino acids since it is identical to human skeletal muscle in these regards. Almost every essential amino acid may be found in muscle meat. Balakrishna *et al.* (2021) says that glutamic acid and glutamine have the most of these amino acids. Arginine, alanine, and aspartic acid are next. It has been shown that the way food is cooked affects how well amino acids are broken down in the ileum. However, overcooking can make meat less digestible and lower the DIAAS (Bailey *et al.*, 2020). Food

produced from poultry are easy to digest because they don't have a lot of the structural protein collagen (Das *et al.*, 2020)

The developed food system cannot feed everyone in the world, nor can it maintain the health of everyone (WHO, 2020). The time and process of preparing food on the market determines when, who, and how food is available (FAO, 2019). Therefore, maintaining a healthy and nutritionally sufficient, yet environmentally sustainable diet requires striking a fine balance between adequate, increased, and reduced consumption of animal food remains (WHO, 2021; FAO, 2019). The food system depends on seasons, climate change and the availability of natural resources (Pretorius *et al.*, 2021).

2.5.2. Geographical distribution that influences smallholder farmers production

Different temperatures and extreme seasonal rainfall that affect smallholder farmers' production are not uncommon in Provinces such as Limpopo province, which is why it is called the drought-prone Province (Maluleke *et al.*, 2020). This has negatively impacted the Province's agriculture economy because there is less grass and water for livestock and irrigation (Nesamvuni *et al.*, 2022). Limpopo Province was the hardest hit by drought in South Africa. Dam levels there dropped to 50% from 84% in the late 1990s (Zhou *et al.*, 2022). Especially in the Province's rural parts, agriculture is a vital economic sector (DALRRD, 2019). Because of climate change, farmers are increasingly vulnerable to economic setbacks. (Baltenweck *et al.*, 2020; Mapiye *et al.*, 2021; Michalk *et al.*, 2019).

Throughout rural South Africa, the food crisis has been a significant obstacle for agricultural endeavors (DALRRD, 2019; Thinda *et al.*, 2020). Matata's (2019) research on the effects of environmental issues on rural livestock farming indicated that the health of cattle deteriorated and that disease outbreaks in livestock led to death (Thinda *et al.*, 2020). Some of the world's dams have been silted, damaged, or emptied due to overuse of the dam's water for livestock and human consumption. The drought caused the deaths of a lot of animals (DALRRD, 2019). These problems endanger the growth and potentially the long-term viability of our current industrial and agricultural systems.

2.5.3. Main constraints livestock smallholder farmers face

When compared to commercial farmers, smallholders in South Africa suffer several obstacles that prevent them from expanding and making meaningful contributions to food security (Atube *et al.*, 2021). Some of these constraints may be associated with access to land and poor infrastructures (Kathuri, 2022). Most smallholder farmers live in rural or semi-rural locations, which severely limit their opportunities to develop. The capacity of farmers to move their produce is severely influenced by the scarcity of access to decent routes to the markets (Siphesihle & Lelethu, 2020; Kolog *et al.*, 2023). Smallholder farmers face challenges when it

comes to accessing agricultural inputs and goods due to a lack of readily available markets and a scarcity of market services (Kamara *et al.*, 2019; Sassi, 2022).

Potential markets are missed due to smallholders' lack of assets, information, and access to services (Hlatshwayo *et al.*, 2022). Smallholder farmers face high input, transaction and transportation costs and lack of storage facilities (Cordero-Animan, 2020). Poor infrastructure is a leading cause of high transaction costs, which in turn stunts the development of smallholder farmers (Atube *et al.*, 2021). For example, a lack of a stable distribution system and roads could reduce agricultural output by encouraging farmers to focus on producing fewer perishable foods (Sassi, 2022). Farmers' choices of inputs and marketing approaches may need to change because of rising transportation costs (Kamara *et al.*, 2019). Poor communication services and other infrastructure in outlying rural areas are a leading cause of high transaction costs (Mazeda *et al.*, 2022).

Informational inefficiency and institutional issues like a lack of formal markets could emerge as a result. However, these challenges to food security have been recognized by the South African government, which has resulted in the creation of a comprehensive national program. (Sihlangu & Odeku, 2021). Livestock plays a major role among households in rural communities because when animals are sold, they promote rural markets (Queenan *et al.*, 2020).

Smallholders produce substandard goods of poor quality, they often do not have access to markets and do not have adequate information about the markets (Barret, 2021; FAO, 2019). Even if they have very little access to markets, they also face a shortage of transportation and storage facilities (Sassi, 2022). According to the FAO (2021), one of the biggest problems for smallholder farmers is a lack of stable markets. When selling their goods at the farm gate or in nearby markets, many of these farmers can receive reduced prices (Kolog *et al.*, 2023) for their products. Small-scale farmers typically receive low prices for their goods because of a lack of awareness of product diversification potential and the boundaries between market development of products and research (FAO, 2021; DALRRD, 2019).

The lack of knowledge of the product leads to a reduction in the quality of production (Stats SA, 2021). Most smallholder farmers have limited access to resources like land, water, and capital, therefore their output is typically low volume and low quality (Oduniyi *et al.*, 2020). This has led to their products being neglected in the production markets (Martin *et al.*, 2020). Due to rising consumer demand and worries about food safety, there has been a worldwide trend toward more concentration in the food value chain in recent years (DALRRD, 2020). Due to their low production capacity and inferior quality, smallholder farmers have a hard time breaking into high-value markets (Bahta, 2020).

Lack of bargaining power coupled with incompatibility in production is also a major challenge facing smallholder farmers (Hlatshwayo *et al.*, 2022). Most smallholder farmers are irregular in their output of agricultural goods and their provision of those goods to both end users and wholesalers (Beacom *et al.*, 2021). However, their negotiating power is minimal because of a lack of information and access to financial markets (Mulenga, 2021). Because of this, they can't sell their goods during the most lucrative period.

Access to finance

Smallholder farmers are frequently unable to obtain accreditation without collateral and are obligated to create profitable business plans (Cordero-Animan, 2020; DALRRD, 2019; FAO, 2019). Because of this, it is almost impossible to get a loan to develop their fields. They lack technical skills and the proper infrastructure. For smallholder farmers, a lack of human capital is a major obstacle (Mazeda *et al.*, 2022). Because of their low levels of education and technical competence, they may have trouble gaining entry to the formal institutions that distribute technical information (FAO, 2019). Most small farmers don't know how to manage money or promote their products effectively, so they can't sell at farmers' markets or to food processors (Kathuri, 2022).

Impact of disasters on livestock smallholder farmers

Maintaining a basic food supply is a fundamental of food security, thus it's crucial to build up smallholder farmers' resilience to crises like the COVID-19 pandemic. Monoculture, mixed crops, and mixed farming with a wide variety of livestock are all approaches used by smallholder farmers. Integrated crop-animal farming systems provide various benefits, including improved food security, economic growth, healthy soil, livestock feed, and less environmental pollution (Memon & Lohana, 2021). Smallholder farmers supply food and nutrition security at the national, regional, and global levels, among other socioeconomic and environmental effects. Moreover, Olaimat *et al.* (2021) argue that smallholder farmers are crucial to efforts to end world hunger and malnutrition.

Since they produce about 80% of the food in sub-Saharan Africa and Asia, the smallholder farmers can contribute to the improvement of the global food security (Bene, 2020). However, as a result of the influence that shocks like climate change and other unfavourable natural events have on production systems, which in turn affects smallholder farmers' productive capacity, these farmers are particularly susceptible to these types of catastrophes. Farmers allege that they lack knowledge, networks, and political power to successfully handle risk and keep their lives afloat in the face of shocks, despite their vital role in global food supply systems (Merchant *et al.*, 2022).

For regions that rely heavily on livestock production, such as those hit hard by recent pandemics, the livestock sector's share of economic losses has serious implications for food security (Ceballos *et al.*, 2021). As COVID-19 has emerged, restrictions placed on the interaction between animals and humans have had a negative effect on livestock production and the livelihoods that depend on it. Policy responses to reduce the risk of COVID-19 disease transmission have had severe consequences for animal production, farm outputs, and supplies to markets in severely affected areas due to a simultaneous shutdown of human activities in these areas (Sihlangu & Odeku, 2021; Bene, 2020). Farm animals need daily access to supplies like food, water, and medicine, as well as the means to produce.

If farmers were restricted in their ability to raise livestock and obtain necessary farming inputs, it would have far-reaching consequences for the well-being of farm animals, as well as the farmers' ability to make a living and consumers' ability to buy the products they need. Movement restrictions have a disproportionate impact especially on the smallholder farmers, whose way of life is dependent on traversing grasslands in search of food and other resources. Limited Internet connectivity in rural areas makes it difficult to get in touch with extension services and technical experts to help solve farming-related issues (Ceballos *et al.*, 2021). Given that extension agents' frequent on-farm visits could facilitate the spread of disease from one farm to another, this presents a unique set of challenges.

Because of their short shelf life, livestock products are especially vulnerable to spoilage and post-harvest losses when farmers are prevented from transporting their goods to local markets and stalls (Memon & Lohana, 2021). Limiting the flow of commerce could disrupt fresh food distribution networks, hastening spoilage and wasting. The losses in farm products and the fluctuations in the demand for livestock products are both discouraging and preventive to produce and promote livestock and animal products.

2.6. Conclusion

The term food security describes a population's ability to meet its members' nutritional requirements. Individuals in many poor nations are denied their basic human right to food security. Poverty, restricted access to resources, environmental concerns, and political instability are just some of the challenges that developing countries encounter on the road to food security.

Poverty is a significant factor that restricts developing countries from achieving food security. Many people in developing countries live in poverty, which limits their ability to access sufficient food. Poverty leads to inadequate nutrition, malnourishment, and undernourishment, which in turn affects the productivity and wellbeing of individuals. Without proper nutrition, people cannot engage in productive activities, which can lead to a never-ending cycle of

poverty and poor health status. Poverty also restricts the ability of governments to invest in agriculture and food production, leading to low productivity, inefficient production processes, and insufficient food supplies.

Limited access to resources is another factor that restricts developing countries from achieving food security. Natural resources, seeds, and fertilizers are essential for production, yet in developing countries many people lack access to these resources. In some instances, large international companies and rich landowners own a substantial amount of cultivable land, restricting access for small farmers, who are the main source of food production in developing nations. Numerous communities in developing countries face water scarcity due to droughts or lack of access to pure water sources due to a lack of access to water sources. Lack of access to high-quality seeds, fertilizers, and additional inputs also hinders the capacity of small farmers to increase productivity and satisfy the demand for food.

Environmental factors also contribute to the inability of developing nations to achieve food security. The effects of climate change, natural calamities, and environmental degradation on food production limit farmers' ability to cultivate crops and raise livestock. Extreme weather conditions caused by climate change, such as droughts, floods, and cyclones, damage crops and reduce yields. Natural disasters such as earthquakes, hurricanes, and floods can also cause destruction to crop and infrastructure, affecting food production and distribution. Environmental degradation caused by deforestation, soil erosion, and pollution also limits the ability of farmers to produce sufficient food, leading to food insecurity.

Political instability is also a significant factor that restricts developing countries from achieving food security. Political instability, conflict, and civil unrest affect food production, distribution, and access. Conflict can destroy infrastructure, disrupt supply chains, and displace people, affecting their ability to access food. Political instability also affects the ability of governments to invest in agriculture and food production, leading to low productivity and inadequate food supplies.

In conclusion, achieving food security is a complex problem that requires addressing various factors that affect food production, distribution, and access. Poverty, limited access to resources, environmental factors, and political instability are significant factors that restrict developing countries from achieving food security. Addressing these issues requires a multi-faceted approach that involves investing in agriculture, improving access to resources, addressing climate change and environmental degradation, and promoting political stability and peace. By resolving these issues, developing countries can attain food security, guaranteeing everyone has access to sufficient, nutrient-rich food to satisfy their dietary requirements.

Chapter 3: Materials and Methods

3.1 Introduction

The data set used in this study was all secondary data that was originally collected from July 2011 and August of 2011 by students from the universities of Ghent, Stellenbosch, and Pretoria with the guidance and supervision of Dr N. De Cock, Prof M. D’Haese, Dr N. Vink, Prof C. J. van Rooyen, Prof L. Staelens, Prof H. C. Schönfeldt and Prof L. D’Haese. Collaborators from the Limpopo Department of Agriculture, and members of the supervision group were the tally takers. The Ethics committee from the Faculty of Natural and Agricultural Sciences (NAS51/2020) approved the use of archived data (Appendix C).

3.1.1 Materials

A quantitative study design was used in this study. The data collection commenced by spending the first week focusing on Capricorn district data collecting, to ensure that correct processes were followed with data entries. The remaining four jurisdictions completed data collection in weeks two and three. Each district was given a team of eight people, including four enumerators and two students, to collect and enter data. On average, each enumerator completed three surveys daily; this resulted in 120 surveys per district and the collection of qualitative and quantitative data on food security for 600 households across ten municipal areas and five districts in the Limpopo Province as shown in Table 3.1.

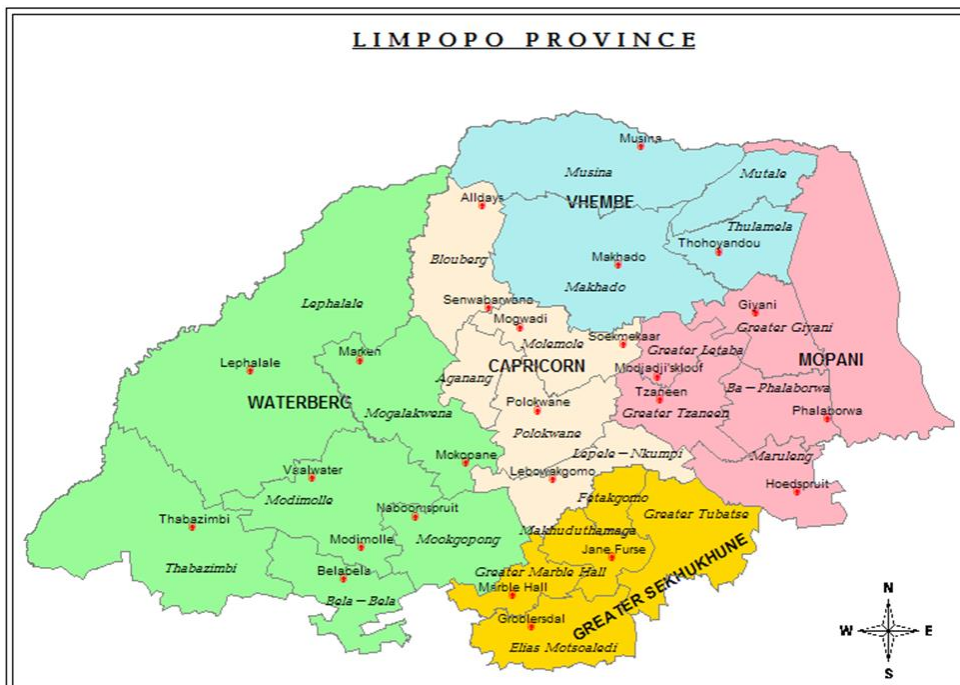


Figure 3.1: Districts and municipalities in the Limpopo Province where data was collected (Source: source: <http://www.sa-venues.com>; (accessed on 24 August 2020))

Information for this study was taken from the original data set, which included information from 600 households in the districts of Limpopo Province as shown in table 3.1.

Table 3.1: The number of households interviewed in each district/municipality.

		DISTRICTS				
MUNICIPALITIES	Capricorn District	Mopani District	Sekhukhune District	Vhembe District	Waterberg District	
	Aganang	Baphalaborwa	Groblersdal	Makhado	Bela-Bela	
	Blouberg (60)	Giyani (60)	Fetakgomo (60)	Mutale (60)	Mogalakwena (60)	
	Lepelle	Letaba	Makhuduthamaga	Musina	Modimolle	
	Molemole (60)	Maruleng (60)	Tubatse (60)	Thulamela (60)	Mookgopong (60)	
	Nkumpi	Tzaneen	Marble Hall		Thabazimbi	
	Polokwane				Lephalale	
						Total sample size: 600

The demographics of the Limpopo Province were studied by compiling data from 600 households. Food security indicators for the Province of Limpopo were calculated using data collected from a sample of 301 households (those who kept livestock and poultry). Table 3.2 displays the parameters and measures conducted at the home level in the 10 municipalities that were randomly selected in each district, including both qualitative and quantitative data.

Table 3.2: A Summary of the data applied based on the key issue for the different municipalities.

Main key/parameter	Measures	How the data was collected
1. Household Characteristics	Average Household size Households headed by the two different genders Different age groups of Head of Household Working HH Educational level of HH	Section B questions in Annexure A
2. Household income sources	HH having a specific type of income Main types of income	Section E questions in Annexure A
3. Household livestock	Households owning livestock Proportion of households farming with livestock	Section D questions from D4 in Annexure A
4. Household food availability, consumption, and dietary diversity	Food consumption status Nutritional status Food availability Food accessibility	From the data/information collected from the questionnaire in Section C in Annexure A, the following were estimated; HFIAS, HDDS, FANTA and the Hunger Index

Methods

3.1.1.1 Statistical analysis

The data was collected and analysed using Statistical Package for the Social Sciences (SPSS version 22, 2020) and excel. Kerr *et al.* (2021) conducted an analysis using HDDS and HFIAS scores to determine the occurrence of food insecurity in regions outside urban areas in the Limpopo Province. Households experiencing food insecurity were the focus of an analysis using cluster analysis (2-step cluster), analysis of variance (ANOVA), and the t-test. The

causes of food insecurity in families were studied using multilinear regression. And lastly to determine the effect of animal production, a propensity score matching was done.

For every specific objective, an analytical tool used to analyse the dataset to achieve that specific objective. Figure 3.2 specifies the objectives and the analytical tool used.

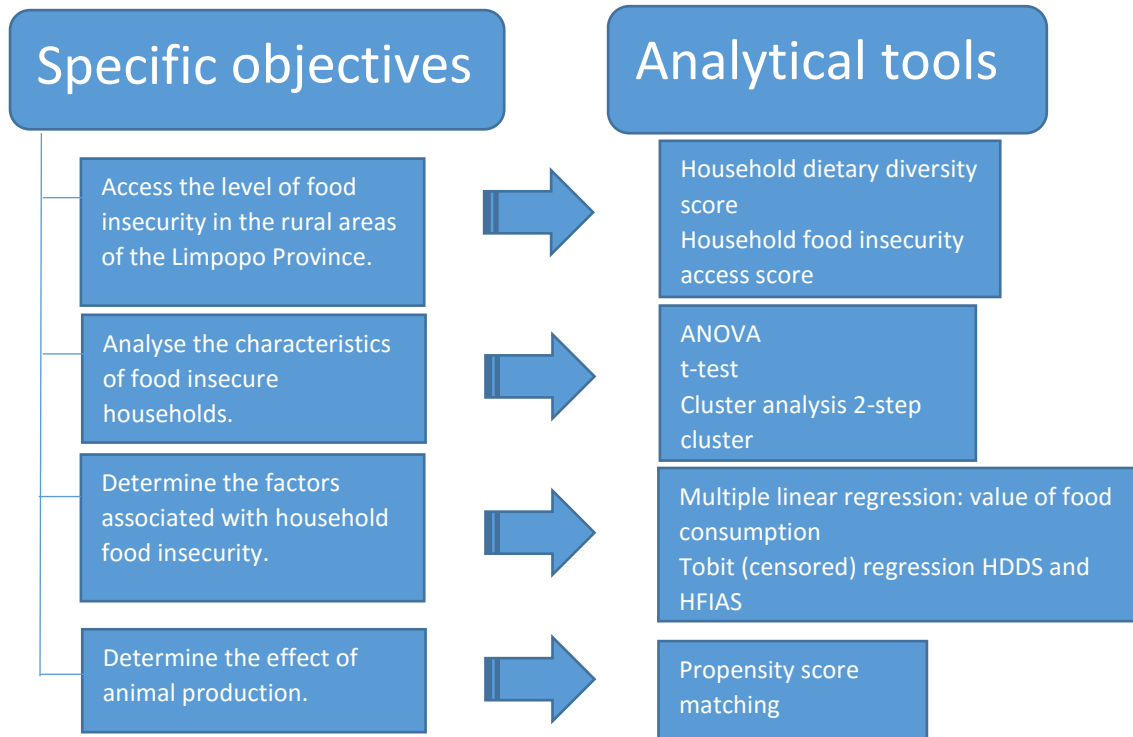


Figure 3.2: Specific objectives for this study and their analytical tools

3.1.2 Food security parameters

Food security parameters that were analysed in this study are shown in Table 3.3:

Table 3.3: Food security measures (Kerr et al., 2021)

Measure	Score	Description
HFIAS	0-27	Based on 9 questions to determine inadequate access to food at any point in the preceding four weeks ->score poor security
HDDS	0-9	Indicates variety of food eaten
MAHFP	0-12	Number of months during the previous 12 months were family experienced food shortage
LEA		A home having less food than is needed to provide the recommended energy intake

To a lesser extent, this study's food security indicators also assess food quality and safety. The MAHFP index captures some of the complexity of sustainability challenges. The use of food may be better assessed with a 7- or 24-day recall of food intake. However, inaccuracies or mismeasurement may introduce significant biases if the subject cannot recall the exact quantities consumed. The survey should consider how often people eat and how large their meals are on a daily basis. It was decided against providing a 24-hour recall of food consumed at home due to the considerable measurement bias it would introduce as well as the time and effort it would require from respondents. Similarly, practicalities and the limited availability of scales meant that residents weren't asked to keep weekly food diaries.

Chapter 4: Results

4.1. Household characteristics

The overall sample size was 600 households, and a household consisted of six to seven family individuals as shown in Table 4.1. The study found not statistically significant ($p > 0.05$) difference in average family size between districts.

Table 4.1: Average household size in the districts and municipalities in the Limpopo Province

<i>Province</i>	<i>N</i>	<i>District</i>	<i>N</i>	<i>Municipality</i>	<i>N</i>
<i>Limpopo</i>	7	Capricorn	7	Blouberg	7
				Molemole	6
		Mopani	7	Giyani	6
				Maruleng	7
		Sekhukhune	6	Fetakgomo	6
				Tubatse	6
		Vhembe	7	Mutale	6
				Thulamela	7
		Waterberg	7	Mookgopong	6
				Mogalakwena	7

Males headed 60% of households and females 40% in Limpopo. The gender distribution of different types of household heads is depicted in Figure 4.1. Vhembe and Sekhukhune districts both had a very even distribution of male household heads, with 90% and 80% of households being led by males, respectively.

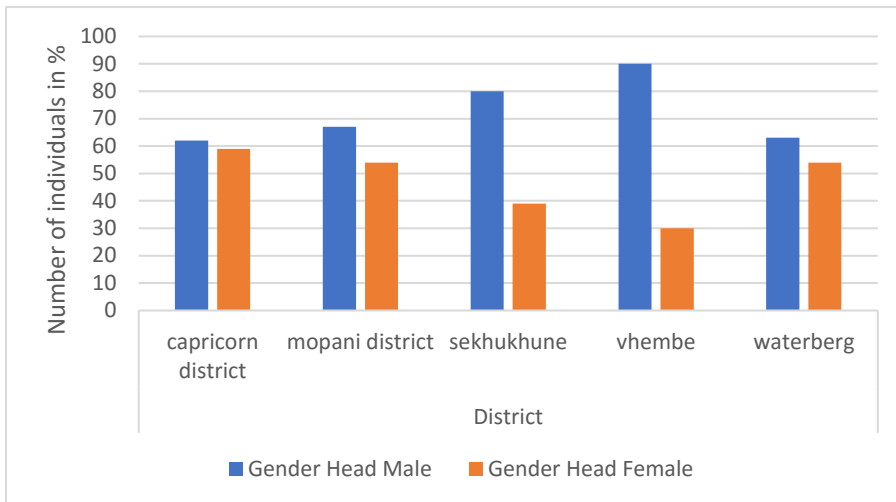


Figure 4.1: Gender distribution of Head of household

The average age of a Limpopo Provincial home breadwinner was 57 years. Figure 4.2 illustrates the age breakdown of the households. Only in Mopani did children as young as 18 lead their own families (known as child-headed households). People over the age of 71 years make up between 16% and 30% of all household heads. It can infer that the number of households with a male breadwinner is higher for all age groups except those under 18 years of age in relation to Figure 4.1.

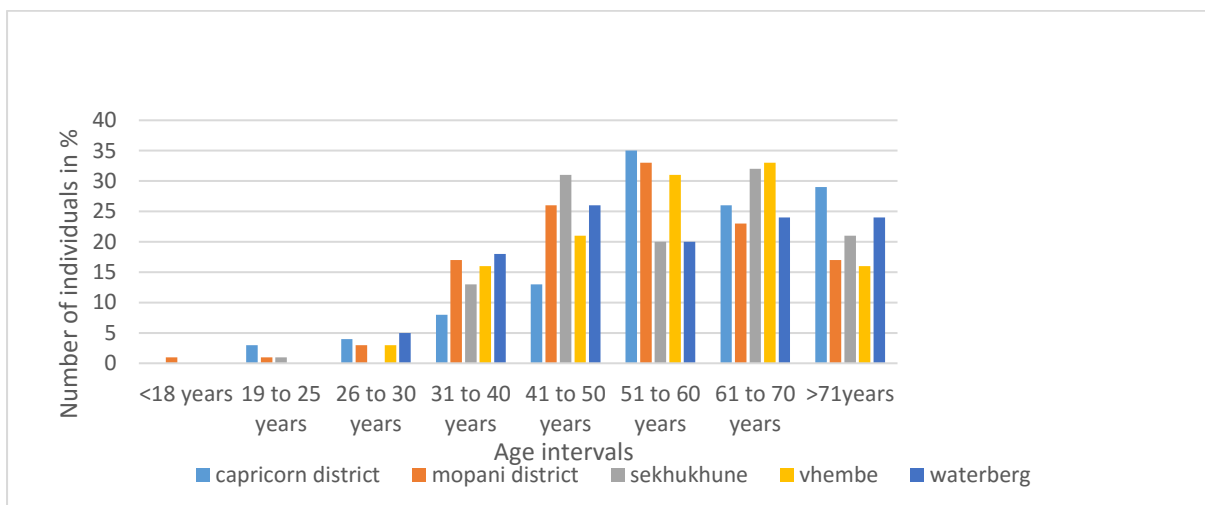


Figure 4.2: Head of household by age categories/groups

Most household heads are illiterate with up to 32% of adults do not have any formal education (Figure 4.3). Many heads of households have completed at least one year of secondary education. Only 5% have earned a bachelor’s degree or higher, while 16% have completed elementary school (grades 0 through 4), 15% have completed middle school (grades 5 through 7), 17% have completed some secondary school (grades 8 through 11), 11% have completed high school (grades 12), 3% have earned a certificate or obtained some formal training, and 5% have completed a diploma or a degree.

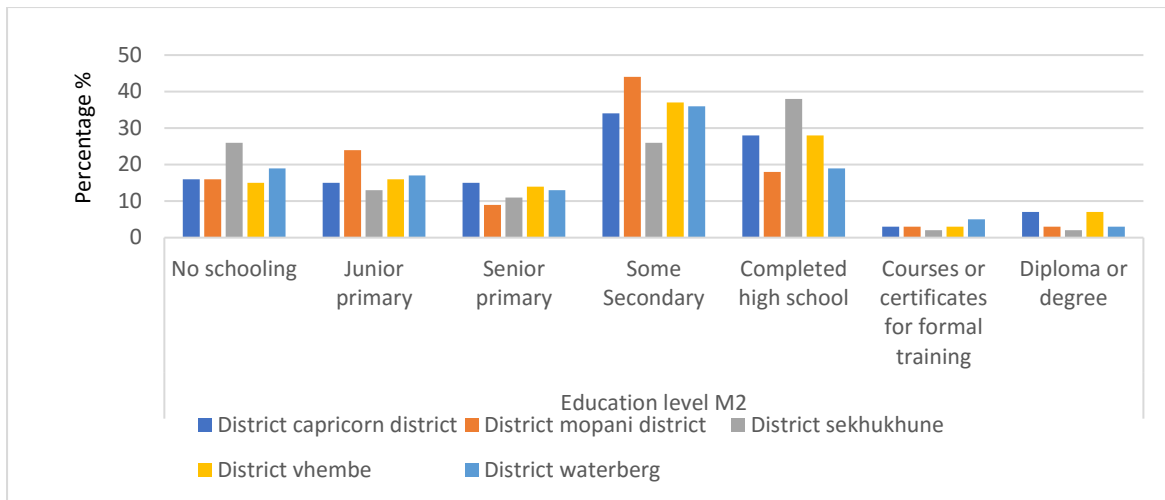


Figure 4.3: Educational level of household head

Household breadwinners are depicted in Figure 4.4. If the ratio is less than 0.5, then there are fewer members in the home who are financially contributing than are not. When looking at the dependency ratio on a per-income basis, there are no statistically significant changes between districts ($p > 0.05$). There are fewer people in each household who have earnings than who do not since the activity rate is less than 0.2 in all five districts. However, this is not represented in the percentage of working-age adults vs those who are jobless who live in the same family (Figure 4.4: dependency ratio 0.2).

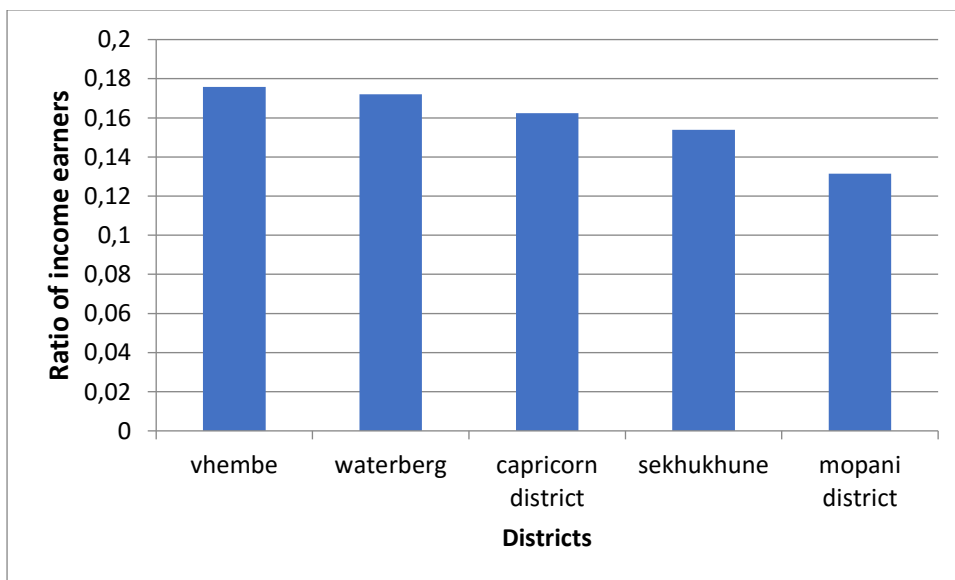


Figure 4.4: Working head of household in the different districts of the Limpopo Province.

4.2. Sources of household income

The sample households have an average monthly income of R1609 (Standard Deviation: R845). Figure 4.5 shows the monthly household income distribution per Province.

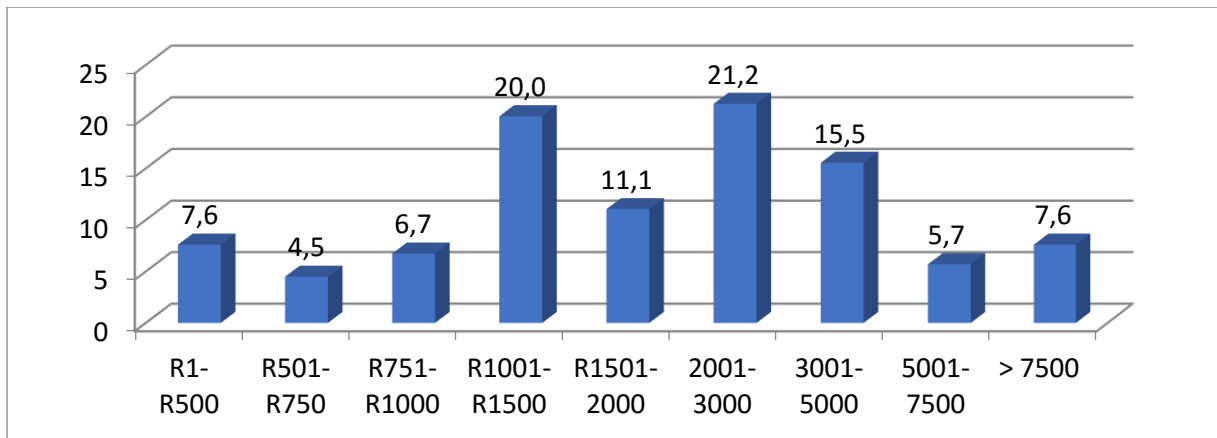


Figure 4.5: Monthly income distribution in household of Limpopo Province

When asked about their monthly sources of income, 75% of households reported that they received grants/gifts which restricted them from purchasing/ getting food with all the necessary nutrition required by the bodies for sustainability. Farming income was listed by 15% of households, while remittances were listed by 13% of households, as other sources of income. The percentage of homes that rely on each income type is shown in Figure 4.6.

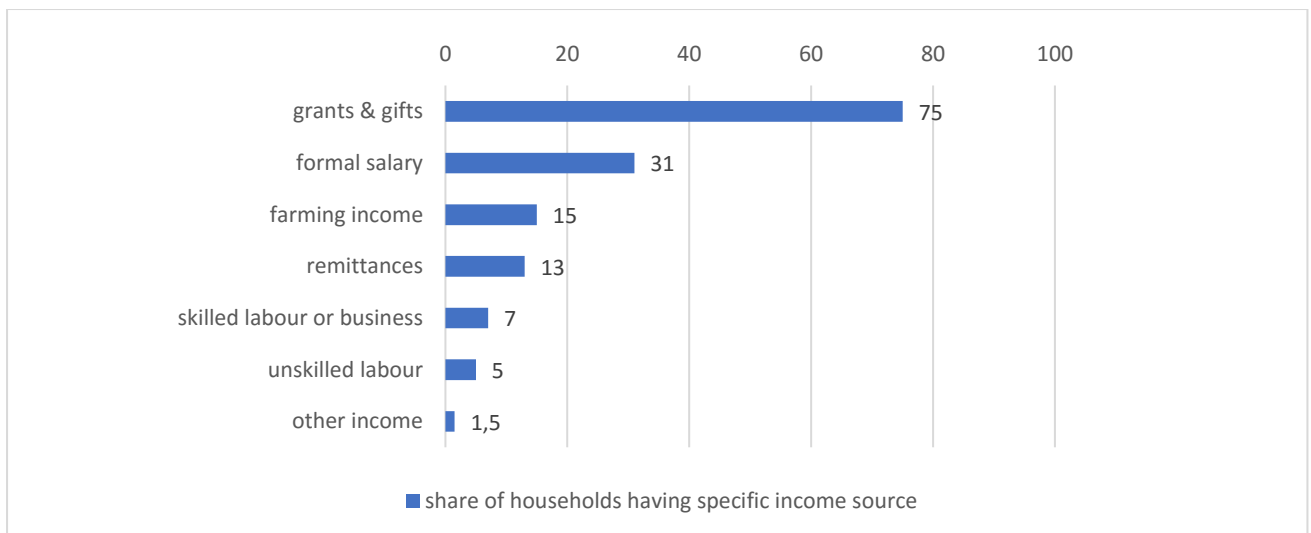


Figure 4.6: Distribution of households in Limpopo by sources of income.

As seen in Figure 4.7, households in all districts rely on grants and gifts, but the residents of Waterberg rely heavily on the grants and gifts. Nearly half of Vhembe respondents rely on farming for their livelihood.

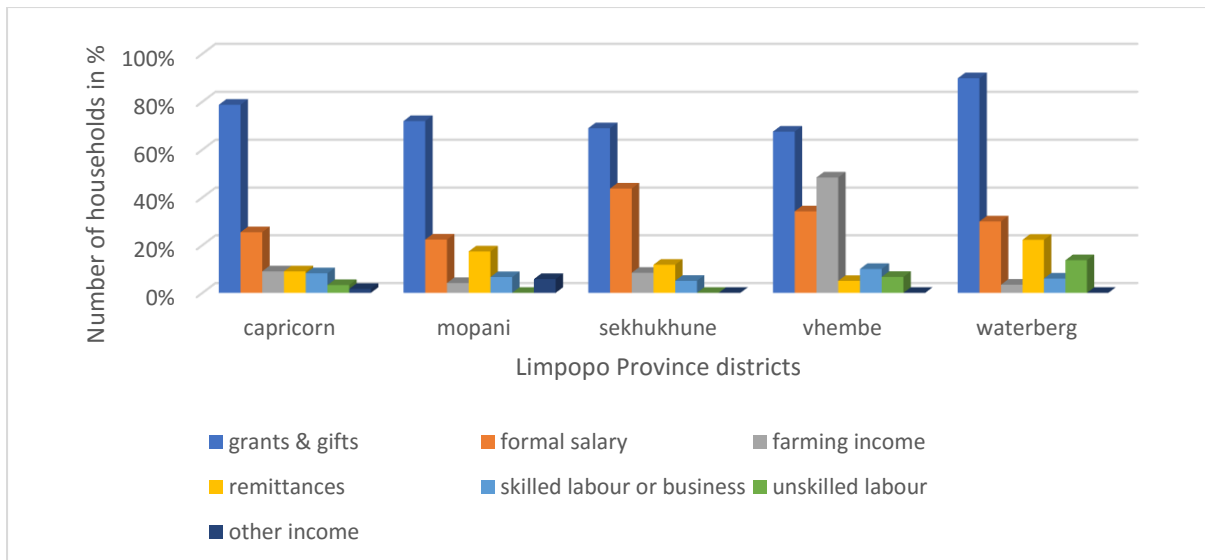


Figure 4.7: Overview of the sources of household income by different Limpopo Provinces.

4.2.1. Main types of income sources

For 26.2% of families, a regular salary was the main source of income. Sekhukhune had the largest percentage with 43.7% receiving a formal salary, while Mopani had the lowest percentage of 18.3% receiving formal salary.

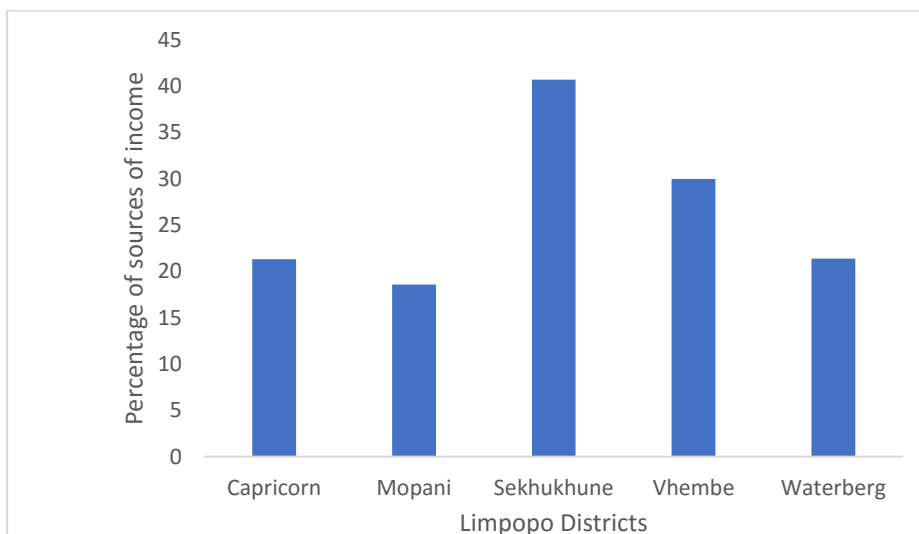


Figure 4.8: Formal salary in each district as the main source of income

It is estimated that 43% of Limpopo families have at least one member who has migrated outside the Limpopo Province in search of gainful employment. Only 25.5% of households, meanwhile, said they have received money from relatives who had migrated. The percentage of migrants who send money back to their home countries is highest in the Sekhukhune district

(28.6%), and lowest in the Capricorn and Mopani district with 23% and 23.1% respectively (See Table 4.2). The average monthly remittance received by a family is R1183.31.

Table 4.2: Households that receive remittances from migrants.

Province	% household obtaining remittances	District	% household obtaining remittances	Municipalities	% household obtaining remittances
Limpopo	25.5	Capricorn	23.0	Blouberg	25.0
				Molemole	20.4
		Mopani	23.1	Giyani	36.1
				Maruleng	10.0
		Sekhukhune	28.6	Fetakgomo	28.3
				Tubatse	28.8
		Vhembe	26.7	Mutale	20.0
				Thulamela	33.3
		Waterberg	26.5	Mookgopong	22.4
		Mogalakwena	30.5		

4.3. Household livestock

Only 301 of the 599 homes in the sample kept any kind of livestock or poultry. The highest concentration of livestock and poultry keepers (82% of households) was found in Vhembe. Of all the regions in South Africa, just 25% of households in the Waterberg region kept cattle and poultry. Figure 4.9 shows that there were 62% of households in the Capricorn district and 66% of households in the Mopani and Sekhukhune districts that raised cattle or poultry.

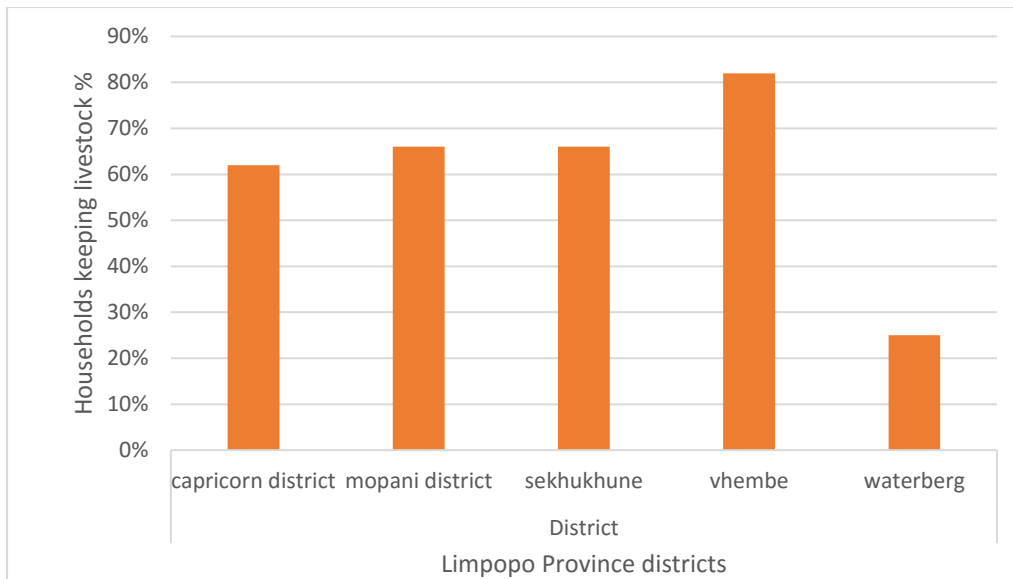


Figure 4.9: Household owning livestock in the different districts of the Limpopo Province.

Percentages of households who are involved in livestock productions are displayed in Figure 4.10. These are the households that have commercialized the production of their livestock. Apart from Waterberg, where only roughly 21% of families are livestock owners, the vast majority of households throughout all districts kept cattle. Significantly, 68.3% of families in the Vhembe district either owned cattle or farm with livestock, making this area unique.

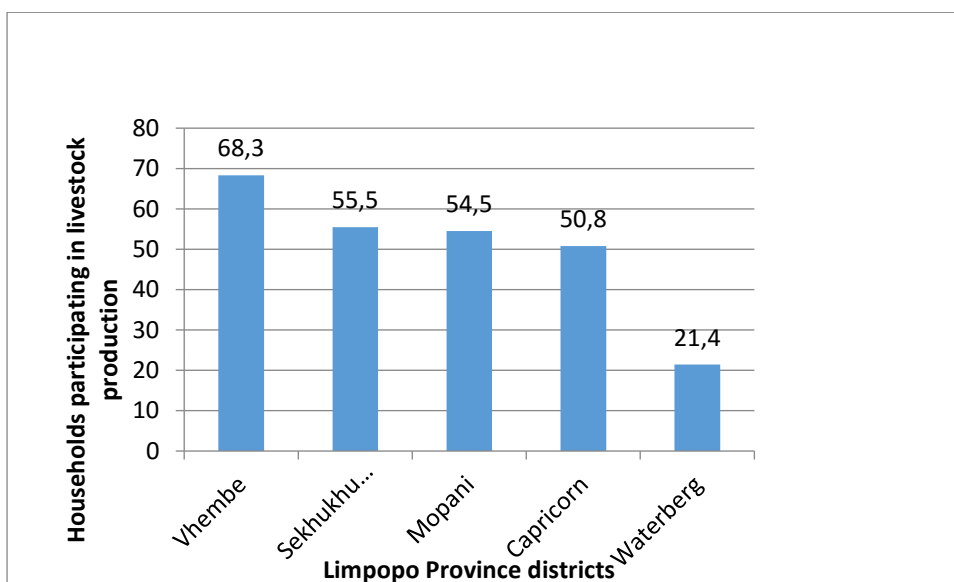


Figure 4.10: Percentage of households that are involved in livestock production in the districts of Limpopo.

Vhembe, Mopani, Sekhukhune, Capricorn, and Waterberg districts each had 68%, 55%, 51%, and 21% of families that maintain chicken. Vhembe is home to 30.8% of all cattle, followed by 24.0% in Mopani, 23% in Capricorn, 20% in Sekhukhune, and 8.0% in Waterberg. The highest

concentration of goat owners, 29%, may be found in the Capricorn and Vhembe areas. This is closely followed by Sekhukhune, which accounts for 27.7%. Fewer homes in Mopani have goats than those in Waterberg, according to the data collected for this study. Less than 5% of families in Capricorn, Mopani, and Sekhukhune own pigs, but 11% of those in the Vhembe area do. Domestic animal ownership variety across all five districts is depicted clearly in Figure 4.11.

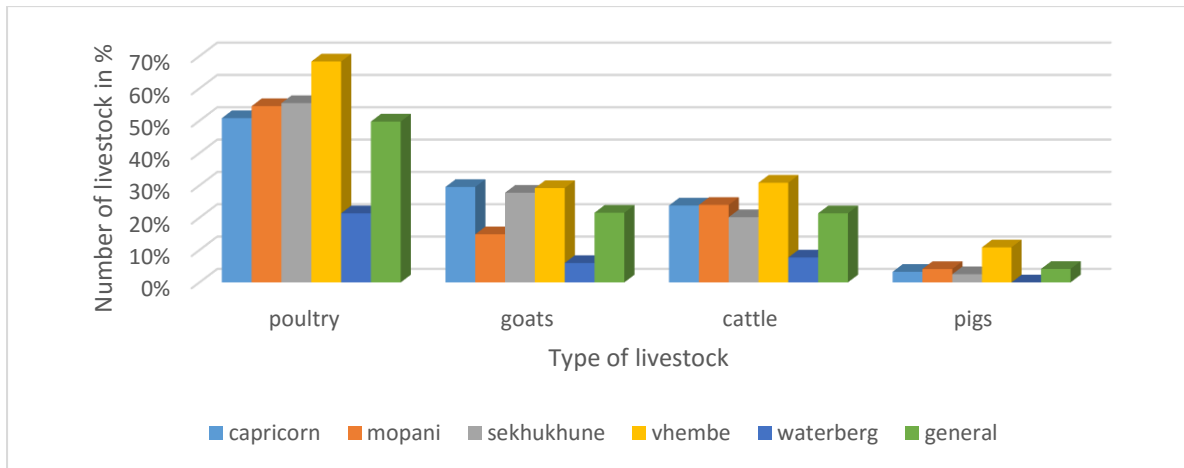


Figure 4.11: Percentage of households that own different kinds of livestock and poultry in each district.

The various livestock are summarized in Figure 4.12. The average number of chickens per household is 16. The typical cow herd consists of eleven head of cattle. Most goat-keeping households have ten goats. The most common type of livestock in every area is poultry. Additionally, the average family with cattle has a herd of eleven animals.

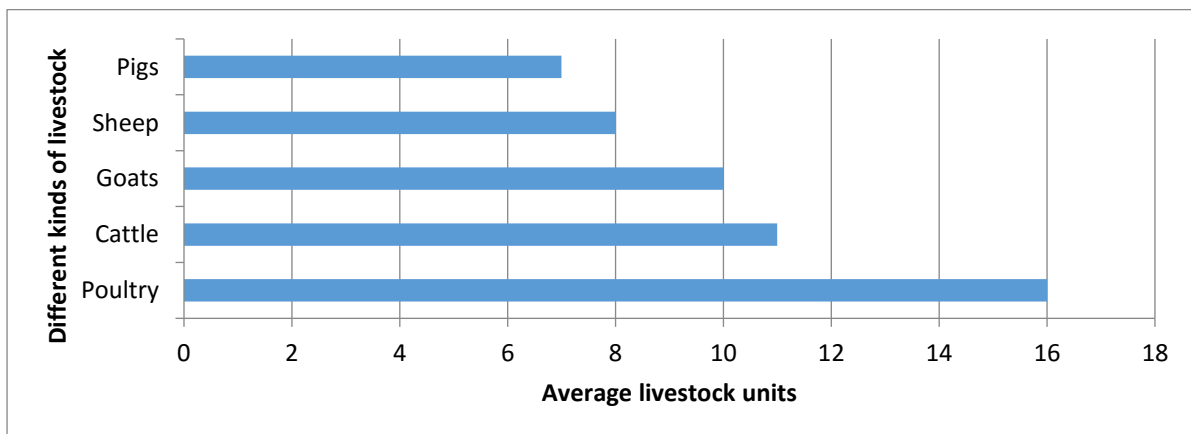


Figure 4.12: Average livestock units in Limpopo

4.4. Household food availability, consumption, and dietary diversity

Table 4.3 shows the percentages of people in the four categories of the food security status, as determined by the HFIA methodology (USAID FANTA).

Table 4.3: HFIA Categories in Limpopo

Food Security Status	Frequency	Percent	Cumulative percent
Food Secure	87	14.5	14.76
Mildly Food insecure	35	5.8	5.9
Moderately Food Insecure	155	25.9	26.2
Severely Food insecure	314	52.4	53.1
			100

Table 4.4 shows a higher percentage of households in Sekhukhune are food secure than in any other district, while a higher percentage of households in Waterberg are food insecure. Fetakgomo is a municipality in the Sekhukhune district, and just 29.3 percent of its population is food secure. Only 10.3% of households in the Mookgopong municipality in the Waterberg district seemed to be food secure.

Table 4.4: Distribution of households in each category of Food Security Status

Province	District	Municipality	Food secure	Mild food secure	Moderate food secure	Severe food insecure
Limpopo	Capricorn	Blouberg	9.1	1.5	27.3	62.1
		Molemole	13.5	5.8	21.2	59.6
	Mopani	Giyani	8.2	6.6	23.0	62.3
		Maruleng	6.7	3.3	25.0	65.0
	Sekhukhune	Fetakgomo	29.3	13.8	31.0	25.9
		Tubatse	18.6	11.9	37.3	32.2
	Vhembe	Mutale	13.3	5.0	40.0	41.7
		Thulamela	20.7	3.4	25.9	50.0
	Waterberg	Mookgopong	10.3	1.7	20.7	67.2
		Mogalakwena	18.6	6.8	10.2	64.4

Mopani District has the largest number of persons living on less than R18.14 (1 US dollar) per day, with 49.6% of families, while Vhembe District has the lowest percentage, with 19.2% of homes. The poverty rate is highest in Mopani, where its residents earn less than R36.28 per day (2 US dollar) at 74.9%, while Sekhukhune has the lowest poverty rate, at 43.7%. As indicated in Figure 4.13.

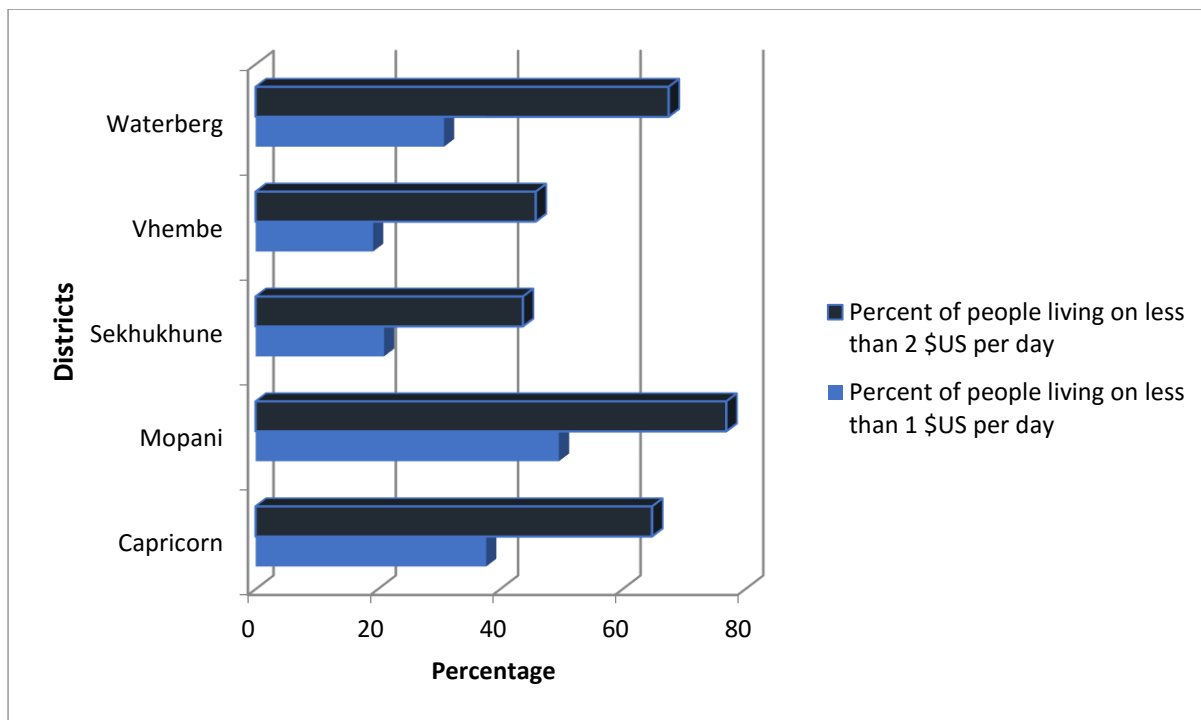


Figure 4.13: Poverty measures per district

In Table 4.5, we can see the Province-wide, regional, and local averages for the number of hungry months. Waterberg had a higher average number of months per person experiencing hunger, at 3. However, during the preceding year, the Mopani district encountered a few months where households went hungry.

Table 4.5: Mean distribution of hungry months in the Limpopo districts and municipalities.

Province	Mean hungry months	District	Mean hungry months	Municipality	Mean hungry months
Limpopo	1.7	Capricorn	1.8	Blouberg	1.9
				Molemole	1.6
		Mopani	0.8	Giyani	0.9
				Maruleng	0.7
		Sekhukhune	1.2	Fetakgomo	0.9
				Tubatse	1.5
		Vhembe	1.8	Mutale	2.1
				Thulamela	1.5
		Waterberg	3.1	Mookgopong	3.2
				Mogalakwena	2.9

Table 4.6 reveals that the average HDDS for the 9 food groups consumed by households is 6.7, indicating that households have a diverse diet. The boundaries between the districts and the municipalities are often blurred.

Table 4.6: Household Dietary Diversity Score (0 to 9)

District	Municipality	Mean HDDS	Std. deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Capricorn	Blouberg	6.4	2.0	.2	5.9	6.9
	Molemole	7.0	1.6	.2	6.5	7.4
Mopani	Giyani	6.0	2.2	.3	5.4	6.6
	Maruleng	6.5	1.8	.2	6.0	7.0
Sekhukhune	Fetakgomo	6.9	1.7	.2	6.4	7.3
	Tubatse	7.0	1.6	.2	6.6	7.4
Vhembe	Mutale	6.3	1.6	.2	5.9	6.7
	Thulamela	6.6	1.6	.2	6.2	7.1
Waterberg	Mookgopong	7.3	1.4	.2	6.9	7.7
	Mogalakwena	7.2	1.8	.2	6.7	7.7
Total		6.7	1.8	.1	6.6	6.9

The frequency with which each food group was consumed last week was used as a measure of the eating pattern. As indicated in Figure 4.14, maize products were consumed the most frequently, with a mean of 6.7 per week.

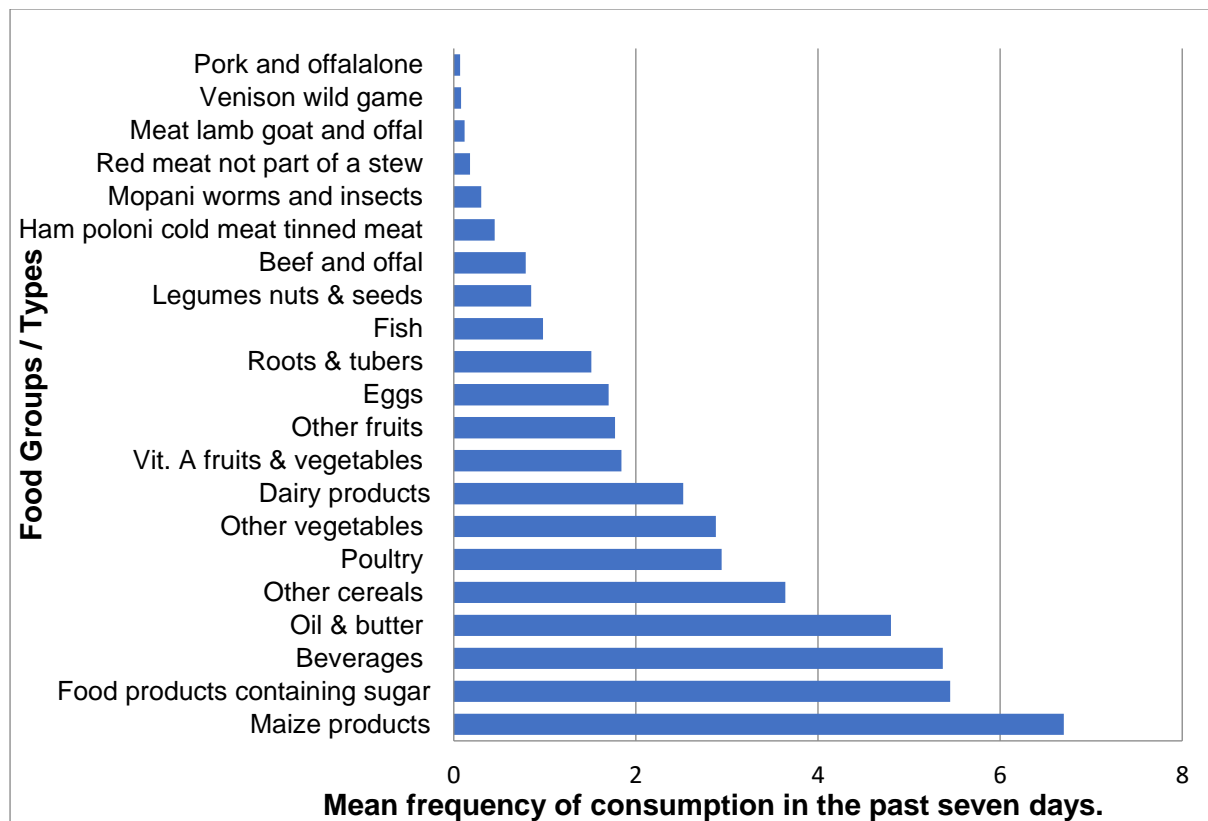


Figure 4.14: Mean frequency of HH consumption of different food groups in the last 7-days in the Limpopo Province.

In Figure 4.15 it is shown that female adults (18+) accounted for 48% of respondents who said they would reduce their food intake during a food crisis in the Province. Children older than 5 and younger than 5 are the exceptions to this rule (5 to 18 years) and they appear to have more food than any other age group in the household.

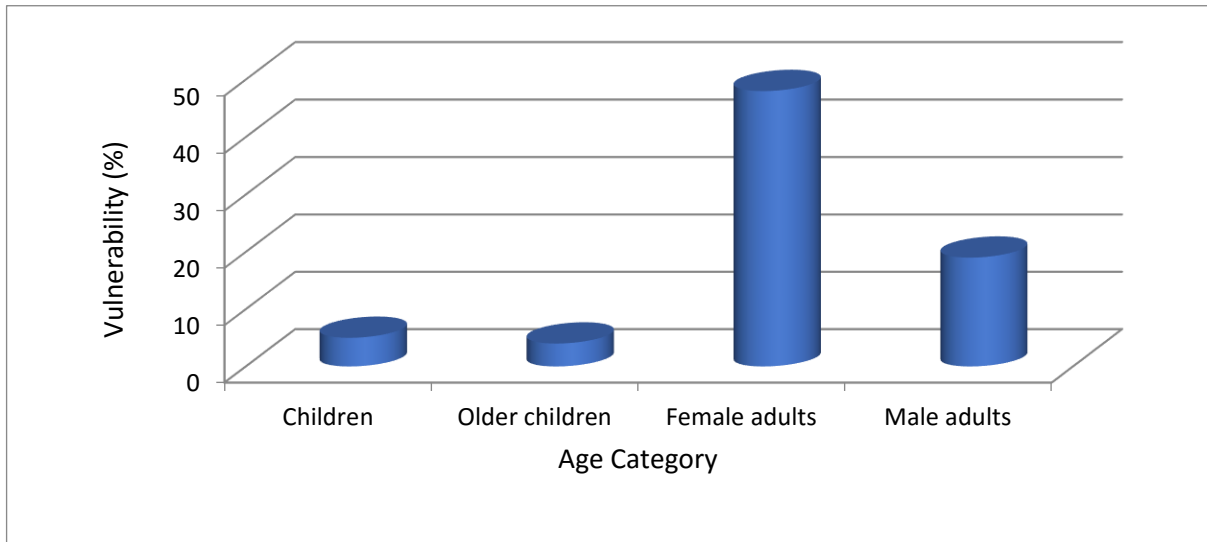


Figure 4.15: Food distribution within Limpopo households

Table 4.7 shows that Compared to households headed by someone without a high school diploma, individuals with a diploma or higher are more probable to have the availability of healthy food. Further, the study revealed that families headed by someone with no formal education were 40.5% more likely to experience extreme food insecurity.

Table 4.7: Human capital representation by food security status

		HFIA Category				Total	Test
	Unit	Food Secure	Moderately Food insecure	Severely food insecure			
Female-headed households	Female	%	22.1 %	39.0 %	45.9 %	39.2%	$\chi^2= 20.769^{***}$
Average household size	Members		5.7	6.3	6.9	6.5	F = 147.006 ^{***}
Education level of household head	No schooling	%	21.5	26.6	40.5	32.9	$\chi^2=78.158^{***}$
	Junior primary	%	13.2	16.2	16.8	15.9	
	Senior primary	%	11.6	19.5	13.3	14.6	
	Some Secondary	%	16.5	17.5	18.1	17.6	
	Completed high school	%	11.6	14.9	8.4	10.8	
	Courses or certificates for formal training	%	9.9	1.9	1.6	3.4	
	Diploma or degree	%	15.7	3.2	1.3	4.8	
Average age household head	Years		57.8	56.5	55.9	56.5	F = 309.010
Dependency Ratio			0.79	0.83	0.87	0.84	F = 0.619 ^{***}
Presence of contributing migrant workers	%		31.1%	27.7%	21.7%	25.2%	$\chi^2=4.911$
The average presence of HH in the area			34.05	32.11	30.91	31.90	F = 764.721

Figure 4.16 shows that more households owning poultry are moderately food insecure than households owning cattle and goats. Households owning pigs less than 10% food secure as compared to households farming with other livestock.

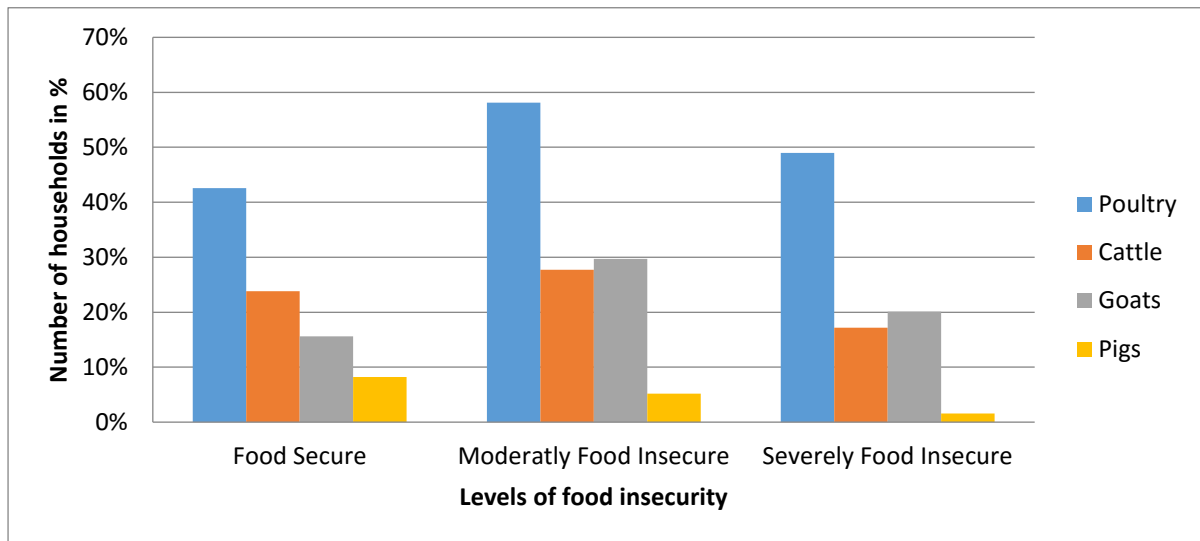


Figure 4.16: Food insecurity status of households involved in livestock production.

Figure 4.17 shows that among households that are moderately food insecure, extremely food-insecure, and food secure, the primary source of income is grants/gifts (59% and 62% respectively) and salary (49%) for food secure households.

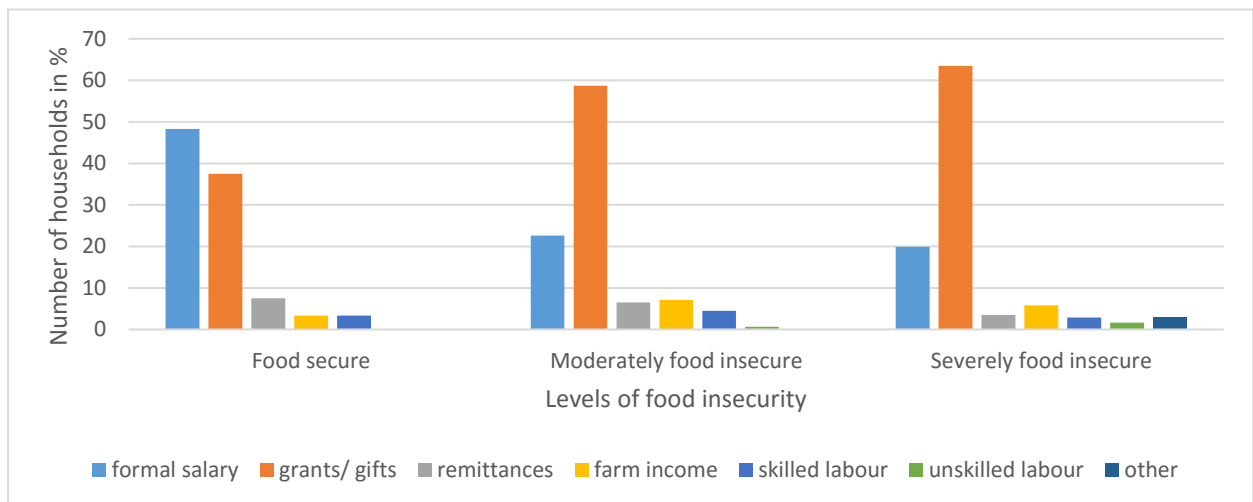


Figure 4.17: Food security status by main sources of income

Figure 4.18 shows that households that are food secure spend more money on food than the moderately and severe food insecure households. The figure also shows that red meat makes up a large share of monthly food budgets for households who are food secure, with such

households spending 35.1% of their total budget on red meat, compared to the 19.1% spent by households that are severely food security.

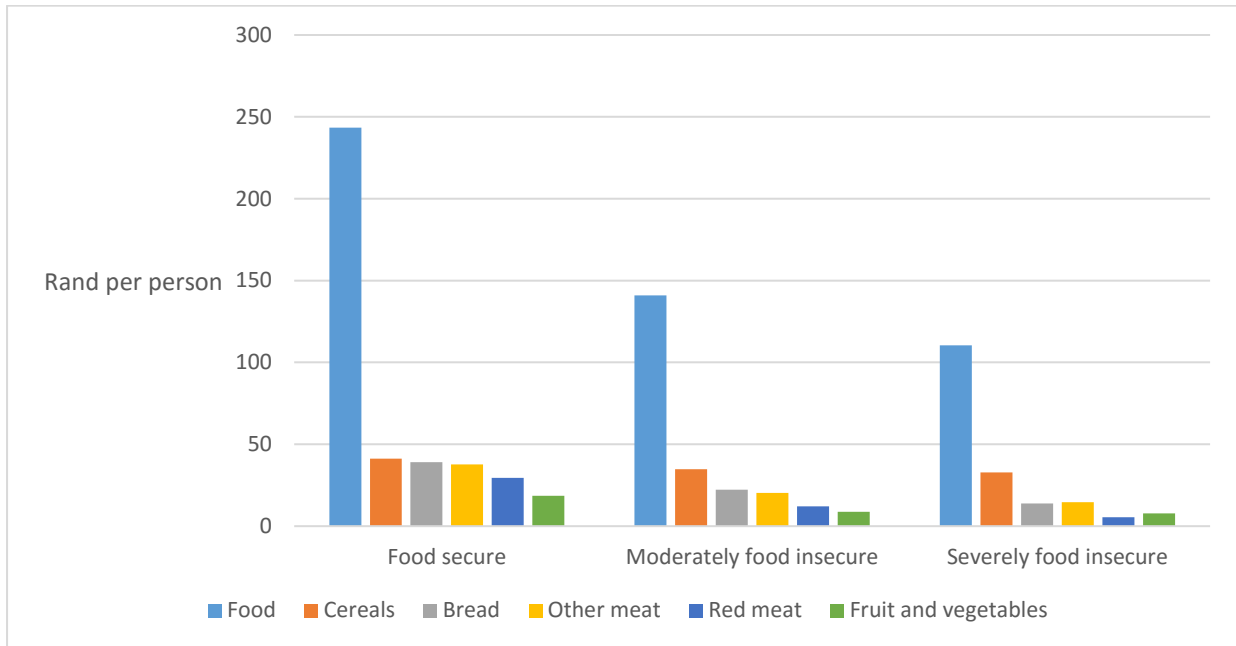


Figure 4.18: Food security status by food monthly expenditure

Chapter 5: Discussion

5.1. Introduction

As a measure of food security, the aim of the study was to investigate the access of households with livestock to essential nutrients for their families. During the month of August 2011, qualitative and quantitative data were collected from 600 families spanning five districts in the Province of Limpopo. There was a compilation of data on the makeup of the household, dietary intake, cultivation of food, household income, and resource accessibility. To achieve the objectives of this study, accurate procedure of determining food security and destitution were obtained from this dataset and analysed.

5.1.1. Summary of the food insecurity status in South Africa that support this study.

Most South African households lack sufficient food to sustain an active and healthful lifestyle, despite the fact that the country as a whole is officially food secure (Mota *et al.*, 2019). According to Akindola, 2020, 11% of the population (or 6.5 million) of South Africans are hungry and food insecure. Climate change, poverty, and rising populations are the primary drivers of hunger and food insecurity. There are now 59,893,885 people living in South Africa, a rise of 0.84 percent from 2021 (Stats SA, 2022). This growth is a major factor in the rising demand for food.

According to Olaimat *et al.* 2022, most households are unable to meet the nutritional needs of children despite receiving government assistance. Food security and Millennium Development Goals and Sustainable Development Goals will be more difficult to attain in South Africa (Aderemi *et al.*, 2021). In 2017, more than half a million families with children younger than five went hungry (Govender *et al.*, 2021). The Provinces of Northern Cape, KwaZulu-Natal, and Limpopo had the highest rates of household hunger. Drammeh *et al.* (2019) found that the majority of hungry households with small children were in rural areas.

5.2. Household characteristics

The average size of a household was 6.5 members in this study, with a Standard Deviation of 3.0. According to Stats SA (2022) the average household size in South Africa is 3.34 people. This is a decrease from the average household size of 4.1 people in 1996, this is mostly due to family members moving to the cities to get better job and educational opportunities, this leaves fewer household members at homes, and these are the few people that stats SA is able to capture. Household's members of 6-10 and > 10 significantly increase extreme poverty by 26% and 29%, respectively, compared to 1-5 household's members (Davis, 2019). There were no statistically significant variations in average household size across jurisdictions. Despite Limpopo Province's relatively young population, the HH average age was 57 old (with

a SD of 15.7). Males made up 60.5% of household heads in Limpopo Province, while females were for 39.5%. The majority of people who were responsible for running their own households had a limited education. While the majority of family breadwinners had at least a high school diploma, 32.4% of the population had not even completed elementary school. Older people had disproportionately low levels of education since they were born and raised during apartheid, when they had little opportunity to attend school (Memon and Lohan, 2021).

The educational level of a household's breadwinners was a significant predictor of that household's food security in Limpopo, but this relationship was complex and must be understood in context. The percentage of households headed by someone without a high school education or equivalent (21.5%) is larger than the percentage headed by someone with a diploma or equivalent (15.7%), as shown by the analysis. According to the General Household Survey (2020) by Statistics South Africa, the education level of South African households varies widely. In 2019, 29.9% of those aged 20 or older had no formal education, while 8.6% completed grade 12 or its equivalent. Rural areas had a higher percentage of individuals with no formal education (43.3% versus 18.5% in urban areas). The percentage of those with higher learning was also greater in urban areas (23,5%) than in rural regions (6.5%). The survey also revealed a correlation between the educational level of the household's chief and its income level. Consequently, education remains a significant determinant for assessing the socioeconomic condition of South African households.

In this study, two distinct dependency quotients were calculated. In the first place, the number of people who could potentially be active (those between the ages of 18 and 65) was divided by the average size of the household. As a result, a measure known as the "independence ratio" can be derived, which indicates whether or not a given percentage of households are economically independent. The average ratio was 0.84, which means that almost everyone in the sample was eligible to contribute to the household's finances. Second, the dependency ratio indicates the relative number of breadwinners in a family. Each breadwinner in the representative sample provided financial support for 5.16 nonworking or unemployed family members.

Helpless homes, who include a demographic disproportionately at-risk during food shortages and famines, bear the brunt of chronic hunger, but middle- and upper-class families seldom feel its impacts because of their ability to escape extreme poverty (FAO, 2019). According to Uzma and Muhammad (2019) Household income was a crucial factor of per capita energy intake, as those with more disposable money are able to purchase the more appropriately proportioned and nutritious food that was needed in comparison to those with less disposable

income. The research verifies that the family income is a significant factor in determining food security. The results indicate that as incomes rise, so does the level of food security.

5.3. Sources of household income

Davis (2019) states that the diverse income sources of rural households in Sub-Saharan Africa, including South Africa, include subsistence farming, keeping livestock, utilization and sale of natural assets, and specialization in on-farm activities. However, numerous rural households in South Africa continue to contend with poverty and low revenue, with 89% of households generating less than R750 each month, which is below the South African statistics agency's household poverty threshold of R800 per month. Therefore, while rural households in South Africa have diverse income sources, poverty and low incomes remain a significant challenge.

An average monthly income of R2,953 per household was found in the data set (SD: R4121). There were 7.6% of households that reported making less than R500 per month, and the same percentage reported making more than R7,500 per month. Nearly 20% of households in the Mopani district had monthly incomes of less than R500, making it the lowest-income district overall. 43.4% of households in both Sekhukhune and Vhembe reported monthly incomes of at least R3,000. 75% of households reported receiving social subsidies from the State as their primary source of monthly income, while 31% reported receiving some type of formal compensation.

A comparable proportion of households (15%) relied on agricultural income, while a somewhat lesser proportion (13%) relied on remittances. In all localities, social transfer income predominated. The principal source of income for 26.2% of households was a regular salary. Sekhukhune had the highest percentage of households whose principal income came from a formal salary with 43.7%, while Mopani had the lowest percentage of 18.3%. More than half (53%) of Limpopo households had at least one member who had emigrated in search of gainful employment. Only 25.5% of all migrants reported sending money back to their original families. This is similar to finding found by Siphesihle and Lelethu (2020) that showed that the percentage of migrants living in the Sekhukhune area who send money home was the highest (28.6%), while that of Capricorn was the lowest (23%).

Monthly remittances to homes averaged R1,183.31, most of which were deposited into bank accounts. Among residents of Limpopo Province, 5% said that money sent home by loved ones was more valuable than any other form of income. This was a drastic drop from the S.A. general household survey's 20.8% in 2019 (Stats SA, 2020). In addition to questions on income, respondents were also asked if they had any savings or investments. About 6% of household heads had burial insurance, 42.2% had savings accounts at banks or post offices,

and 26.4% were members of burial societies. Contrary to burial societies, burial insurance was a legally binding agreement between the insured and a financial institution that stipulated the proceeds could only be used to fund the insured's burial and funeral costs. People in the same community often band together to join a burial society as a sort of informal financial protection against the high costs associated with burials. 5% of families in Limpopo Province cite remittances as their primary source of income. In comparison to the 20.8% recorded in the South African general household survey, this was a considerable drop (Stats SA, 2021).

The 59% of the homes in Limpopo Province relied on grants rather than salaries as their main source of income (Stats SA, 2019). The R350 COVID-19 Social Relief of Distress grant was available from May 2020 to April 2021 to unemployed people who did not have any sources of income (Stats SA, 2019).

5.4. Household livestock

Poultry, goats, cattle, and pigs are the most common types of important livestock in the Province's homes. About 43% of the families had either goats or cattle, whereas just 8% had pigs, sheep, or fish. Compared to Waterberg, where just 21% of families own livestock, 68.3% of Vhembe households own livestock. On average, a home with poultry had 16 birds; a household with cattle had 11 cattle; and a household with goats had 10 animals. Therefore, raising animals was a choice made by the family as an investment.

Having access to livestock may be a lifeline. The quantity and kind of animals a family has might provide important details about their food security. Livestock production was present in all five of Limpopo Province's districts. About half of the respondents had some connection to cattle production. Chickens, goats, cattle, and pigs are the most common types of domesticated animals kept by residents of this region. Fewer than 5% of families had pigs, sheep, or fish, compared to the 30% who keep chickens, 22% who keep goats, and 22% who keep cattle. Similarly, Oduniyi (2020) conducted a study in Thulamela local municipality in Limpopo Province and found out that 73% of the respondents were facing the issue of food security. Livestock was an important means of exchange among rural households as they boost the rural markets (Martin *et al.*, 2020).

80 % of South Africa's rural population relies on agriculture for subsistence (Oluwatayo, 2019). Food, jobs, and income for the vast majority of this population come from smallholder agriculture (Zantsi, 2021). This demonstrates that agriculture was still a mainstay for many rural families, playing an important role in ensuring adequate nutrition and decreasing levels of poverty (FAO, 2021). Although smallholder agriculture has the potential to reduce food insecurity in rural areas using self-production, commercial purchases, or equitable food distribution, it is currently hampered by a variety of factors (Tomita *et al.*, 2020). Farmers who

cultivate and raise livestock on plots of land that are less than 2 hectares in size and with few other resources are considered smallholder farmers (Oluwatayo, 2019). About 2 million South Africans are engaged in small-scale farming (FAO, 2021). These farmers engage primarily in subsistence agriculture, growing food for their families and selling any surplus in the immediate community.

Due to their unique circumstances, including limited resources, antiquated methods of production, low income, seasonal shifts in available labour, and unsteady land, smallholder farmers require assistance from the government and other relevant stakeholders (the private sector in particular) in the form of agricultural policies like credit policy, input policy, mechanization policy, and many others to ensure their families' continued access to nutritious food. Providing the required impetus by establishing agricultural production-friendly conditions would considerably improve the well-being of all people, as shown above. In low-income or developing nations, smallholder agricultural development can be an effective strategy for combating hunger (Martin *et al.*, 2020).

5.5. Food availability, household consumption, and dietary diversity

The study shows how the homes headed by either male or female differ with regards to indicator ratings. It's likely indicative of their lower socioeconomic status that female HH achieved poorer than male HH. The percentage of income spent on food was higher in female-headed households. Except for LEA, an independent t-test showed there were substantial disparities between households headed by men and those headed by women. The average HFIAS, HDDS, MAHFP, food/HH spend, LEA, and FP are shown in Table 4.7 for households with different degrees of education among their heads. Where a high school diploma or college degree was held by the breadwinner of the home, indicators such as HFIAS, HDDS, MAHFP, food/HH expenditure, LEA, and FP were all the highest.

Enhanced nutrition understanding and improved access to food due to a higher income are believed to be the main reasons why education boosts a family's food security. The Tukey test was also used to assess whether there was a statistically significant differences between the groups, and the majority of the differences were found to exist between the two education groups. Low HFIAS scores, a high monthly income, and a high per capita income all characterize food-secure households. These families had a mean of 5.61 people and a mean age of 57.63 for the head of the house.

Despite having more farmland available, their utilization of renewable energy was not the highest. In addition, the percentage of families where a male was the breadwinner was the higher than the percentage of families where a female was the breadwinner. High food

insecurity was associated with larger family sizes, younger heads of home, lower monthly family incomes, lower per capita incomes, and higher HFIAS scores.

The high food insecurity in larger family sizes, young heads of households home and households receiving low monthly incomes was expected given the commonalities among food-insecure households, including large family sizes, and reliance on home-grown sources of food and energy. The findings on energy intake were supported by factors including age, family size, and the fact that the highest energy intake was achieved through self-production. However, they had the least amount of farmable land (0.88 hectares) and cattle (1.64 units) on average. Nearly half of all households were led by women, and the number of those without a high school diploma was also high. While nearly 18% of all household heads had finished some post-secondary education, only 8.30% had graduated from high school.

Households, where everyone had sufficient availability of food, had a few household members and a high stable income coming in each month. Both the LEA and FP were quite high, and HH average age was 57. These households indicated a disproportionately high proportion of non-income earners among their members. They relied heavily on homegrown resources for food and energy, as seen by their larger number of cattle units (6.31). On average, they farmed 1.11 hectares of land and produced 2.74 distinct crops.

60% of the food-secure had a male HH, and their members had a wide range of educational backgrounds. For example, 42% of the adults in these homes did not complete secondary level education. It was found that the households classified as food insecure are disproportionately headed by women with lower levels of education, have larger family sizes, and have lower incomes. These families did little to no farming of any kind and also tended to have their dependency ratio greater than other households. A smaller family size, a lesser dependency ratio, male household heads' prevalence, and greater education levels were also indicators of food-secure households. They needed either a high stable formal income and minimal agricultural activity or have a low formal income and extensive agricultural activity to ensure their food supply.

Using the HFIAS categories and the families' own self-reports, 53 % of homes were found to be very low food security. The poverty rate appeared to be highest in the Mopani area (50%) and lowest in the Vhembe district (19%). After analysing livestock production in depth, it was clear that the output of four animals had a noticeable impact on the availability of food. Households with marginal and low food security are disproportionately responsible for poultry production, despite the fact that it was one of the animals that ultimately determines food security. In all homes struggling to put food on the table, 58.1% had turned to chicken production of some way. Fewer chickens are produced by all types of families, but especially

by those that are self-sufficient in their food supply (42.6%). However, raising cattle appears to be something that was done mostly by those that are either self-sufficient in food or had only marginal food security. Here, marginal food secure households were most likely to engage in such production (27.7%), while nearly 17% of food-insecure households reported completing such agricultural work.

Goats are more common in households with moderate food insecurity as opposed to households with severe food hardship. Goat production was engaged in by around 30% of moderately food insecure households, whereas only 15% of well-fed households had responded to do it. Fewer families are engaged in pig production compared to other forms of animal production, which impacts food security. The findings indicate that 8.2% of households with enough food supply engage in this behaviour, while only 5.2% of homes with inadequate food supply do so. Among those with very low food security, just 1.6% are pig farmers. Jesson (2021) found that the proportion of a family's budget that goes toward food was a reliable predictor of vulnerability. Spending a big portion of income on food increases the risk of food insecurity for families. The study found that households in Limpopo Province that are most food secure had the smallest percentage of their monthly budget go toward food costs. Costs associated with feeding a family here make up 54.8% of all family expenses; in moderately and severely food-insecure households that percentage jumps to 65.2% and 69.0%, respectively. Consequently, people with high food security save more money on food than those with marginal or low food security.

The data demonstrate an ongoing trend of staggeringly high food insecurity rates, where the problem of food insecurity remained still a severe one. The research suggests the following categories for the most important determinants of food security at the household level: Human capital, which is largely comprised of the education and age of the family head, the size of the household, and dependence ratio; financial resources; and geographic location all play a role. There was little evidence that increasing food security through home food production helps reduce hunger. Because of this, subsistence food production cannot really assist households whose access to external revenue was limited. Education was substantially connected to food security, and these results show that promoting education in rural areas may considerably help to increasing food security. The labour market was a second key area for policymakers to focus on. Sustainable job possibilities in rural areas should be a top priority for policymakers.

While South Africa as a whole had food security, not every family benefited from this (FAO, 2021). UNDP projects that by 2020, 16.1 million South Africans, or 16.1 percent of the population, will live in families with very low food security. About 20.6% of households in South Africa will experience hunger in 2020 (Stats SA, 2021). Affordability of food was an important

consideration for most people in meeting the nutritional demands of their families. Women, children, and the elderly make up the vast majority of the poor in South Africa (Stats SA, 2019), which accounts for about 55.5% of the population. Twenty-five percent of South Africans are food insecure as a result (Modjadji & Madiba, 2019). Because of the 25% of stunted growth in children below 5 years of age, there is a need for a dietary and sociological overhaul in the country, and because of 40% of women being obese (Modjadji & Modiba, 2019; Sartorius *et al.*, 2020).

Smallholder agriculture is characterized by low productivity, poor infrastructure, low input, a shortage of capital, technology, and expertise, a self-sustaining system of production, a failure to achieve the economies of scale required to compete on regional and global markets, and a lack of access to input and output markets (Clapp *et al.*, 2022; Janssen *et al.*, 2022; Gwiriri *et al.*, 2019). The capacity of the sector to produce sufficient food for South Africa's growing population was hampered not only by these limitations, but also by the country's rapid population growth. South Africa, however, has a lot of agricultural potential, so encouraging market-oriented farming could have had a huge effect on improving the economic security of rural farm households. Smallholder farmers' increased involvement in the market should result in the development of more specialized production systems that maximize efficiency (Mulenga, 2021).

Chapter 6: Conclusion

Based on the findings there was still a lack of knowledge about food security and how to achieve this in rural livestock farming. The prospective effectiveness and efficiency of smallholder farmers illuminates the importance of these farmers to national economies, especially those in developing countries, and highlights why smallholder agriculture was essential to accomplishing the aim of guaranteeing food security for everyone.

Recommendations

Achieving food security requires the participation of the South African government. First, they need to rectify what food insecurity has done, such as illnesses caused by inadequate nutrients. This can be done by providing adequate medical care in rural areas. Smallholder farmers should be educated on how to ensure that they get all the nutrients they need from livestock and poultry. Start-up capital can be provided to help them purchase high quality feed and had proper health management of their livestock. There was a noticeable gap between the rich and the poor in South Africa. Governments can attempt to close this gap by consulting with rural communities and their smallholder farmers when they need to develop policies in which they are most involved in. This helps educate the community and participate in economic development.

The following recommendations have arisen from the research:

1. Improving smallholder farmers' access to agricultural supplies, financing, and insurance has the potential to considerably reduce farmers' workload, increase food production, expand farmers' access to markets, and boost farmers' incomes.
2. If smallholder farmers were given more access to land and had their rights protected, they would likely increase their farming areas and output.
3. To further accomplish the nutrition component of the food security definition, smallholder farmers should be encouraged to diversify their production and place a greater emphasis on growing various food kinds that supply nutrients. Having food available isn't enough to provide food security if dietary needs aren't met.
4. Smallholder farmers can be equipped with better production know-how through education on nutrition, health, and childcare.
5. Increasing agricultural output in Africa can be achieved by gender mainstreaming of policies that promote and increase women's rights to resources, notably land.

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Addendum

Annexure A: Questionnaire used to collect data for this study

FOOD SECURITY VULNERABILITY IN SOUTH AFRICA

Good day, _____ I'm part of a team from the department of Agriculture of _____ we are currently interviewing households in the entire province of Limpopo, including your municipality. The aim is to obtain detailed information about the livelihood status of households, including their food consumption and food production. Your participation would be very helpful as the collected data will lead to policy advice for future undertakings in the region.

Your participation is voluntary. You may choose not to answer any question and you may choose to stop the discussion at any time. Refusing to participate will not affect you or your family in any way. We would like you to answer as honestly as possible. We want to emphasize that your responses will be kept confidential. Are you willing to participate in this study? YES 1 / NO 2: STOP QUESTIONNAIRE

Section A: Survey Identification

A1. Survey record number				
A2. Hh_id number				
A3. Province				
A4. District (code)				
A5. Municipality (code)				
A6. Enumerator_code				

district	municipality	
1. Capricorn	1. Blouberg	6. Tubatse
2. Mopani	2. Molemole	7. Mutale
3. Sekhukhune	3. Giyani	8. Thulamela
4. Vhembe	4. Maruleng	9. Mookgopong
5. Waterberg	5. Fetakgomo	10. Mogalakwena

A7. DATE: _____ / _____ / _____

A8. VILLAGE NAME: _____ GPS CODE _____

A9. RESPONDENT'S POSITION:

1. Head 2. Spouse 3. Other

A10. SURVEY CHECKED BY:

1. Lotte 2. Ellen 3. Luc 4. Other: _____

Signature of Supervisor: _____

1.Code	2. List names of all individuals in the household (List <u>household head first</u> , use first names only)	3. What is _____'s relationship to household head?	4.Gender Male:1 Female:2	5.Age in Years (at last birthday)	6.What is the highest education or qualification attained by _____?	7. Is _____ currently working for cash or in-kind income? Yes: 1 No: 0	8. If _____ is not working, why did _____ not work during the past seven days?	9. How many months did _____ spent away from the household in the last 12 months?	10. What is the reason for his/ her absence (use code box)
	Name	Code	1 - 2	Years	Code	0-1	Code	Months	Code
01.									
02.									
03.									
04.									
05.									
06.									
07.									
08.									
09.									
10.									
11.									
12.									
13.									
14.									
15.									

Section B: Household Demographics

INTERVIEWER PLEASE NOTE:

A household is a person or a group of persons who eat from the same pot and share livelihood resources, and are normally living together at least 4 nights a week.

The following information must be obtained in respect of every person in this household. **Do not forget babies.**

Codes for question 3	Codes for question 6	Codes for question 8	Codes for question 10
01= resident head	01= no schooling	01= Has found a job, but	1= employment
02= absent head	02=Junior primary (Gr 0	not started yet	2= looking for employment
03= wife or husband or partner	through to Gr4/ Std 2)	02= scholar or student	3= schooling
04= son or daughter	03= Senior primary (Gr 5/ Std	and prefers not to work	4= student
05= father or mother	3 to Gr 7/ Std 5)	03= housewife/	5= personal reasons
06= grandchild	04= Some Secondary (Gr8/	homemaker prefers	6= escape violence or
07= grandparent	Std 6 to Gr 11/ Std 9/ Form 4)	not to work	political problems
08= mother- or father-in-law	05= Completed high school	04= retired and prefers	7= visiting spouse or family
09= son- or daughter-in-law	(Gr	not to seek formal	8= visiting friends
11 = aunt or uncle	12/Std 10/Form 5/ Matric)	work	9= living with other partner
12= sister or brother	06= courses or certificates	05= illness, invalid,	0= prison
13= niece or nephew	for formal training	disabled, or	1= vacation
14= cousin	07 = Diploma or degree	handicapped	2= in hospital or clinic
15= great-grandparent		06= too young or too old	3= away on business
16= household help (or relative of)		to work	4= national service
17= lodger or relative of lodgers		07= seasonal worker,	5= other (specify)
18= other family		e.g. fruit picker,	
19= other non-family		shearer	
		08= lack of skills or	
		qualifications for	
		available jobs	
		09= cannot find any work	
		10= cannot find good	
		work	
		11= contract worker, e.g.	
		mine worker	
		12= retrenched	
		13= other reason	

Remark:

- If the answer is 'none', write '0'

- If the answer is 'don't know' or 'not applicable', then leave blank and go to next question.

Section C: food availability, consumption and dietary diversity

For each of the following questions, consider what has happened in the past **30 days**

C1. Please answer whether this happened never, **rarely (once or twice)**, **sometimes (3 to 10 times)** or **often (more than 10 times)** in the past 30 days.

	Household Food Insecurity Access Scale (HFIAS)	Never	Rarely	Sometimes	Often
1	Did you worry that your household would not have enough food?	1	2	3	4
2	Were you or any household member not able to eat the kinds of food you preferred because of a lack of money?	1	2	3	4
3	Did you or any household member eat just a few kinds of food day-after-day owing to a lack of money?	1	2	3	4
4	Did you or any other household member eat food that you preferred not to eat because of a lack of money to obtain other types of food?	1	2	3	4
5	Did you or any household member eat a smaller meal than you felt you needed because there was not enough food?	1	2	3	4
6	Did you or any other household member eat fewer meals in a day because there was not enough food?	1	2	3	4
7	Was there ever no food at all in your household because there was not money to get more?	1	2	3	4
8	Did you or any household member go to sleep at night hungry because there was not enough food?	1	2	3	4
9	Did you or any household member go a whole day without eating anything because there was no food?	1	2	3	4

C2. In which of the last 12 months did you experience a lack of food or money such that one or more members of your household **had to go hungry**?

	Aug 2010	Sept 2010	Oct 2010	Nov 2010	Dec 2010	Jan 2011	Feb 2011	Mar 2011	Apr 2011	May 2011	June 2011	July 2011
Yes	1	1	1	1	1	1	1	1	1	1	1	1
No	0	0	0	0	0	0	0	0	0	0	0	0

C3. Did you or anyone else in the household **eat** _____ **yesterday and in the past 7 days?**

[Fieldworker: read out each food group below]

During the past seven days, how many days did you or anyone in your household eat _____? (If the food item was eaten more than one time in one day, it should be counted as one).

What is the main **source** of _____? (See code below)

	Food group	Examples	1. Ate it yesterday		2. Number of days food was consumed in past 7 days	3. Main source of food consumed	4. Average expenditure per month (Rand/month)
			Yes	No			
					0 to 7	Code	
A	Maize or maize products	mielie-meal porridge (stiff, crumbly or soft), samp, whole maize (corn-on-the cob)	1	0			R
B	Other cereals	wheat, bread, breakfast cereals, sorghum, rice, pasta, oats, morvite, fermented/sour porridge, mahewu	1	0			R
C	Roots and tubers	potatoes, sweet potatoes, potato salad, amadumbe	1	0			R
D	Vitamin A-rich fruit & vegetables	<u>yellow/orange</u> coloured fruit and vegetables: mango, peach, butternut, carrot,	1	0			R

		pumpkin, paw paw,yellow; <u>Dark- green leafy</u> vegetables: spinach, mifino, amaranth, pumpkin leaves, beetroot leaves, dried green cowpea leaves					
E	Other vegetables	beetroot, broccoli, cabbage, cauliflower, chickpeas, cucumber, green beans, green peas, green pepper, lettuce, mushrooms, onions, tomato,	1	0			R
F	Other fruit	apple, apricot, banana, grapes, grapefruit, guava, lemon, lime, morula fruit, naartjie, orange, peach, pear, plum, pineapple, prickly pear, raspberries, strawberries, watermelon, wild fruit, dried fruit, canned fruit	1	0			R
G	Red meat	Beef & offal alone or as part of a stew	1	0			R
		Mutton, lamb, goat & offal alone or as part of a stew	1	0			R

		Venison, wild game including rabbits and birds	1	0			R
		Pork & offal alone or as part of a stew	1	0			R
H	Consumption	How often do you eat red meat (beef, venison, mutton, lamb, goat, pork) NOT as part of a stew?	1	0			R
I	Poultry	Chicken & offal (giblets, feet)	1	0			R
J	Other meat	Ham, poloni, cold meat, tinned meat	1	0			R
		Mopani worms, insects	1	0			R
K	Fish	Fresh, canned, frozen, fish	1	0			R
L	Eggs	eggs	1	0			R
M	Legumes, nuts & seeds	baked beans, dried peas, cowpeas, peanuts, nuts, sunflower seeds, pumpkin seeds, dried beans, sugar beans	1	0			R
N	Dairy	milk, amasi/maas, yoghurt, condensed milk, powdered milk, cheese	1	0			R
O	Oils and fat	any food made with oil, margarine, butter or Holsum, ice cream	1	0			R

P	Sugars	sugar, syrup, sweets, honey, chocolate, sugarcane	1	0			R
Q	Beverages	tea, coffee, cool drink, fruit juice, beer, homemade beer (this does not include water!!!)	1	0			R

Sources		4.	Gathering
1.	Purchase	5.	Gift
2.	Own production	6.	Exchange
3.	Hunting	7.	Food aid

C4. If there is not enough food for every member of your household, which members will get less to eat than necessary to fulfil their needs?

		Yes	No
A	Children younger than 5 years old	1	0
B	Children aged between 5 and 18 years	1	0
C	Female adults between 18 and 65 years	1	0
	Female adults older than 65 years	1	0
D	Male adults between 18 and 65 years	1	0
E	Male adults older than 65 years	1	0

C5. Yesterday, how many times (meals) did the adults in this household eat? /_____/

C6. Yesterday, how many times (meals) did the children (3-6y) in this household eat? /_____/

SECTION D: AGRICULTURAL PRODUCTION

Crop Production

D1. Arable crop production including home consumption

Interviewer ask: What crops, if any, did the household harvest in the past year? Ask for local unit of measure and express everything in this unit

a. Arable crop name	b. Units of measure	c. How much of _____ (crop) were harvested in the past 12 months?	d. How much of _____ were sold in the past 12 months?	e. After harvest, how much was lost to insects, rotting... (in units!)		f. How much of _____ (crop) were consumed by the household? (in units!)	g. How much of _____ (crop) were given to pay for labour or land? (in units!)
Name	Code	Unit	Unit	Average price Per unit	Unit	Unit	Unit
Maize							
Potatoes							
Sweet potatoes							
Wheat							
Sorghum							
Millet							
Beans							
Groundnuts/peanuts							

Units of measurement					
1: kilos	3: 25 kilo bags	5: 80 kilo bags	7: boxes	9: piece/'ear'	11: bunches
2: 10 kilo bags	4: 50 kilo bags	6: tons	8: 25 liter drums	10: basin	12: other

D2. Vegetable production including home consumption

Interviewer ask: What vegetables if any, did the household harvest in the past year? Ask for local unit of measure and express everything in this unit

a. Vegetable name	b. unit of measure	c. How many m ² were dedicated to_____?	d. How much of _____ were sold in the past 12 months?		e. After harvest, how much was lost to insects, rotting...	f. How much of _____ (crop) were consumed by the household?	g. How much of _____ (crop) were given to pay for labour or land?
Name	Code	M ²	Unit	Average price Per unit	Unit	Unit	Unit
Tomatoes							
Cabbage							
Pumpkins/squash							
Onions							
Spinach							
Other leafy vegetables							
Carrots							

D3. Fruit production including home consumption

Interviewer ask: What crops, if any, did the household harvest in the past year? Ask for local unit of measure and express everything in this unit

a. Type of fruit		b. unit of measure	c. How many trees do you have on your fields?	d. How much did you sell in the last year?		e. How much did you consume yourself?	f. How much of _____(crop) were given to pay for labour or land?
Fruit group	Name	Code	Unit	Unit	Average Price per unit	Unit	Unit
Citrus	Naartjes						
	Oranges						
Stone	Peaches						
	Grapes						
	Pears						
Subtropical	Pineapples						
	Bananas						
	Pawpaws						
	Litchis						
	Avocados						
	Guavas						
	Mangos						
Other							

Livestock

D4. Does the household own or farm with any animals or poultry of any kind?

YES _____ 1

NO _____ 0 -> go to following part 3.3.

Other farming income

		Cattle	Sheep	Goats	Pigs	Poultry
A.	How many _____ (name of animal) does the household own at the moment?					
B.	In the past year, how many, if any _____ were born?					
C.	In the past year, how many, if any _____ did the household sell?					
D.	(Ask for each kind of animal sold): in the past year, how much money did the household get from the sale of _____? (Rand)					
E.	In the past year, how many _____, if any, did the household buy?					
F.	In the past year, how many _____, if any, did the household slaughter (both for selling and home consumption)?					
G.	In the past year, how many _____, if any, did the household lose because they were stolen or died OR: Were run over, or something like that (e.g. fined, impounded)?					
H.	At present, how many _____, if any, has the household loaned to someone else?					
I.	At present, how many _____, if any, has the household borrowed from someone else?					
J.	And at present, how many _____, if any, has the household received as gifts from someone else?					

D4. Do you farm fish? **If yes:** How much, if anything, did the household make from the sale of fish in the past 12 months?

Rand _____

D5. Ask all who have **cattle or goats**:

- a. About how many liters of milk were obtained from year herd during the past week (last 7 days)? _____ litres
- b. And, how much of this was for this household's own use (last 7 days)? _____ litres
- c. And, how much of it was for sale or exchange (last 7 days)? _____ litres
- d. What was the value of milk sold or exchanged (last 7 days)? _____
Rand

D6. Ask all who have hens or ducks or other **poultry**:

About how many eggs were obtained from your poultry during the past week (last 7 days)? _____ and, how many of these did the household use? _____ and, how many did the household sell or exchange? _____

What was the value of eggs sold or exchanged (last 7 days)? _____
Rand

D7. Ask all who have **sheep**: In the past 12 months, how much did the household make, if anything, from the sale of wool and mohair?

Rand _____

D8. **Ask all who own animals**: in the past 12 months, how much, if anything, did the household make from the sale of animal skins and hides?

Rand _____

3.3. Other farming income

D9. Did the household receive anything in the form of subsidies (including livestock fees) or drought relief in the past 12 months?

Yes	1	No	0
-----	---	----	---

D10. IF YES: how much was it worth in Rand? Rand _____

D11. In the past 12 months, did the household receive anything by providing a service to other farmers, for example, ploughing or planting?

Yes	1	No	0
-----	---	----	---

D12. IF YES: How much was it worth in Rand? Rand _____

D13. In the past 12 months, did the household receive anything in any other way not already mentioned from farming?

Yes	1	No	0
-----	---	----	---

IF YES: DESCRIBE

D14. Does this household own any tractors or other farming vehicles?

Yes	1	No	0
-----	---	----	---

Other farming costs

D15. In the last 12 months, how much, if anything, did the household pay in cash and credit for:

	Code	Rand/past 12 months
Seeds/planting material	01	R
Fertilizer	02	R
Pesticides	03	R
Herbicides	04	R
Other farming materials/ equipment	05	R
Wages for workers who helped with farming	06	R
Petrol, diesel and oil for machines	07	R
Food for the poultry or farm animals	08	R
Farm land that was rented from someone else	09	R
Other payments made in the last 12 months	10	R
Land taxes	11	R
Various services, for example for tractors, oxen which were used for ploughing	12	R
Interest on loans	13	R
Any other costs (describe)	14	R

Section E: Income and expenditure of the household

E1. Now I would like to talk about your household's sources of income and how the household spends money

a. What are your household's sources of income throughout the year?		b. Who generates this income?	c. Who makes decisions on how the resources from this activity are used?	d. Please estimate the percentage of total income that comes from this source
Code		Code	Code	Use proportional piling
Main				%
2				%
3				%
4				%
5				%
6				%
Total				%
Codes Question				
1 = Formal salary or wages	7 = Food crop production/ sales	13 = Skilled labour		
2 = Remittances (money from migrants)	8 = Cash crop production/ sales	14 = Brewing		
3 = Pension	9 = Livestock production/ sales (non-poultry)	15 = Vegetable and fruit production/ sales		
4 = Child Support Grant	10 = Poultry production/ sales	16 = Food assistance/ gift		
5 = Other social grant (Foster Care, Disability, etc.)	11 = Fishing	17 = Other assistance/ begging/ gifts		
6 = Small business	12 = Petty trade (firewood sales, etc.)	18 = No other source		
Codes Question				
1 = Head of the Household only	5 = Women only	8 = Women and children		
2 = Spouse of the head of the Household only	6 = Adults only	9 = Men and children		
3 = Household head and Spouse of household head	7 = Children only	10 = Men and women and children		
4 = Men only				

E2. What are the main sources in each month? (Indicate with a cross that income)

Sources	JAN 2011	FEB 2011	MARCH 2011	APRIL 2011	MAY 2011	JUNE 2011	JULY 2011	AUG 2010	SEPT 2010	OCT 2010	NOV 2010	DEC 2010
1												
2												
3												
4												
5												
6												

E3. What is the average total household income per month? Rand

E4. What is the average total household income per year? Rand

Migration/ Remittances

E6. (A migrant worker is someone who is absent from home for more than a month each year to work or to seek work. Working includes self-employment as well as working for someone else.)

A	Do you have any household or extended family members who live away from the household?	1 = yes	if no (0), go to following part 5.2. Consumption
B	If yes, where? Circle all that apply	1 2 3 4 5 6 7	Nearby town – Specify Elsewhere in this municipality – Specify Another municipality or province – Specify Johannesburg, Cape Town or Durban – Specify Other country in the region – Specify International (UK, etc.) – Specify I don't know

C	How many household/family members are working away from home?	A. Regular migrants (returns every month)	B. Seasonal migrants (for a limited period each year)	C. Prolonged period away (more than 6 months at a time)
D	How many are	a. Men	b. Women	
E	What job do they do or which sector	1. Business 2. government 3. education (teaching) 4. contract worker (mining etc.) 5. house aid (cleaning lady etc.) 6. agricultural worker 7. Other		
F	Does the household receive money (or other contributions) from the migrants?	1 = Yes 0 = No (-> 2.15)		
G	If yes, how often do you receive money (or other contributions)?	1	Once a year	
		2	Every few months	
		3	Monthly	
H	How does the household receive the money	12	Bank	
		3	Mpesa	
		4	Post	
		5	PostNet	
		6	Neighbour/family/friend	
		7	Shoprite	
			Other	

I. How much did this household receive from remittances (money or contribution expressed in monetary value) per year?

R _____

J. For each month can you indicate how much is received by the household (money or contribution expressed in monetary value

Month	Rand	Month	Rand	Month	Rand	Month	Rand
Aug 2010		Nov 2010		Feb 2011		May 2011	
Sept 2010		Dec 2010		Mar 2011		June 2011	
Oct 2010		Jan 2011		Apr 2011		July 2011	

Consumption

E7. In the last 30 days did you spend any money on the following items for household consumption?

If none, write '0', if don't know, leave blank and go to next item.

Expenditure item		Estimated expenditure in RAND during last month	Expenditure item		Estimated expenditure in RAND during last month
A	Cereals (mielie, mielie meal, rice, etc.)		M	Medical care	
B	Roots and tubers (potatoes, sweet potatoes, etc.)		N	Education (school expenses)	
C	Bread		O	Rent	
D	Legumes (beans, peas, groundnuts)		P	Loan repayments	
E	Fruit & vegetables		Q	Communications (cell phone, telephone, internet)	
F	Red meat		R	Transport	
G	Other meat		S	Sugar, (ice cream, etc.)	
H	Fish		T	Water & electricity	
I	Eggs		U	Personal items (clothes, shoes)	
J	Oil, fat, butter, ice cream		V	Beverages (tea, soda drinks,...)	
K	Milk & milk products (cheese, yoghurt)		W	Other...	
L	Milling				

Section F: Characteristics of the household

F0A. To what ethnical group does your household belong to? _____

1	African	3	Indian	5	Other
2	Coloured	4	White		

F0B. How long has the household been living in this area? _____ years

F0C. Are any of the following facilities within 30 minutes (2 km) walk of your house?

Facility	Distance in km	Distance in walking time (min.)
A. Shop where basic food can be bought		
B. Market to buy goods and food		
C. Markets where you can sell goods and food, if different		
D. Bank		
E. Post office		

F1. WATER

In this section we are going to talk about the water used by this household for drinking, cooking, bathing, or washing clothes, and other household purposes like these.

F1A. What is the source of water used most often in this household for things like drinking or bathing and washing clothes? (Single mention only)

- piped –
- internal.....1 -> go to following part F.2. Sanitation piped – yard tap.....2 -> go to following part F.2. Sanitation water carrier/ tanker.....3 -> go to following part F.2. Sanitation piped – public tap/ kiosk (free)..... 4 piped – public tap/ kiosk (paid for)..... 5
- borehole.....
- 6 rainwater tank..... 7 flowing river/ stream..... 8 dam/ stagnant water..... 9 well (non-borehole).....10
- protected spring.....11 other (specify).....12

F1B. Does the household have to fetch and carry water to the house each day?

Yes	1	No	0
-----	---	----	---

IF NO -> go to following part F.2. Sanitation

F1C. About how far away is the water that has to be fetched?m

F1D. Who in the household usually fetches water?

	53a. person fetching water	53b. average number of trips per day	53c. How long does each round trip take on average? (include time spent waiting in queue)	53d. How much is carried to the house each day?
	NAME	NUMBER	MINUTES	LITRES
First mention				
Second mention				
Third mention				

F2. SANITATION

F2A. What kind of toilet does the household use?

Flush toilet..... 1

Improved pit latrine – with
ventilation (VIP)..... 2 Other
pit
latrine.....
.....3

Bucket
toilet.....
..... 4 Chemical
toilet.....
..... 5

None..... 6 -> Go to following part F.3.
Energy

F2B. Where is the toilet?

Inside
dwelling.....
..... 1 outside
dwelling – on
stand.....
. 2 outside dwelling – off
stand.....
. 3

F3. Energy

In this section, we are going to talk about the different kinds of energy that this household uses for different purposes.

F3A. Is the house connected to an electricity supply?

Yes	1	No	0
-----	---	----	---

F3B. I'm going to read a list of different household activities. For each one, I'd like you to tell me what the main source of energy is.

	1. Cooking and boiling water	2. Cooking meat	3. Cooking other food	4. Lighting
	Main source	Main source	Main source	Main source
Wood	1	1	1	1
Paraffin	2	2	2	2
Charcoal/ coal	3	3	3	3
Electricity from grid	4	4	4	4
Electricity from generator	5	5	5	5
Candles	6	6	6	6
Gas from bottle (LPG)	7	7	7	7
Town gas (piped)	8	8	8	8
Car battery	9	9	9	9
Dry battery (eg. Torch)	10	10	10	10
Dung	11	11	11	11
Other (describe)	12	12	12	12

F3C. If wood is mentioned as a source of energy for any of the above activities: ASK:

Who in the household usually collects the wood?

	a. person collection wood	b. average number of trips per week.	c. how long does each round trip take on average? (include time spent collection wood)

	NAME	NUMBER	MINUTES
1. First mention			
2. Second mention			
3. Third mention			

F4. Financial assets

Does this household, or a household member, have any of the following financial assets? (Tick the right box)

Financial asset	YES (1)	NO (0)	DON'T KNOW (3)
A. Money in a savings account at a bank/ post office			
B. Burial insurance			
C. Rotating saving bags			
D. Insurance			
E. other savings, specify			

F. Does any person in this household have at this moment taken out a loan/credit?

Yes, at a bank or formal institution..... 1

Yes, from a microfinance institution or NGO..... 2

Yes, from someone who buys my crops/animals..... 3

Yes, from the grocery store.....

... 4 Yes, from a shop in town, e.g. furniture shop..... 5

Yes, from a friend or neighbor.....

. 6

No..... 7

F5. LAND ACCESS & USE

A. Does any person in this household have the right to use (have access to) any land for arable farming, that is, to grow and cultivate crops on? IF YES, is this land.....? What is the size of this land?

Does any person in this household have the right to use (have access to) any land for stock farming, that is, for animals to graze on?

IF YES, is this land.....? What is the size of this land?

IF YES, IS THIS LAND...	Crops		Grazing	
	yes (1) /no (0)	Estimated size (ha)	yes (1) /no (0)	Estimated size (ha)
A. Communal?		ha		n/a
B. Private (own farm)?		ha		ha
Private (rented)?		ha		ha
D. Others (specify)?		Ha		ha

B. What is the total size of all land that is available to household members for growing crops? Record in hectares for those who can give this information hectares

if information cannot be given in hectares, think of a soccer field –is the total area smaller, about the same or bigger than a soccer field? if bigger: determine about how many soccer fields would cover the land the household could use for growing crops? Interviewer: Remember

- (I) A soccer field is about ½ hectare.
- (II) One hectare equals approximately 2 acres.

C. Thinking about last year: of the land that the household could have used for growing crops, about how much did it actually use? % of total land area

D. If all land or part of your land is not used for production, why not? (multiple responses possible, tick the right box)

a) lack of seeds		e) pest		i) not interested	
b) lack of fertilizer		f) rented out		j) other purposes for the land	
c) lack of water		g) too old/ young/ weak		k) other specific reason	
d) lack of labour		h) too little money		Specify:	

E. How much of the land is irrigated?ha

F. What are the sources of irrigation water, if any, used on the land used for growing crops? (allow for multiple responses, up to three)

	Sources of water used
a) River/ stream	1
b) Dam	2
c) Borehole	3
d) Tank	4
e) Municipality	5
f) Rain	6
g) Neighbour	7
h) Other (Specify):	8

G. What irrigation system do you use?

Hose	1
Buckets	2
Drip irrigation	3
Pipes	4
Others	5
	6

H. How much did you pay for irrigation water last year?Rand

I. Does the household have the right to sell any part of the land it uses for growing crops?

Yes	1	No	0
-----	---	----	---

b. IF YES: about how much of it can be sold?hectares

c. How much do you think the household would be able to get for the land if it sold this land?

Rand

J. Of the land that is available to the household for growing crops, was any of it rented out to other people in the past 12 months?

Yes	1	No	0
-----	---	----	---

b. IF YES: what is the share of the total land held by the household?
.....%

c. IF YES: how much was paid to the household as rental for land used for crops?

Rand/year OR Rand/season
.....

K. Did the household have to pay rent for any of the land used for growing crops in the past 12 months?

Yes	1	No	0
-----	---	----	---

b. IF YES: how much was paid in rent? Rand/year

L. Does the household have the right to sell any part of the land it uses for grazing of animals?

Yes	1	No	0
-----	---	----	---

b. IF YES: about how much of it can be sold? hectares

c. IF YES: how much do you think the household would be able to get if it sold this land?

Rand/ha

M. Of the land that is available to the household for grazing of animals, was any of it rented out to other people in the past 12 months?

Yes	1	No	0
-----	---	----	---

b. IF YES: what is the share of the total land held by the households?
.....%

c. IF YES: how much was paid to the household as rental for land used for grazing?

Rand/year OR
.....Rand/season

N. Did the household have to pay rent for any of the land used for the grazing of animals in the past 12 months?

Yes	1	No	0
-----	---	----	---

b. IF YES: how much was paid in rent? Rand/year

SECTION G: STRESSES, SHOCKS, COPING AND INTERVENTION STRATEGIES AFFECTING THE HOUSEHOLD

G1. We would like to know whether specific events or situations occurred in this household over the last 12 months and how many times they have occurred.

	In the last 12 months has your household suffered from	How many times did this happen in the last 12 months?		
		Yes	No	
A	Increase in the number of people in the family / household (insert number of people)	1	0	
B	Increase in food production costs (water, rent, equipment, seeds, fertiliser)	1	0	
C	Cut-off or decrease of government grant which is not a result of the death of beneficiary	1	0	
D	Flood	1	0	
E	Storm	1	0	
F	Drought	1	0	
G	Serious injury or chronic illness keeping household member from doing normal activities	1	0	
H	Loss of a job of a breadwinner in the household	1	0	
I	Loss of remittances (money received from migrants)	1	0	
J	Loss of possessions, theft	1	0	
K	Death of many livestock	1	0	
L	Food cost or food price increases	1	0	
M	Death of a family member	1	0	

G2. Has your household been confronted with a sudden and severe decrease in monthly income in the past?

		Yes	1	No	0			
.	If Yes, what was your response?	Yes	No	How many times did this happen in the last 12 months?				
A	Sell livestock	1	0					
B	Sell land, tools, or other assets	1	0					
C	Use own savings	1	0					
D	Borrow money from relatives or friends	1	0					
E	Take out a loan from mashonisa	1	0					
F	Take out a loan from a formal institution	1	0					
G	Borrow food from relatives or friends	1	0					
H	Take on additional work (e.g. farm labour,)	1	0					
I	Migrate to find work	1	0					
J	Reduce spending	1	0					
K	Reduce food consumption	1	0					
L	Reduce or stop debt/loan repayments	1	0					
M	Received gifts or money	1	0					
N	Received professional counselling (government services, organisations, projects....)	1	0					
O	Other, specify:	1	0					

G3. If your household did not have enough food available, how did your household cope with this?

(Don't suggest) (If no problem with FOOD shortage, leave blank)

	A. Eat less preferred food	B. Reduce food intake	C. Buy food on credit	D. Borrow food	E. Exchange one type of food for another	F. Consume seed stock
YES	1	1	1	1	1	1
NO	0	0	0	0	0	0
	G. Send members to eat elsewhere	H. Send members to beg	I. Limit or reduce portion size	J. Restrict consumption in favour of children	K. Feed working members at the expense of nonworking members	L. Ration money to buy ready-to eat food
YES	1	1	1	1	1	1
NO	0	0	0	0	0	0
	M. Skip meals for an entire day	N. Gather wild food	O. Asked neighbours/ family relatives for help	P. Found extra income sources or use savings	Q. Household members moved elsewhere	R. Sold household assets
YES	1	1	1	1	1	1
NO	0	0	0	0	0	0
	S. Sold livestock	T. Worked for payment in kind	U. Appeal for food aid	V. Depended on charity/welfare (no social grants)	W. Borrowed money for food	X. Took children out of school
YES	1	1	1	1	1	1
NO	0	0	0	0	0	0
	Y. Could not do anything					
YES	1					
NO	0					

G4. On whom do your household members rely mostly in difficult times? [CIRCLE CODE]

	Neighbours	Relatives/ family in area	Relatives/ elsewhere	family	Church
Yes	1	1	1	1	1
No	0	0	0	0	0

G5. How do they mainly provide help? [CIRCLE CODE]

	Food	Money	Counselling	Childcare	Other (Specify).....
Yes	1	1	1	1	1
No	0	0	0	0	0

G6. Has your household or has a member of your household been a **beneficiary of any one of the following government programmes** over the **last 12 months**? Adapt to local interventions in Limpopo province

		Yes	No
A	Agricultural Starter Pack Programme (ASPP)? Or: legima.	1	0
B	Comprehensive Agricultural Support Programme (CASP)	1	0
C	Expanded Public Works Programme (EPWP)?	1	0
D	Food Parcel Scheme (FPS)?	1	0
E	Integrated Sustainable Rural Development Programme (ISRDP)?	1	0
F	Land Care Programme (LCP)?	1	0
G	Land Redistribution for Agricultural Development (LRAD)?	1	0
H	Land Restitution Programme (LRP)?	1	0
I	Municipality implemented food security projects	1	0
J	National School Nutrition Programme (NSNP)?	1	0
K	Poverty Relief Programme (PRP)?	1	0
L	Unemployment Insurance Fund (UIF)?	1	0
M	Other government programmes (Specify)	1	0

G7. What do you personally suggest can be done to help households that are experiencing **hunger or a lack of food**?

Thank the respondent for his/her co-operation

Annexure B: Approval for the use of historical data

Gent 01/05/2020



To whom it may concern

I undersigned Prof Dr D'Haese Luc authorize Ms. Phina Mdaka the use of the qualitative and quantitative food security related data collected at the level of 600 households of ten local municipalities / 5 districts of Limpopo province (food security survey, 2011). The data are covering on the following key issues:

1. Household Characteristics	
2 Food security and nutrition outcomes	
<i>Food Consumption Status</i>	
<i>Nutritional Status</i>	
3 Outcome indicators for vulnerability factors	
<i>Environmental Conditions</i>	
<i>Economic Conditions</i>	
<i>Socio-Cultural Conditions</i>	
4 Risks, Hazards, Shocks (see Focus group interview.)	
5 The major components of Food Security	
<i>Food Availability</i>	
<i>Food Accessibility</i>	
<i>Food utilization: Health and Sanitation</i>	
<i>Care and Feeding Practices</i>	

Ms. Phina Mdaka may use the data in order to fulfill the requirements for her MSc. thesis at the University of Pretoria.

Prof Dr. D'Haese Luc



01/05/2020

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Annexure C: University of Pretoria Ethics Approval



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Natural and Agricultural Sciences
Ethics

CommitteeE-mail:

ethics.nas@up.ac.za

3 August 2021

ETHICS SUBMISSION: LETTER OF APPROVAL - AMENDMENT

Prof E van Marle-Köster
Department of Animal Science
Faculty of Natural and Agricultural Science
University of Pretoria

Reference number: NAS051/2020

Project title: Profiling the determinants of food insecurity in households keeping livestock in the Limpopo Province

Dear Prof E van Marle-Köster,

We are pleased to inform you that the **Amendment** conforms to the requirements of the Faculty of Natural and Agricultural Sciences Research Ethics Committee.

Please note the following about your ethics approval:

- Please use your reference number (NAS051/2020) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.
- Please note that ethical approval is granted for the duration of the research (e.g. Honours studies: 1 year, Masters studies: two years, and PhD studies: three years) and should be extended when the approval period lapses.
- The digital archiving of data is a requirement of the University of Pretoria. The data should be accessible in the event of an enquiry or further analysis of the data.

Ethics approval is subject to the following:

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.
- **Applications using GM permits:** If the GM permit expires before the end of the study, please make an amendment to the application with the new GM permit before the old one expires.
- **Applications using Animals:** NAS ethics recommendation does not imply that Animal Ethics Committee (AEC) approval is granted. The application has been pre-screened and recommended for review by the AEC. Research may not proceed until AEC approval is granted.

The application meets the ethics requirements set by the NAS ethics committee for dealing with human participants. Confirmation of general approval of proposal assuming that there are no secondary restrictions or limitations on or use of data as authorized by PI of previous project in any form or context.

Post approval submissions including application for ethics extension and amendments to the approved application should be submitted online via the ethics work centre.

We wish you the best with your
research. Yours sincerely,



Prof VJ Maharaj

Chairperson: NAS Ethics Committee

Department
University of Pretoria
Pretoria 0002 South Africa

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Fax Number

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