

**THE CONTRIBUTION OF PERI-URBAN LIVESTOCK PRODUCTION ON FOOD
SECURITY OF FARMERS IN THE TOWNSHIP OF BOTLENG, DELMAS,
SOUTH AFRICA**

by

**Nompumelelo Silindile Thobile Xaba
47875836**

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SUPERVISOR: Dr. M. R. Masekoameng

CO-SUPERVISOR: Mr. M. J. Mamashila

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DEDICATION

This study I dedicate to Baba Xaba, my Late Father. If he was here, I know he would be so proud of me, and I can just imagine the great words he would say in expression of how proud he is. He is gone but never forgotten. He lives in our hearts and memories. One day, God willing, we will meet dad and have our long talks. For now, I rest in remembering your great love and support for me. I love you still baba. Nonkosi!

DECLARATION

I Nompumelelo. S.T. Xaba hereby declare that the dissertation with the title: THE CONTRIBUTION OF PERI-URBAN LIVESTOCK PRODUCTION ON FOOD SECURITY OF FARMERS IN THE TOWNSHIP OF BOTLENG, DELMAS, SOUTH AFRICA which I hereby submit for the degree of Master of Science: Agriculture at the University of South Africa, is my own work and has not previously been submitted by me for a degree at this or any other institution.

I declare that the dissertation does not contain any written work presented by other persons whether written, pictures, graphs or data or any other information without acknowledging the source.

I declare that where words from a written source have been used the words have been paraphrased and referenced and where exact words from a source have been used the words have been placed inside quotation marks and referenced.

I declare that I have not copied and pasted any information from the Internet, without specifically acknowledging the source and have inserted appropriate references to these sources in the reference section of the dissertation or thesis.

I declare that during my study I adhered to the Research Ethics Policy of the University of South Africa, received ethics approval for the duration of my study prior to the commencement of data gathering, and have not acted outside the approval conditions.

I declare that the content of my dissertation/thesis has been submitted through an electronic plagiarism detection program before the final submission for examination.

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Date:

26/01/2023

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LIST OF ACRONYMS

CGIAR	The Consortium of International Agricultural Research Centers
COVID	Coronavirus disease
DARDLEA	Department of Agriculture, Rural Development, Land and Environmental Affairs
FAO	Food and Agriculture Organization
FNS	Food and Nutrition Service
FANTA	Food and Nutrition Technical Assistance
HFIAS	Household Food Insecurity Access Scale
IPCC	Intergovernmental Panel on Climate Change
IFAD	International Fund for Agricultural Development
MLA	Modern Language Association
NDDB	National Dairy Development Board
NGO	Non-governmental organization
PUA	Peri-urban agriculture
SPSS	Statistical Package for Social Sciences
UN	United Nations
UN-HABITAT	United Nations Human Settlements Programme
UNICEF	United Nations International Children's Emergency Fund

USAID United States Agency for International Development

USA United States of America

UNISA University of South Africa

UA Urban agriculture

VKLM Victor Khanye Local Municipality

ABSTRACT

This study aimed to explore the food security status of peri-urban livestock farmers in the township of Botleng, Delmas, South Africa, and determine whether livestock production has contributed to food security of the households of the farmers in the area through assessing the food access of the households. The specific objectives were to determine: (i) the demographic and socio-economic characteristics of farmers in the township of Botleng, Delmas, South Africa, (ii) the food security status of farmers in the area, (iii) the contribution of peri-urban livestock farming on food accessibility of farmers in the area, and (iv) other contributions acquired through livestock production in the study area. The primary data was collected from households in the area; 108 farmers were randomly selected and interviewed. A cross sectional questionnaire was administered to the farmers. Demographic and socio-economic information was collected to understand livestock farmers in the area. The standard HFIAS questionnaire was used to determine their food security status. Thereafter, questions was administered to determine the contribution of livestock farming to their food security status. The last questions were used to determine how livestock production helps in other ways than food security. Descriptive and simple data analysis was performed and the results showed that the area only had black farmers, majority of which were elderly males. It was found that 86.1% was food secure and that 99.1% showed that livestock production contributed financially to the household. Furthermore, 99.07% indicated that the money they receive from sales was used to buy food, amongst other things. This showed that livestock production contributed to food security in the households of the farmers. The study recommends that livestock production be encouraged in more households, that farmers receive more training to capitalise on its potential, and that livestock production be encouraged more amongst women and youth, as the majority of practicing livestock owners were found to be retired, elderly males.

Keywords: Food security; Food access; Urban Agriculture, Peri-urban

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CHAPTER 1

STUDY ORIENTATION

1.1 Study background

Food security has been a topic of discussion since ancient civilization. It affects every level of human hierarchy, from an individual to nations and continents. When food is limited, it affects family life, health, and livelihoods, and governance of that place is challenging, and all security is problematic (Falvey, 2015). When this rudimentary need is not fulfilled it can start a chain reaction of different problems in society.

Food security has been defined as when every person, always, has physical and economic access to safe, nutritious, and sufficient food that meets their dietary needs and food preferences for an active and healthy life (Coates, 2013). Food security is also defined by four pillars. First is food availability, whereby there is enough food available that is of satisfactory quality and can be supplied through either by imported food (which includes food aid) or locally produced food. Second is food access, where individuals in society have the required resources to acquire good food that will constitute a nutritious diet. Third is utilization, how food is used through adequate diet, health care, hygiene and clean water to achieve a status of good health where all needs of a physical nature are met. Fourth is stability; where the individual, household or community have access to nutritious food, of good quality and sufficient amount at all times, and should not be at risk of losing this access due to economic, climatic or seasonal factors (FAO, 2006).

Since 2015, there has been a growing number of food insecure and undernourished people in the world with current levels last seen in 2010-2011 (FAO, 2019). Urbanization, defined as the increase share of the population that is in urban areas (McGranahan and Satterthwaite, 2014). In sub-Saharan Africa many cities have seen an influx of people with an 11.3% increase in 2010 and an expected urban population increase of 20.2% by 2050 (UN-HABITAT, 2014). Several studies have reported problems related to the coming together of two elements; cities growing at a fast pace and food and nutrition insecurity resulting from increased urbanization (UN, 2008; Naab *et al.*, 2013). Other studies have found that poverty is on the rise in the urban areas of African cities, with food and nutrition insecurity being indicators of urban poverty (Mvula and Chiweza, 2013).

Rapid urbanization has been problematic due to it being rapid with economic growth not being able to keep up, resulting in rising poverty. Rising urban poverty has led to many low-income households suffering from low levels of livelihood security. With the urban poor facing this challenge, they turn to urban livestock keeping to alleviate the effects of food insecurity, and to mitigate hunger. Many people living in urban and peri-urban areas are from rural areas, and thus already have a background in livestock production. In addition, most urban dwellers, given the chance, practice livestock production in their settlements, which contributes to their basic food needs, directly or indirectly. This is a major cause of urban and peri-urban agricultural practices in sub-Saharan Africa.

The global financial crisis and ensuing increase in fuel and food prices led to an increased struggle in modern society. Urban agriculture has been uniquely placed to assist with these challenges. This has led to the mushrooming of research studies on food security and its dynamics, with a focus on the African continent, which has one of the highest levels of food insecurity along with Asia (FAO, 2019).

The definition of urban and peri-urban agriculture (PUA) is the planting and growing of plants and rearing of animals in and around city areas. This includes forestry, floriculture, horticulture, aquaculture, and livestock production. This may also involve other related activities such as the inputs delivery, processing and marketing of products (Drescher, 2003; Chagomoka *et al.*, 2015; FAO, 2019).

The small scale or mixed small farming systems practiced in peri-urban and rural livestock production, are evolved efficient systems understood by people of old, nomads and farmers. Peri-urban and rural livestock production is ignored by franchised, narrow, commercial practices that underestimate the role of sheep, goats, cattle, rabbits, poultry, rodents, buffalo, native pigs, yak, reptiles, camels, horses, fish, and insects in providing milk, meat, offal and other food products outside the bigger markets. Peri-urban and rural livestock production's financial value to commercial farmers is far less than the value it holds for subsistence farmers as it provides meat, milk, hides, wool/hair, byproducts, transport, draught power, fuel, savings, investment, risk mitigation status and products are used in traditions (Falvey, 2015).

It has been stated that households and/or populations involved in agricultural activities such as livestock production, should have reduced levels of vulnerability to hunger in

urban and rural areas that are food insecure (STATS SA, 2017), with livestock production believed to assist in this.

1.2 Problem statement

A food insecure person is defined as a person who does not have regular access to sufficient, nutritious, and safe food that aids in normal growth and development as well as in an active and healthy life (FAO, 2019). Mitigation strategies have been, and are still, being put in place for a food secure world by 2030 as aimed by the Food and Agriculture Organisation (FAO), but it is evident from the data reported that more needs to be done (FAO, 2019). Further studies are needed to evaluate the effectiveness of implemented strategies, how they can be improved, and other potential strategies.

Studies on food security in crop production have been conducted such as those of Zondi *et al* (2022) and those of Aworh (2018), however, little is known about food security in relation to livestock (Falvey, 2015). Livestock play an important role in the lives of small scale and subsistence farmers. They provide multiple outputs, such as: draught and traction power for agriculture, high-quality protein, income, they can reproduce themselves, provide various edible and non-edible by-products and nutrient recycling (Falvey, 2015). In the South African setting they are also socially important as they offer status and are used for religious purposes.

According to the FAO (2022), the assessment in the 2020 report of food insecurity, whereby the world experienced the rapid spread of the COVID 19 pandemic revealed huge setbacks with an indication of growing numbers of people experiencing hunger and food insecurity. In a study by Brooke (2021), he highlighted the importance of the role livestock play in the lives of smallholder farmers and of equal importance, was also the role they played in during the COVID 19 pandemic in contributing as much as 50 % of the much-needed food. It was also Brooke (2021) who found that livestock received little attention from research and development initiatives from local governments and therefore comprehensive information on livestock as pertaining to food security was limited. It is, therefore, important to develop appropriate strategies for promoting urban livestock production to vulnerable groups that have not taken part in this activity. Participatory analysis of vulnerable groups can be conducted as a first step towards identifying potential contributions that urban livestock production can add in their household livelihoods. This research study aimed to explore the food security

status of peri-urban livestock farmers in the township of Botleng, Delmas, South Africa and the contribution livestock practice has played in this outcome.

1.3 Research questions

The study aimed at addressing the following questions:

- What are the demographic and socio-economic characteristics of the farmers in the township of Botleng, Delmas, South Africa?
- What are the types of livestock present in the area and which are prevalent?
- Are livestock farmers in the study area food secure?
- What other contributions are acquired through livestock production in the households of the study area?

1.4 Aim and objectives of the study

1.4.1 Aim

The main aim of the study was to explore the food security status of peri-urban livestock farmers in the township of Botleng, Delmas, South Africa and the contribution livestock practice has played in this outcome.

1.4.2 Objectives

The objectives of the study were as follows:

- To determine the demographic and socio-economic characteristics of farmers in the township of Botleng, Delmas, South Africa.
- To determine the food security status of farmers in the study area.
- To determine the contribution of peri-urban livestock farming to food accessibility of farmers in the study area.
- To determine other contributions acquired through livestock production in the study area.

1.5 Significance of the study

Food security has been described as the minimal level of food that is required for survival and that achieves basic human nutrition (Falvey, 2015). It has been a topic for discussion since ancient civilization and is still relevant today. It applies to all levels

of modern-day society and is a major global issue affecting the highest levels of governance and international development organizations such as the FAO (FAO, 2011).

It was found that people experiencing severe levels of food insecurity, where a person is without food for a day or more, comprised 9.2% of the world population or slightly more than 700 million people in 2018 (FAO, 2019). In Africa, 27.4% of the population was said to be severely food insecure, almost four times higher than other regions (FAO, 2017). Food insecurity is said to be growing, particularly in sub-Saharan Africa. In the years 2014-2016 food insecurity increased by approximately 3% (FAO, 2017). In southern Africa, the prevalence of under nourishment rose from 6.5% in 2005 to 8.0% in 2017 (FAO, 2019).

There is a lack of information as to how specifically livestock farming contributes to food security in peri-urban settings. Evidence suggests that most of the studies conducted in food security have concentrated on general food security and poverty issues, this has been a broad subject and lacked focus on food security-agriculture in urban areas specifically (Du Toit, 2011; Wight *et al.*, 2011; Masuku *et al.*, 2014).

This study aimed to address the knowledge gap on how effective livestock farming in urban settings is in contributing to food security. The study is relevant to the Gauteng Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) as it provided additional insight into the profiled livestock farmers' households, which are supported by the department.

1.6 Definitions of concepts

This section explains the terms that were used in the study as various researchers and organisations define food security and PUA differently. For the purposes of this study the terms peri-urban and urban areas were used interchangeably.

1.6.1 Peri-urban agriculture

It has been understood that peri-urban areas are mixed areas under an urban influence but with a rural morphology (Caruso, 2001). These areas are largely found in African countries. In this study peri-urban agriculture is farming practices that are conducted in the areas adjacent to an urban area or city. These may include but are

not limited to owning livestock such as cattle, sheep, goats, chickens, and planting vegetables such as spinach, tomatoes, and peppers.

1.6.2 Food security

A state of food security exists when every household and person, at all times, has the physical and economic means to gain access to enough, nutritious and safe food that can meet their nutritional needs and meet their selective, individual food preferences for an active healthy life (FAO, 2008). The food security challenges that rank highest is ensuring that all who need food have access to it and have the means to purchase it (FAO, 2011). Thus, food insecurity is where households and persons do not have secure and constant access to enough amounts of nutritious and safe food that aids in good development and a healthy life (FAO, 2013). Food security is an issue of international concern that has attracted global attention throughout history. Food security is vitally important for national and international security. A nation's security is vulnerable when that nation is generally food insecure. In addition, it is important to view food security as much a psychological state of safety as it is a physical state of eating. In doing so we are able to empathise with those who are in need of food rather than viewing them as statistical numbers (Falvey, 2001).

The FAO has combined the various UN fundamentals of food security into four aspects which are: sound food safety and nutrition; access to food (also during conflicts and crises); food availability; and reliability of supply (FAO, 2011). Having a food system that meets all four pillars at the same time is said to be one that is 'sustainable and resilient' (FAO, 2021). This system is useful in defining, in simple terms, who is food secure and who is not.

Nutrition and food insecurity has been and still is a challenge worldwide. Although there has been progress, sub-Saharan Africa has the highest occurrence of food and nutrition insecurity over a period of time in the world (FAO, 2014), with post-apartheid South Africa having poverty levels not found in the majority of other higher middle-income countries (Adato *et al.*, 2004).

Food security in urban agriculture has four pillars, namely food accessibility, availability, utilization and stability (Lupia & Pulighe, 2015). These are defined as follows:

1.6.2.1 Accessibility

Food accessibility refers to the ability of an individual or household to obtain food from the marketplace or through other means such as gifts, transfers, and loans. Food access is largely determined by the household's purchasing power or income, which is highly influenced by market integration, market conditions and price policies. Jiao *et al.* (2012) said that both physical and economic access are encompassed by food access and Broca (2002), stated that individuals don't always have access to resources to acquire the required foods to achieve a diet that is nutritious. Crush *et al.* (2010) suggested that urban agriculture was in most parts observed in cases related to survival of the household rather than in generating income for the household. Households that struggle with food security have been found to more often be involved in their own food production, suggesting that the poor use this as a tool in poverty alleviation (Crush *et al.* 2010).

Musemwa *et al.* (2015) observed in the Eastern Cape Province of South Africa, that the majority of the households were reliant on government social grants to meet household food requirements, instead of participating in their own food production. Other studies similarly observed that the government played a major role when it came to assisting households in accessing food and the assistance was in the form of social grants (Masekoameng, 2015).

A study conducted by Masekoameng (2015) in the rural areas in the District of Sekhukhune, South Africa, revealed that 84% of the study respondents had anxiety when it comes to their households not having enough food, 33% went to sleep without eating, and 24% were found to not having eaten the whole day including the night. The results indicated food insecurity as more than 80% of people in the district of Sekhukhune did not have adequate food access (Masekoameng, 2015). It should be kept in mind that the current study focuses on livestock, whereas Masekoameng (2015) had different types of food.

1.6.2.2 Availability

Food availability in a country is measured by the overall domestic agricultural output and net food imports. It is most hindered by failures in production that are associated with labour constraints, land acquisition, gender inequality and the loss of productive assets needed to sustain household food production. Availability of food is an essential pillar to consider when pursuing a sustainable food security system and it is clear that

in ensuring food security, food should be readily present in satisfactory amounts and food quality must be good. This was confirmed by the FAO (2006), stating that when the food availability aspect of food security is met, an adequate amount of food that is of a good quality should be available to individuals and each person should gain access to food either through imports or domestic production. Gebremariam *et al.* (2017) simply stated that food availability talks directly about the physical presence of food.

Livestock production in peri-urban areas contributes to the increase of food availability and allows for fresh, good quality meat to be readily available to households throughout the year (Falvey, 2015). This makes it advantageous for the farmer to be involved in the practice and receive an income on a continuous basis. Even more so, food availability is increased not only in one household, but in the surrounding households, as in most cases the slaughter of an animal is usually performed and shared with neighbouring households. This is because larger animals such as cattle are usually too big for one household and are therefore usually shared via celebrations and meetings held at the particular household. Storage also plays a role in increasing the availability of food in households, for when meat is properly stored it can last for months, for example when frozen. Lastly, reciprocation also aids in increasing food availability; when one household shares with another household, the recipient household will reciprocate when they have slaughtered an animal.

1.6.2.3 Utilization

Food utilization deals with the quality of the available food in terms of dietary requirements. According to Barret (2010) “utilization reflects concerns about whether individuals and households make good use of the food to which they have access”. Barret (2010) stated that the nutritional value of food, especially the essential micronutrients and vitamins and the ability of the body to metabolize and absorb these nutrients is important for food security. Farre *et al.* (2011) elucidated on the potential of genetic engineering as a strategy for solving the nutrient deficiencies of food. In the same study they went further to explain that genetic engineering offers a prospect of nutritionally complete staple crops that could assist in reducing malnutrition on a global scale (Farre *et al.*, 2011). Devereux and Maxwell (2003) stated that food should be eaten in the correct way for its nutrients to be adequately absorbed. Verhart *et al.* (2016) said that the food security pillar of utilisation also addresses the reality of

diverse food consumed when it comes to meeting the individual's dietary needs. Jones (2013) reported that due to various reasons, food distribution in a household is not always necessarily fair nor equal between members of the household.

1.6.2.4 Stability

This pillar views the stability of access of food and food supply and these are often affected by the global and local economy, their pricing and political issues (DE-la-Torre, 2019). Therefore, the world market directly affects food stability at a household level. Stability is also considered to be affected when the food supply at a household level remains constant throughout the course of a year and beyond. This includes income, food and economic resources that enable the household to acquire food when needed. Stability leads to the maintenance of the other three pillars of food security (accessibility, availability, and utilisation of food) over a period of time, and during economic, natural, political and social stresses and shocks (Drimie *et al.*, 2009). Stability is also defined as when a household or individual is able to acquire food throughout all seasons and transitory shortages. It is also known as the ability to maintain levels of consumption levels in the long term (Owino, 2014).

The FAO has indicated that the pillar of food stability comprises primarily two dimensions, namely, resilience and vulnerability (FAO, 2009). Food security vulnerability is long-term or short-term (FAO, 2009). Resilience in food systems is when such a system is not vulnerable to disruptions (Rikkonen *et al.*, 2023). However, it can be managed using the following livelihood strategies: (a) risk mitigation, (b) risk coping, and (c) risk prevention (FAO, 2009; Pieters *et al.*, 2013). While in South Africa the consumption of wild foods has been used as a mitigation strategy by the poor (Chakona & Shackleton, 2019). The strategies used for coping with the risk include limiting food intake to ensure that children eat enough, diversity of the diet being reduced and gaining credit (Kuchler *et al.*, 2012; Pieters *et al.*, 2013). While public policies by governments are encouraged to be improved, in ensuring the basic human right to adequate food for assistance in risk prevention. (Pereira & Oliveira, 2020). Manenzhe *et al.* (2016) conducted a study in Bushbuckridge, Mpumalanga Province, South Africa, and found that 83% of its respondents that were small-scale farmers were deficient in farming skills; with only 17% having the required skill sets. Because of this, it is imperative when developing strategies for increasing food stability, that small-scale farmers be adequately equipped with the necessary skill sets for proper

effectiveness in the farm, in order to limit food insecurity effects and increase resilience.

1.7 Scope of the study

The study focused specifically on the farmers dwelling in the peri-urban area of Botleng, in a town of Delmas, called the Victor Khanye local Municipality, a township in the Mpumalanga Province, South Africa. The study focused on the farming practices of livestock farmers in the area. The study sought to evaluate whether the farmers are food secure or not and furthermore, for those who are food secure, to determine the contribution livestock practice has played in this outcome. No other factors, such as sanitation, health care, physiological needs, and clean water, were considered.

1.8 Sequential order of the study

The following is the outlined structure of the study divided into five Chapters, namely:

- **Chapter 1** dictates the orientation of the research; it introduces the study and describes its background. It outlines the problem statement, then states the research questions, the aim and objectives, the hypothesis, the study significance, definitions of main concepts and the scope of the study.
- **Chapter 2** is a description of the reviewed literature related to the study.
- **Chapter 3** describes the research methodology used in the study.
- **Chapter 4** presents the results of the study along with the discussion of results.
- **Chapter 5** presents the conclusion of the study and recommendations.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The nutritional health and economic benefits in households practicing urban agriculture have received significant attention (Armar-Klemesu, 2000; Mougeot, 2011; Badami & Ramankutty, 2015; Chagomoka *et al.*, 2015, 2016) even though the actual number of people involved in the practice globally is debatable (Lee-Smith, 2013; Stewart *et al.*, 2013; Frayne *et al.*, 2014). Also debatable is to what extent does PUA play a role in reducing food insecurity. Urban agriculture has been shown in several studies to be useful in mitigating the effects of food insecurity most importantly when urban agriculture is strategized into growing income opportunities while also increasing urban food production (Zezza & Tasciotti, 2010; Korir *et al.*, 2015). Agricultural practices mainly include crop and livestock husbandry. Livestock compared to cereals, are considered not as important holistically in food security, as the latter are the major human food. This explains the lesser focus on livestock research. The lower focus may also be because livestock products have been viewed as more of a luxury food in most parts of the world (Falvey, 2015). Notwithstanding, livestock production plays an integral part in the farming operations of smallholders and subsistence farmers in poor and non-developed countries.

Livestock production is more common to rural areas than urban and peri-urban areas. Livestock commonly found are sheep, guinea fowl, goats, and chickens for the household. In rural areas people often slaughter their own livestock for food purposes and this has assisted rural people to acquire their regular high-quality nutritional needs in a simple and inexpensive manner. Similarly, the urban poor, in response to limited alternative livelihoods and food insecurity, turn to urban livestock production (Waters-Bayer, 1995). A study by Triveni & Sreenivasulu, 2020; showed that urban livestock farming benefits the poor and made accessible opportunities to diversify livelihood activities to disadvantaged groups. It also provided a locally produced food source for people living close to those livestock farmers. Urban environment raised livestock are conventional animals such as dairy cattle, goats, sheep and pigs for meat, as well as poultry that supply eggs and meat. Recently, species such as rabbits and snails have started to gain popularity (Miller, 2019).

Production systems, based on their primary use, can be classified as subsistence or commercial (Amiri *et al*, 2019). When it comes to subsistent production systems, their main purpose is to meet the needs of families, with little or no commercial dealings. In fact, many urban households keep a few chickens, a few sheep, or goats for consumption on an occasional basis. In such cases, little or no investment is made in animal husbandry and health care. Animal feed is supplemented with waste from the household kitchen, depending on availability (Mbatha and Masuku, 2021). This results in poor performance and high mortality. In commercial production systems, the main purpose is to raise enough animals for sale. Personal consumption comes second or non-existent. Depending on the size of the enterprise, commercial companies may be smallholders or large-scale (Guendel, 2004).

Falvey (2015), stated that if animal production is divided into integrated farming, range land, landless systems, and intensive production, that each element plays an important part in contributing to food security. This study therefore aims to investigate the role of livestock in food security.

2.2 Defining urban and peri-urban areas and their growing need for livestock consumption.

The terms urban and peri-urban have different interpretations and definitions with no definition that is generally accepted (Simon *et al.*, 2006). Moustier and Fall (2004), shared the same sentiments in their study when they used an example between Sierra Leone and Nigeria and they said that what can be described as urban there could be a small town in a place like Nigeria. Due to differences in the literature, working definitions of urban, peri-urban and rural areas have been used (Simon *et al.*, 2006; Chagomoka *et al.*, 2015). Drescher and Laquinta (2000), strongly supported the working definitions of peri-urban areas. Urban areas have been defined as geographical spaces that can be seen by continuous human settlement (Mela, 2014). While peri-urban areas have been defined as transition areas from rural to urban, which are mostly found in the outskirts of urban environments (UNESCO, 2014). Rural areas have been defined as areas where displace populations stay outside these areas which are outside of cities and towns (UNHCR, 2020).

There has been a rise in the number of people residing in many cities in sub-Saharan Africa due to urbanization, which has caused the urban population to rise by 11.2 percent in 2010 and this number is expected to rise again by 20.2 percent in the year

2050 (UN-HABITAT, 2014). This change has led to a rise in the demand for animal produce in developing countries of which the main driver is urbanization, a notable growth in incomes and an ever-increasing population (Thornton, 2010). Urbanization is associated with lifestyle changes, especially an increased consumption of animal products (FAO, 2010). In many countries, especially in Asia and Africa, livestock production has changed from large-scale ruminant farming found in rural areas to intensive pig and poultry farming in urban areas which are close to feed markets and consumers (FAO, 2006). Due to land constraints, urban animal husbandry is largely small scale, often dominated by livestock such as poultry, pigs, and rabbits, with relatively small spaces dedicated to them (McClintock *et al*, 2014). Animals are fed food leftovers from places of industrialization, domestic, gastronomic and communal facilities, such as breweries or canning firms (Schiere, 2001).

Livestock production in the urban setting has favourable and unfavourable conditions as to why farmers continue to practice it. These conditions play an important role in livestock production either contributing or not being able to contribute to the households of the farmer and were documented by Guendel (2004) from case studies conducted on livestock farmers. The strengths are as follows:

2.2.1 Urban livestock production strengths

- *Higher yield per unit area from livestock compared to field crops.* The increasing demand for space in cities for constructing housing favours urban livestock farming because it requires less space and yields are higher per unit area used.
- *Development of favourable markets for urban livestock production by the poor.* The process of urbanization leads to an increased demand for animal products. Proximity to these markets is an advantage for the poor, as this reduces costs.
- *Recycling.* Using resources that already exist, urban animal production offers opportunities to recycle household waste, agro-industrial by-products such as brewery residues and molasses, weeds and grasses from public spaces, crop residues from markets, and waste from urban farmers.
- *Land use flexibility.* Compared to urban crop production, livestock production can easily be moved to other urban areas as and when they become available.
- *Multipurpose activity.* Urban livestock production fits a variety of livelihood strategies and contributes significantly to food security, income and job creation,

insurance and savings. It also provides easily exchangeable assets for important household expenses such as tuition and medical expenses.

- *Provide a social safety net for the poor.* Various case studies demonstrate that vulnerable groups such as female headed households, children, pensioners, widows, and those with little formal education, involved in urban livestock farming, use it as a social protection strategy (Guendel, 2004; Triveni and Sreenivasulu, 2020; Darith et al, 2017).

2.2.2 Urban livestock production weaknesses

- *Improper waste disposal.* Current forms of animal waste management pose environmental and public health problems that become more acute as urban livestock populations increase.
- *Water availability.* Urban livestock keeping competes with humans for water resources because utility services do not consider the water demands of this activity. In many slum areas, municipal water must be purchased, so other water sources, often contaminated, are used for livestock production.
- *Poor animal health and high veterinary service costs.* Studies have shown that animal health often deteriorates due to poor livestock husbandry practices. Poor livestock farmers rarely vaccinate livestock, especially small breeds such as goats, sheep and chickens. Treatment is often suboptimal due to the high cost of veterinary services and medication.
- *Availability and quality of feed.* Forage availability is a particular constraint for large livestock species such as cattle that are not normally pastured. For free-ranging animals, feed quality is an issue. There is none or limited control over food sources. A case study from Nairobi shows that foraging in landfills is common in slum areas.
- *Low levels of production.* Livestock production is generally low due to limited feed availability, poor quality feed, and poor management practices.
- *Poor networking and organization among poor livestock producers.* Poor animal owners are unorganized and unable to coordinate their demands.
- *Lack of research and delivery of services.* Poor urban livestock producers have limited access to information and the adoption of improved technology. A further complication is that existing proposals are not tailored to the needs and living

conditions of the poor. For example, advisory services and training courses promote species that are less relevant to the poor.

- *Limited knowledge of animal husbandry practices.* Lacking information sources and advisory services, poor animal owners often have limited knowledge of how to raise livestock (Guendel, 2004; Triveni and Sreenivasulu, 2020; Darith et al, 2017; Kusiluka, 2012).

2.2.3 Challenges related to food security.

The combination of food and nutrition insecurity and fast-growing cities has led to several countries reporting challenges related to this to the United Nations (UN, 2008; Naab *et al.*, 2013). Studies have also reported evidence of a continual increase in urban poverty in African cities and this has been marked by food and nutrition insecurity (Mvula and Chiweza, 2013).

Supply of food to cities is an aspect of increasing importance affecting food security, because more than half of the world's people now live in what each area defines as cities. However, about 300 million of these city dwellers are considered to be extremely impoverished with most being in Africa and Asia (Ahmed *et al.*, 2007), where low access to food and food security closely associated with severe undernourishment is of international concern.

In the urban areas of South Africa, poverty is particularly found in low-income and informal settlements, which are nearly exclusively occupied by people of colour (Martin *et al.*, 2000). In these areas, there is a higher probability of challenges related to food insecurity and under-nutrition. In the post-apartheid era in South Africa, people are moving from rural to urban and peri-urban areas. In South Africa, as the world over, migration has been used as a tool by those living in rural areas and are poor to improve their livelihood (Ellis and Freeman, 2005). For example, in 1995, 74% of impoverished South African residents lived in rural areas and the poverty rate was around 71% (Adelzadeh *et al.*, 2001). Between 1991 and 2003, South Africa has seen increased urbanization of the black community who were previously restricted to live in pre-selected rural homelands by previous legislation in order to restrict their movements and their choices when it comes to their places of residence (Boraine, 2004).

2.2.4 Defining urban and peri-urban agriculture.

Defining the concept of urban agriculture is a challenge as it takes place in different settings. Therefore, several definitions of urban agriculture are presented. One definition has been that "Urban agriculture is located within (intra-urban) or on the fringe (peri-urban) of a town, a city or a metropolis, and grows or raises, processes and distributes a diversity of food and non-food products, (re-) uses largely human and material resources, products and services found in and around that urban area, and in turn supplies human and material resources, products and services largely to that urban "(FAO, 2022). A previous study of an empirical nature by Ruysenaar (2013), defined urban agriculture generally as activities of a farming nature which include horticulture, livestock rearing and aquaculture, that happen in urban areas. Simply it means any farming activities conducted in areas that are urban, whereby the purposes are for increasing food availability for household personal consumption or selling. Urban agriculture has also been defined as the process of growing useful crops and rearing of livestock such as cattle, pigs, goats, sheep, and poultry (rabbits and snails in lesser quantities) in areas that are within and around cities. It includes forestry, aquaculture, horticulture, livestock production, floriculture and other activities that are similar such as the processing and marketing of products and the delivery of inputs (Drescher, 2003). Urban agriculture is usually performed on a small scale on relatively small pieces of land and Kane-Berman (2016) stated that communal land is usually where small scale farming is operated. Hereafter, the terms urban agriculture and peri-urban agriculture are used interchangeably.

2.3 The contribution of livestock production to farmers in the urban setting

Korir *et al.* (2015), studied the role of urban agriculture to food security of impoverished residents in the Eldoret Municipality, Kenya. The study found amongst others, that respondents had the ability to produce food which enabled them to earn money and subsequently provide for their households. Producing food in urban settings had contributed in a positive manner in the households' food security. Therefore, it was then accepted that agriculture in the urban setting contributes notably in economic, ecological and social development in urban and/or peri-urban areas (Korir *et al.*, 2015).

For the poverty-stricken residents of Eldoret Municipality, Kenya, Korir *et al.* (2015) reviewed the agricultural role when it comes to food security. The study found that the

participants could produce food, gain financially and therefore were able to provide for their families. Urban agriculture had played a positive role in their food security. The study concluded that urban agriculture contributes significantly towards economic, ecological and social development in the urban setting (Korir *et al.* 2015). In support, Machethe (2004) found that poverty was alleviated in four ways through urban agriculture: (a) food prices reduction; (b) increasing wages; (c) improved farm income; and (d) creation of employment.

Urban agriculture and its development in the South African Metropolitan municipalities of the twenty-first century shows that agriculture in the urban setting can potentially improve food security of residents (City of Johannesburg, 2013). The FAO (2010) is also of the view that livestock production can play a role in poverty mitigation by increasing the resilience of some urban communities that are poverty stricken by increasing their accessibility to animal products such as milk, small stock (goat and sheep meat), sheep wool, poultry and in fewer cases snails and rabbits. It was stated by the FAO (2006) that at both a household and national level, livestock production can be a source of income and also assist in safe and nutritious food being consumed (food access). It also increases the chances of having a variety in diet (food accessibility); the availability of enough good quality, food supplied by local production (food availability). It also facilitates an increased access to enough quality food constantly and is able to increase the consistency of food consumed in households against seasonal changes along with other shortages that are not permanent (food stability) (FAO, 2006).

Mudhara *et al.* (2014) had positive views of farming in an urban setting, supplying fresh foods, which included livestock products amongst others, however, they also noted that the positive change differed from area to area. This is particularly in developed and non-developed countries. In developed countries such as the United States of America, New Zealand, Australia, and Canada, urban agricultural activity is observed to be more prevalent and increasing at a fast pace. Several studies in urban agriculture in the USA revealed that urban agriculture contributes towards community, household and individual food security statuses (Corrigan, 2011).

Ramsey and Danielle (2011), observed changes in agriculture in the urban setting in Australian capital cities. They revealed that PUA play a major role in providing needed

food to the people in it, which also included livestock products. The increase in urbanisation has led to a decrease in PUA with concern raised around the potential effect on food security. This has resulted in occurrences of food insecurity when availability or access is left in a vulnerable state. Consequently, this has shown that there is a critical relationship that exists between food production, food security and decreasing agriculture in the urban setting, which may affect food security negatively.

In contrast, nations such as China have realised the benefits of producing locally in urban areas, and placed farms within cities within urban governance areas. Beijing has been reported to generate 70% of its milk within the city (Jianming, 2003) and Shanghai has its own supply of milk and eggs within the city and has governance of its area that would, in other places be defined as 87% rural (Yi-Zhong and Zhangen, 2000). Globally, PUA plays an important role in local food supply for most cities – estimated at about 34 percent of meat and 70 percent of egg production, in the late 1990s (FAO, 2011).

2.3.1 Other contributions of urban agriculture

Farming is an activity that involves human interaction and may result in combined efforts by humans and has been found to not only affect local conditions but national and even international states. It also brings about many other benefits in the lives of those that participate in it. Whether in a rural or urban setting, agricultural activities play more than just the role of providing food to communities, households or individuals (Santo *et al*, 2016).

Battersby and Marshak (2013) in their study of the Vrygrond and the Seawinds area in Ward 64 of the City of Cape Town, found that the City of Cape Town is of the opinion that urban agriculture could be used as a tool in increasing sources of income; however, the sustainable entry of produce from these projects into existing formal markets was difficult. Furthermore, the study also discovered that the practice had social benefits for the farmers, in terms of social cohesion, enabling them to form bonds and to construct unity in their community. This showed that urban agriculture contributes more than just increased food availability and access to the communities, households and individuals that practice it.

2.3.2 Challenges related to peri-urban livestock production.

The challenges facing urban agriculture are reviewed below.

2.3.2.1. Drought

Throughout history drought has occurred in every part of the world, and still has negative effects on urban agriculture particularly agricultural practices especially for livestock production. (Bahta and Myeki, 2022). Lottering *et al.* (2021), used a systematic approach in searching for literature published between 2008-2018 that focused on the effect of drought on small-scale farmers in sub-Saharan Africa. They discovered that in a country's environment, droughts have far-reaching consequences than what is inherently evident. Holman *et al.* (2021) investigated the effects of and responses to drought. They found that most of the reported responses occurred on farms, with varying responses implemented at the institutional level and across the supply chain. This demonstrates the complex interactions within the food system. Drought responses are dominated by reactive and contingency measures to manage or enhance drought recovery, contributing to greater resilience to future droughts. In the twenty first century, droughts are expected to become more frequent and severe in some regions. This requires deliberate government intervention to mitigate the impact (Zhao and Dai,2021).

Yonas *et al.* (2022) and Mare *et al.* (2018), with a focus on drought adaptation strategies, studied the impact that drought has on commercial livestock producers. Their findings were that drought had a significant effect on the average herd size, sheep flock and livestock feeding. However, the South African government did not provide any assistance to the commercial livestock farmers, and it was also observed that during the drought, a major percentage of farmers did not have any mitigation measures put in place for drought.

Drought has become a common occurrence, affecting both smallholder and commercial farmers. Matlou *et al.* (2021) recently investigated drought resilience impact in livestock production on the well-being of smallholder farmers. They found that smallholder farmers that received post drought assistance recovered better. Furthermore, the study found that smallholders had moderate agricultural drought resilience indices but low natural resilience capital. Livestock production declined over time, hurting the smaller livestock, beef, and dairy industries. When drought affects

livestock, it can lead to reduced productivity, reduced fertility, poor animal health and increased livestock mortality. Many farms suffer from various epidemics, especially lung infections, because of the dusty environment caused by drought. This can lead to poor conception rates, afterbirths being retained, poor colostrum production, and compromised immune systems (Udmale *et al.*, 2014).

In South Africa, the impact of agricultural drought on livestock production is of a great physical importance as a stressor, similar to other temperate and humid regions (Rojas-Downing *et al.*, 2017). Agricultural drought largely affects livestock production and its quality. The effect depends on multiple factors such as intensity, recurrent agricultural droughts, vulnerability, water stress and socioeconomic characteristics (Benton *et al.*, 2012). A herd requires time to recover, and the length of time needed for a herd to recover depends on the severity of the drought, the impact on breeding females, and the amount of rainfall during the drought period (Angassa and Oba, 2013). Studies have shown that recovery from severe drought takes two to three years and this depends on the animal species (Vetter *et al.*, 2020). Vetter *et al.* (2020) also found that a livestock farmer in the KwaZulu-Natal Province, South Africa, lost 43% of his cattle herd in the 2015-2016 agricultural drought season, compared with 29% of his goats. Cow numbers remained low three years after he left the drought and thus took longer to recover, but goat numbers recovered quicker. Large number herds had lower mortality rates, and this was because owners of large herds had more resources to support their herds. This means smallholder farmers took longer to recover compared to commercial farmers.

2.3.2.2 Legislature

Livestock production in peri-urban areas has not always been a welcome practice because of legislative land laws which are put in place in some countries as it is seen as risks (Audate *et al.*, 2019). Githugunyi (2014) stated that the soil, water, air and waste found in urban settings could be full of pollution and can be a risk in the sustainability of farming in urban settings. Previous studies have revealed a lack of knowledge regarding the occupational risks of livestock production. Although found to be within reason but, pose a threat in possible health problems to humans (Ackerson and Awuah, 2010).

Due to this, urban-based livestock production is now being gradually done away with, as priority is given to zoonotic disease risk prevention above food security, especially

for poor communities. For example, there was a regular population of more than 200,000 poultry that was grown in Jakarta in the year 2003. The number of these poultry was steadily going up until poultry were banned when there were programs run for avian influenza in 2008 (FAO/ICASEPS, 2008). In addition, in Thailand, there were incentives offered to urban livestock farmers, in the form of tax, to migrate away from Bangkok city (Costales *et al.*, 2006). This then puts a focus on rural dwellers that still produce in rural areas and encourages them not to move to peri-urban areas; adding onto an already stressed demand for food supply. These livestock producers that have minimal access to basic inputs, seldom have access to the basic services they need and are often ignored or shunned by city planners (Waters-Bayer, 1995). Falvey (2015), stated that while it appears that their numbers are decreasing, individuals from societies that depend on livestock should not be forced to move to cities, as this would increase the greater need for food to at the very least 30% above the current levels of consumption. Therefore, simply stated, we can estimate that by them not migrating to the city and continuing with their rural lifestyles, the livestock products they produce would contribute to their own food security and decrease the overall need (Falvey, 2015).

Real urban food needs must be seen as a priority by a city's administration and that priority must also include livestock production as it is a real food need in urban areas. In non-developed countries such as Zambia, in Lusaka, agriculture in the urban setting has under the health act, been treated as an illegal activity, even though this law is not regularly implemented (FAO, 2012).

2.3.2.3. Climate change

The Intergovernmental panel on climate change defined climate change as the long-term changes of the weather and temperature conditions of the earth. These are changes that occur naturally through shifts of the sun or volcanic eruptions that are large in nature. They can be and are often also caused by human activities. These activities are related but not limited to the burning of fossil fuels such as oil, coal and even agricultural activities that give off green-house gas emissions (IPCC,2018). Although it has been said that agricultural activities contribute to climate change, it also affects it negatively (Grossi *et al*, 2019). These negative effects observed incur changes that include, but not limited to severe drought, intense storms, declining biodiversity, flooding, polar ice melting, rising sea levels, severe fires and water

scarcity (IPCC, 2018). Due to these being matters of global importance and affect farmers even on local scales, mitigation and adaptation are important if agricultural practices are to survive.

Mitigating climate change has been defined as reducing climate change, by reducing the amount of greenhouse gas emissions released into the atmosphere (IPCC, 2014). While Adaptation has been defined as making the necessary changes according to the present or expected weather conditions (IPCC, 2014).

For farmers practicing agriculture, measures have to be put in place in mitigating the aftereffects of climate change. Making necessary changes to this ever-changing environment is imperative for livestock farmers if the practice is to survive. Due to the increasing demand for food, specifically livestock produce, which is fueled by an increasing world population. This has spawned to more research being conducted under mitigation strategies and this research has shown to be effective. These strategies have been led to being, but not limited to using younger and more fibrous fodder, use of more feed concentrates than natural grazing and raising feed intake (Arndt *et al*, 2022) Adaptation to climate change in governments and livestock farmers themselves has been unimpressive, with government falling short the most. The example is given by the South African institute of internal affairs about the 2015/16 national drought intervention, describing it as sporadic and un-coordinated (SAIIA, 2016). A study Zhou *et al* (2022), by has revealed that livestock farmers apply adaptations with destocking and buying supplementary feed as the most commonly used.

Adger *et al*. (2003), stated that there is a growing need for adaptation when it comes to climate change, which is due to it remaining a problem that is universal and developing countries remain the most vulnerable. More countries in sub-Saharan Africa have farmers that are exposed to agricultural risks because of climate change, extreme weather, and market shocks making it a challenge to eradicate poverty and food security status being achieved (McDowell and Hess, 2012). Harvey *et al*. (2014) argued that climate change is yet to reach its peak and therefore it will continue to affect small scale farmers negatively, increasing the risks that they face.

Much like other developing countries, South Africa was identified as being vulnerable to climate change and its impacts (RSA, 2011). Studies also found that livestock

production decreased over time, with the small stock, beef, and dairy industries bearing the brunt as they suffered the most in water shortages and other crises (Yonas *et al.*, 2022).

In many areas livestock animals are the only asset of the poor yet are highly vulnerable to climate change and extreme events (Thornton *et al.*, 2007; IFAD, 2010). Agriculture is found to be adversely affected by climate change and yet also contributing to it (Aydinalp and Cresser, 2008). This is reported in various studies and is based mostly on commercial agriculture (Koneswaran and Nierenberg, 2008). Livestock emits three main gases in relation to climate change which are carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), with methane gas the most important agriculturally produced gas (IPCC, 1996). Agricultural activities have been stated to contribute between 18% and 20% to global warming, which according to some sources is higher than that of transport. This is a misrepresentation since the contribution agriculture makes was calculated on the whole lifecycle of agricultural production whilst that of transportation was based on emissions of gas only in the transportation process and did not include the manufacturing process (Pitesky *et al.*, 2009). Livestock production accounts for about 5% to 10% of the total contribution to agriculture (IPCC, 1996). There is evidence of an increase in the global average temperature (+0.74 °C) and ocean temperatures, widespread melting of snow and ice, and global average sea level rise (3 mm per year) (IPCC, 2007a).

It is predicted that climate change will only have a mild impact on livestock production in developed countries, as in the United States most livestock are kept in protected environments (pens, barns, etc.) and fed supplementary diets (Adams *et al.*, 1999). The situation in developing countries is different as animals are generally exposed to the elements and rely on pastures and other natural forage for their nutrition. Under these conditions, which are a more extensive farming system, livestock production is expected to be more vulnerable to climate change.

Climate can directly and indirectly affect livestock. The direct effects of temperature, humidity, wind speed and other climatic factors influence animal performance: milk production, growth, wool production, and reproduction (Houghton, 2001). One of the most obvious and important impacts of climate change on animal production is mediated through:

- Changes in feed source.

- Changes in species composition in grazing and some managed grasslands can significantly affect the type of animal species that can graze on them, altering the eating habits of communities that depend on them (Thornton *et al.*, 2007).
- Plant quality changes coupled with increasing temperature (from C3 to C4 plants), that reduce the decomposition and digestibility rates of plant species (Minson, 1990). This results in less nutrients being available to animals (Thornton *et al.*, 2007).
- However, increased CO₂ concentrations favour C3 plants (Taub, 2010). African farmers are known to keep cattle as insurance when drought ruins their annual crop (Swinton, 1988).

The probability of owning livestock increases with rising annual temperature but decreases with rising annual precipitation. Farmers adapt to the hot, dry climate by switching to livestock farming (Rust and Rust, 2013), but there are limits to keeping arid landscapes suitable for livestock farming. In addition, vulnerability to climate change varies with farm size. Farms of larger sizes are more affected by climate in comparison to smaller sized farms. On the other hand, smaller farms can more easily switch from temperate animals to heat-tolerant animals and from crops to livestock (Seo and Mendelsohn, 2006a). As a result of applying these measures, the income from livestock increases on small farms as temperatures rise.

Climate change has direct and indirect effects on livestock. Climate change will directly affect livestock production in four ways: i) the direct effects of weather and extreme events on animal health, growth, and reproduction; ii) the impact of changes in the availability and price of feed grain; iii) the impact on yield and quality of forage and fodder crops; and iv) changes in livestock diseases and pests (Smith *et al.*, 1996). The indirect effects of climate-induced changes on livestock husbandry can be attributed mainly to changes in the nutritional environment. Studies have shown that climate change will greatly affect the quality and quantity of forage (Topp and Doyle, 1996). Climate change could worsen the quality of grasslands comprising already lower-quality subtropical C4 grasses found in traditionally temperate regions due to warmer temperatures and less frost. However, yield may be increased due to increased CO₂ concentration (Campbell *et al.*, 1995). This effect is directly linked to radiation, which would require heat exchange between the environment and animal. This can also be affected by wind speed, temperature, and humidity.

Given current climate conditions, the animal's inability to dissipate heat from its current surroundings can cause heat stress for many species for at least part of the year (Fuquay, 1981). Heat stress results from an animal's inability to dispose heat sufficiently to maintain heat equilibrium in the body. Relative humidity, high ambient temperatures and radiant energy compromise the animal's ability to disperse heat. This leads to an elevated body temperature, which in turn initiates adaptive and compensatory mechanisms to attain homeothermy and homeostasis. The so-called readjustment is of interest in terms of economics but is essential for the survival of animals (Stott, 1981). Heat stress has different negative effects on livestock and there is a range of thermal conditions under which livestock can maintain a relative constant body temperature, through behaviors and physiology (Bucklin *et al.*, 1992).

Dairy cows exposed to change in heat conditions linked to climate change show a 10-14% milk production reduction. Even after the conditions returned to normal, these cows did not recover (Valtorta, 2002). Other general effects of climate change on dairy production include lower productive rates, reduced livestock weight gain, and lower feed conversion rates in warmer regions. More mixed effects are expected for regions that are colder (Aydinalp and Cresser, 2008). Reproductive rates of dairy cows (especially high yielding breeds) are of interest, because as production increases the interparity period (ICP) tends to increase over time (Olori *et al.*, 2002). As heat and nutritional stress increases, this trend is likely to become a bigger problem.

2.3.2.4 Theft

It has been found that livestock provides the livelihoods as well as food and nutritional security of nearly 1.3 billion people in the world (World Bank, 2020). Thus, livestock is a valuable commodity the world over. The issue of livestock theft is not one that can just be attributed to any region or continent. Livestock theft has been found to be problematic in both developed (e.g., the UK and the USA) and developing countries (e.g., Lesotho, South Africa, and Nigeria) (Clack, 2018b). Some areas experience livestock theft more than others and livestock theft is mainly relevant in areas where livestock occur in large numbers; it is a pressing problem in some African countries (Aiyzhy, 2021) including South Africa.

It may seem that cattle theft in the twenty-first century is an anachronism, however, as the problem causes crippling effects in the economies of some countries it shows that the issue is still relevant (Economist, 2020; Gumba and Traore, 2020). Government

often plays a role in assisting to combat this crime, as agriculture plays a pivotal role in the economies of many countries, and their food security. Therefore, it is in the best interests of governments in countries to facilitate in creating conducive conditions for the prevention of livestock theft and to ensure that the investigation of crimes committed in agricultural communities is prioritised (Clack, 2013). Different countries and their criminal law systems have differences in their legal definitions of livestock theft; examples are cattle raiding in European countries, lifting in India, stock theft in South Africa and the USA, cattle rustling in East and North Africa, and cattle duffing in Australia (Clack, 2018a).

2.3.2.5 Land tenure

Land tenure is defined as the typical or legal relationship that exists among people of community groups or individuals upon acquisition and use of land on specified conditions (FAO, 2003). It is usually categorised into four different types that can either be land that is namely state, communal, private, or open access (Chagutah, 2013). Kane-Berman (2016) observed that arming at a small scale was usually conducted in communal land. The FAO (2011) stated that the availability of land for the purposes of urban agriculture is of great importance, seeing as food security is affected by it. Lee (2010), however, presented that for practices that are small-scale, land could be privately or publicly owned. For example, farms that are smaller in scale are mostly owned by institutions, local municipalities, land trusts and other entities. For land that is publicly owned, permissions that are necessary and may vary, may be required. This will depend on who the landowner is. For private land, small sized farm holders could be given occupation with legalized agreements between the parties (Lee, 2010).

2.4 Food security strategies

Prain *et al.* (2010), stated that urban agriculture meets all the required criteria to assist with challenges presented by food insecurity. Urban agriculture has been arguably said to assist in the reduction of household diet adequacy and to diversify the diet, as livestock sourced foods contain needed nutrients that are of high quality and that are more readily absorbed by the body system in comparison to lower-quality nutrients of other non-food and food sources (Schönfeldt *et al.*, 2013).

Burgess *et al.* (1998) stated that with land and other vital resources readily available, home agricultural production is a major way to address deficiencies in the diet of poor

urban households. Globally, urban agriculture has been and still is one of the strategies poor urban and peri-urban residents utilize in mitigating poverty levels and improving their food security status (van Auerbeke, 2007). Chagomoka *et al.* (2015), found that livestock and crop production contribute to household food and nutrition security (FNS) at different levels.

Other studies have shown that South Africa is similar with its poor residents in the urban and peri-urban areas who utilize livestock and crop production as a poverty reduction strategy. According to van Auerbeke (2007), a major percentage of urban farmers conduct food production in their places of residence as a survival strategy and not for commercial use or as enterprises. Martin *et al.* (2000) also reported that in the South African cities of Cape Town and Pretoria, that urban agriculture was more prevalent in households with problems associated with no employment in the formal sector and was used mainly for home consumption, as this resulted in households reducing food costs. Besides food consumption and reducing food costs, the study also stated that there were other important local benefits found such as cultural, social, environmental, developmental, and aesthetic benefits. In addition, other benefits found were that urban farming helps farmers who have moved from more rural areas to recreate elements of their previous environment, which helps them cope better with the change, physically and socially. It also assists people as a coping mechanism with identity problems, especially women, as food production formed part of their traditional family roles (van Auerbeke, 2015).

Livestock products are accessible for the urban middle class, but this is not the case for the price sensitive poor, who are subjected to risky livestock consumption that occurs due to poor refrigeration, poor hygiene, and unregulated residue and toxin levels. Having no viable and dependable connections to agriculture, those poor urban dwellers with no access to urban farming practices do not have the nutritional benefit of animal products or the high-quality protein sources and so are then left vulnerable to disease and possible early death. Urban livestock farming provides the most cost-effective solution to this problem (Falvey, 2015).

2.5 Livestock food security strategies

Livestock has on a continuous basis contributed to human nutritional health and survival. The main livestock contribution, apart from it considered a “luxury” animal product consumed by the wealthy middle classes, is also for the pastoralists and

exclusive small holder or subsistence farmers that use such practices to help keep themselves and their family's food secure (Falvey, 2015).

Animal production systems are separated into four parts; landless systems, integrated farming, extensive, and intensive production, with each system contributing to food security (Robinson *et al.*, 2014). Land less systems are those whereby farmers have limited land and livestock is kept in limited space and mostly fed supplementary feed i.e. feedlotting. Intensive systems being those whereby animals are kept indoors, with environmentally controlled enclosures. Integrated or mixed systems include both extensive and intensive production systems combined at different stages of the production cycle (Robinson *et al.*, 2014). Intensive farming systems are those with minimal land and a high concentration of resources is focused in that land for production (Frona *et al.*, 2019). These systems are seen all over the world and examples still seen today. Such as the rural agricultural systems of Mongolia and Tibetan China, the mixed crop and livestock systems which encompass billions across most of the poor developing countries. There are also dairy herders that do not have land, milkers in India that make effort to ensure their neighbors have regular access to these high-quality protein sources in their diets. Also important are the intensive and sometimes commercialized production systems that provide low value byproducts to impoverished urban residents especially in China. Each system contributes to the food security of the vulnerable poor (Mearns, 2022).

Falvey (2015), continued to state that instead of assuming that systems such as these will eventually evolve into commercial agriculture, it would be better to rather address the needs of each animal production system individually and uniquely. This is because each system contributes differently to food security needs. The negative environmental impact of large-scale intensive production systems has been observed while addressing the need for animal products. This need is not only for the large-scale intensive production systems for the supply of larger markets but is also for the small scale and subsistence farmers as animal produce is also needed there. This means that rather than assuming that producing commercially is always the goal, it is important to remember that small subsistence farmers and their animals are providing for up to two billion small-farming families globally (Falvey, 2015). If urbanization were to take place and these families move to cities, what would then follow is the inevitable increase in food demand in urban areas which would not be able to be met. This is based on the current levels of production of broad commercialized agriculture and

would be the case even if all available land that was once worked by small scale farmers was utilized (Falvey, 2015).

Studies have shown that in poor countries with a significant part of the population existing in poverty, the ways to meet amino acid and micronutrient needs are done more easily with the use of livestock products (Bender, 1992; Ahmed *et al*, 2018; McCance and Widdowson's, 2002). Even small portions of animal products have shown nutritional benefits; for example, livestock meat products provide zinc and iron, and increase the absorbability of plant-based iron (Bender, 1992). Milk and meat supply vitamin B12, vitamin A, riboflavin and calcium is provided by milk. Deficiencies in iron impair brain development of 40 to 60 percent of the children of developing countries, affecting some 1.6 billion people (DeBenoist *et al.*, 2008), and has also been implicated in 20 percent of maternal deaths annually (UNICEF, 2007). Thus, ensuring a good source of small quantities of livestock products is vital to human health and food security. The efficient use of animal byproducts remains increasingly essential. For example, Chagomoka *et al.* (2015) found that livestock production contributes greatly to the reduction of food waste at household and commercial levels, particularly in the form of waste recycling. Households involved in livestock keeping were found to experience significantly less wastage compared with households not doing livestock keeping.

Another added benefit to household animal production is that animals graze and scavenge by themselves, although this is limited in urban livestock production and is greatly seen in extensive or rural areas. Studies have revealed that urban African residents are involved in agricultural activities that range from crop to animal production with the purpose of addressing food insecurity. Another strategy used by peri-urban residents that opt for livestock keeping rather than crop production is due to the large space requirement for most crop production activities compared to livestock pens (Chagomoka *et al.*, 2015).

Animal sourced foods have been said to contain vital micronutrients that are needed by the human body and which are much more readily available compared to their non-animal-based counterparts, such as iron in organ meat (liver, heart and blood-based foods) (FAO, 2011). This has been a successful strategy in assisting to have effective food security. Schönfeldt *et al.* (2013), revealed that in addition to the quantity of the nutrients, the high-quality nutrients found in livestock product sources were important

for human consumption as the high quality contributed significantly to how readily available these nutrients were when absorbed into the body compared with lower quality sources found in food and non-food items.

2.6. The role livestock has played in society.

Livestock play a crucial role in meeting multiple developmental objectives and while doing this also contributing to food security. Internationally, animal production is important as it provides about 30% of protein and 20% of food energy. These figures don't reveal the greater value livestock truly has to those that own them, this especially to the globally impoverished whereby animals are more than just meat but at times, even valued labour. It doesn't reveal their higher value to the poor, as this is about the relative excess consumption of livestock products in some diets, nutrient deficiencies in others, geographical distribution and cultural dietary differences (CGIAR, 2008).

There are new global concerns about livestock production related to their contribution to global gas omissions. Livestock production that is non-commercial and practiced by the rural poor is not a major contributing factor as they do not consume a lot of grain and are thus not a major source of risk of greenhouse gas emittance. The complaints in relation to livestock production are more relevant to larger commercial systems used to feed cities. In fact, small scale or mixed small farming systems usually in peri-urban and rural livestock production, are really evolved efficient systems that are understood by nomads and farmers that practice in a way that has been forgotten by franchised, narrow, commercial practices that underestimate the role of sheep, cattle, goats, rabbits, poultry, rodents, buffalo, native pigs, yak, reptiles, camels, horses, fish, insects, cattle providing milk, meat and offal, as well as other food products from areas outside of bigger markets (Napogbong *et al.*, 2021).

The livestock keepers that service such 'markets' are not the same as the ones in commercially linked systems. For example, they view dung not only as manure, but also as a useful tool in their households that serves as a material for construction in their houses and as a cooking fuel; the livestock as not only for production but for ploughing and working mills, packing, and traction, while providing a regular financial income and nutritional contribution from other products produced such as blood, hair, eggs and milk (Falvey, 2015). Livestock keepers prefer smaller breeds than larger ones to lower the risk of loss if an animal is lost; and may see animal meat as an end-of-life byproduct. Milk to them may be seen as more than a liquid drink, but rather a

daily staple food, especially when mixed with other staple foods, and in the South African context for example, turned to sour milk called “maas” which is consumed on a regular basis. Livestock keepers also know that the monetary value of an animal set by the urban market often understates its economic value, especially to the livestock keepers and the societies these animals serve. The financial value of the livestock to the subsistence farmers is far less than the value it holds as a source of meat, milk, hides, wool/hair, byproducts, transport, draught power, fuel, savings, investment, risk mitigation status and traditions (Falvey, 2015).

With meat consumption expected to increase more in developing than developed countries, as indicated in Table 2.1, it is now even more important to view the potential roles of livestock food products in the diets of poor urban residents.

Table 2.1: Projected rise in meat and dairy product consumption

Product	World consumption (t x10 ⁶)			Developing countries (t x10 ⁶)		
	2010	2050	% Rise	2010	2050	% Rise
All meat	269	464	173	158	330	209
Dairy (not butter)	657	1038	158	296	641	216

Source: FAO (2011).

Average national food consumption figures suggest that the consumption of animal products increases with the increase in income (Delgado, 2003). However, the national statistics do not show variations within countries and simple relationships between income and animal product consumption can also not consider the cultural taboos found in societies such as in Muslim communities and their non-consumption of pork, or social changes, or for example Thailand where they are traditionally a society that does not drink milk but changed to one. With milk being largely drank in schools, 25% of national milk consumption occurs in urban areas compared to between 1% and 9% elsewhere in the country (Griffin, 2004). Livestock production supply about 13% of global calorific intake and about 28% of protein, which shows the significance of livestock products. Widespread misinformation of vegetarianism in India, for example, means that the country’s role in being the world’s leading dairy product producer and consumer is usually ignored (Falvey and Chantalakhana, 1999).

Livestock production has also increased substantially in East and Southeast Asia in recent decades while production in sub-Saharan Africa has lagged behind. Production systems that are intensive are the ones mostly responsible for this increase. China on its own is responsible for the production of about 70 million tons of eggs and 15 million tons of poultry meat while India on the other hand only produced 3 million tons of eggs and 0.6 million tons of poultry. With that being said, poultry production in India is also quickly on the rise and its consumption now stands at 50% of livestock protein consumed per person in 2003 compared to 22% in 1985 (Pica-Ciamarra and Otte, 2009). In Thailand, between 1996 and 2002 the Vietnamese increased consumption of dairy products by 300% (Garcia *et al.*, 2006). In India, which is traditionally a dairy producing country, consumption of poultry increased from 178 grams per day in 1992 to 258 grams per day in 2009 (NDDDB, 2010). While these occurrences are less prevalent in more impoverished Asian countries like Bangladesh (Halderman, 2005), the increase in production and in consumption of livestock products in Asia is of notable significance.

The total of livestock products to absolute food security from three livestock systems (pastoral, small scale farms, and urban livestock) might be about 1.5 billion individuals. This means that had these people not had these sources of animal protein as part of their diet, they would be nutrient deficient and left vulnerable to nutrient deficiency diseases (Falvey, 2015). Including both intensive and extensive farming, these systems have produced about 19% of global meat production and about 12% of milk production. On the borders of Asia, systems like these in Australia have made Australia the world's largest exporter as 45% of their total production is for export (MLA, 2011).

Animal production on the household level still plays an important role in modern day society to a large number of people globally. The benefits are not only quantifiable in terms of financial gains which are uses for many household needs. For example, income acquired from even seasonal production can be used for food purchases, for food not able to be produced in the household by farmers (e.g., sugar, cooking oil and salt) and it also contributes to meeting other household financial needs such as payment of school fees. Animal production also plays other significant roles in the household. Therefore, it is imperative that further research studies are performed to improve these production systems and that their impact is evaluated in our ever-changing society. It is estimated that the 1.5 billion people that are benefiting from the

use of livestock products may be disadvantaged if extant pastoral and small-scale farms are not assisted with animal science research and also in food security plans on the national, international and governmental level due to the low number of studies that has been conducted in this field (Falvey, 2015).

2.7 Review of literature of the study area

During the apartheid years in South Africa, peri-urban areas called townships were segregated areas for non-white residents surrounding towns and cities. These areas were and still are areas with high poverty levels. People often came to townships from different rural areas with knowledge of farming systems and relied on them for food security.

Due to the high current unemployment rate and poverty in these areas, dwellers practice agriculture in the form of crop and livestock production. Urban agriculture has also been identified by different formal structures such as government and NGO's, to aid in addressing growing urban food insecurity (MFAKU, 2019).

Botleng is a peri-urban area in South Africa. It is situated in the Victor Khanye local Municipality, Mpumalanga Province, one of the nine provinces of the Republic of South Africa. It is under a predominantly agricultural town called Delmas, which is heavily involved in both crop and livestock production activities.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The following section will describe the systems applied to investigate the contribution of peri-urban livestock production on the food security of farmers in the township of Botleng. It shows the methods used in attaining the desired outcome including a description of the study area, the process of choosing the research design, the data collection method used, the ethical considerations, and the data analysis.

3.2 Study area

Agriculture plays an increasingly important role in the South African economy as the industry keeps on growing. Townships form a large part of the peri-urban areas in South Africa. A quarter of South Africa's population live in the 76 biggest townships. Township areas were formed in the late twentieth century during the apartheid years and were areas of racial segregation formed by the then apartheid Government (Averbeke 2011). Townships are often very underdeveloped, peri or semi urban areas, with high levels of poverty.

This study was conducted in the township of Botleng, a medium sized township in the small town of Delmas under the Victor Khanye local municipality. The study area was selected as it had a good source of livestock farmers. The town of Delmas is primarily an agricultural hub with a high number of farmers in crop production, so it creates a conducive area for livestock production, as it has relatively easier access to feed and also has nearby auctions for easy buying and reselling of livestock. Delmas is a small maize farming town in the Nkangala District of the Mpumalanga Province of South Africa, largely known for wheat, potatoes, and chicken farming (Figure 1).

Botleng is an example of agriculturally inclined townships that exist in South Africa. It has a population of 44,727 people and is a vibrant agricultural community, especially in terms of livestock husbandry (STATS SA, 2011). This is mainly because it has two animal auction houses for people who wish to sell their animals. It caters to locals and people from other provinces in South Africa which auction their animals there. It has high poverty levels which can be linked to a high crime rate and high unemployment numbers.

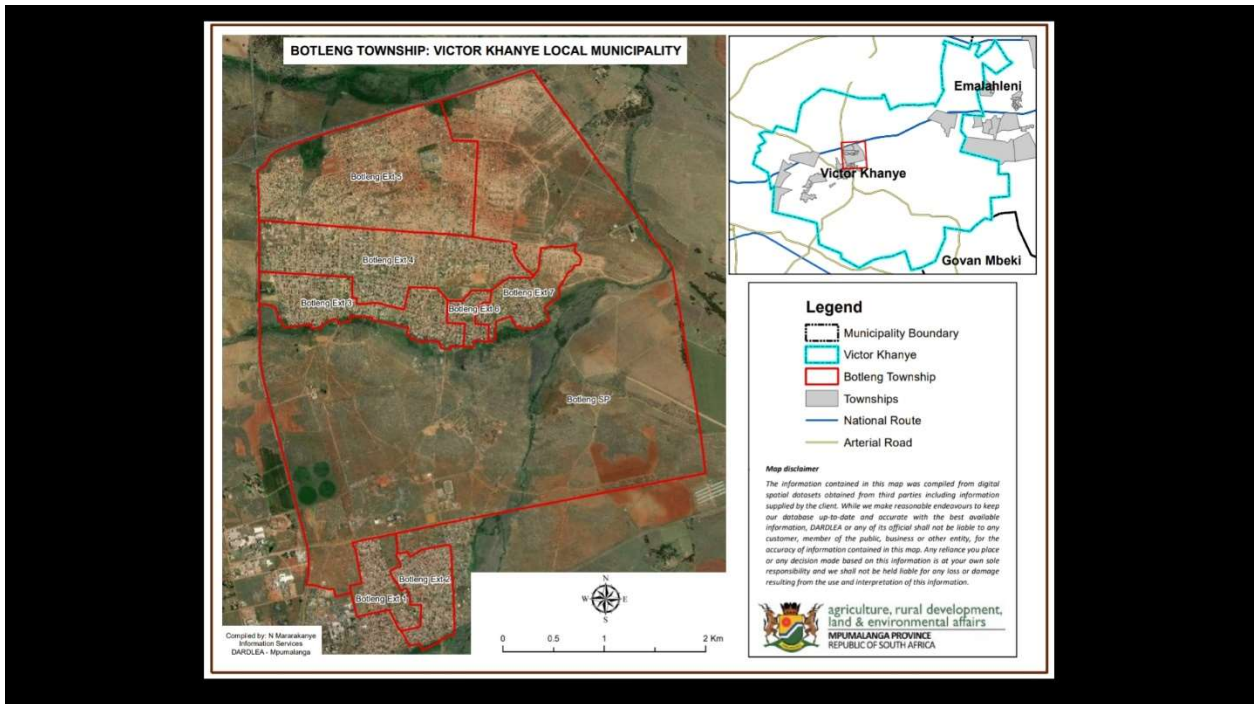


Figure 3.1: Aerial top view map (Botleng)

Source: Google maps. Accessed on 22/06/2020.

3.3 Research design

The study was conducted during the COVID 19 pandemic and as the disease was a worldwide pandemic with transmission taking place, amongst others, through human to human and human to animal interaction (WHO, 2020) the study was adjusted to suit South Africa's latest mitigation strategies for the virus. Thus, both telephonic and face to face interviews were conducted.

The research design chosen was a quantitative survey method, which was suitable to this type of study as it required human interaction answers. The study needed to answer the research questions through responses from farmers who had households from the area of Botleng township and who were involved in livestock production.

The study adopted a simple random sampling method. A farmer database of the study area was acquired from the Department of Agriculture Rural Development Land and Environmental Affairs' extension division and respondents randomly selected. A random selection was done using Microsoft Excel and bias eliminated by giving each farmer an equal chance to be selected. As the goal of sampling strategies is to acquire a significant sample that can represent the collective population of interest (Dillman *et al*, 2014), this method therefore sufficed.

The following formula was used to calculate the amounts shown in Table 3 that determines sample sizes in a given population number (Krejcie and Morgan, 1970):

$$S = \frac{X^2NP(1-P)}{D^2(N-1) + X^2P(1-P)}$$

Where:

S = Required sample size

X = Table value of chi-square for 1 degree of freedom at the desire confidence level

N = Population size

P = Population proportion

D = The degree of accuracy expressed as a proportion

According to Yates *et al.* (2008), one of the traits of random sampling is that every individual in the target population will have the same opportunity of being chosen as any other local individuals.

There were 150 small scale livestock farmers in the study area. Using Table 3.1 a sample size of 108 was generated.

Table 3.1: Table for determining sample size from a given population.

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2 800	338
15	14	110	86	290	165	850	265	3 000	341
20	19	120	92	300	169	900	269	3 500	346
25	24	130	97	320	175	950	274	4 000	351
30	28	140	103	340	181	1000	278	4 500	354
35	32	150	108	360	186	1100	285	5 000	357
40	36	160	113	380	191	1200	291	6 000	361
45	40	170	118	400	196	1300	297	7 000	364
50	44	180	123	420	201	1400	302	8 000	367
55	48	190	127	440	205	1500	306	9 000	368
60	52	200	132	460	210	1600	310	10 000	370
65	56	210	136	480	214	1700	313	15 000	375
70	59	220	140	500	217	1800	317	20 000	377
75	63	230	144	550	226	1900	320	30 000	379
80	66	240	148	600	234	2000	322	40 000	380
85	70	250	152	650	242	2200	327	50 000	381
90	73	260	155	700	248	2400	331	75 000	382
95	76	270	159	750	254	2600	335	100 000	384
Note: N = Population size and S = Sample size									

Source: Krejcie and Morgan (1970)

3.4 Data collection

After the process of simple random sampling of the identified livestock farmers in the area, data collection was conducted by firstly giving the livestock farmers a choice of whether they would like the interview to be conducted telephonically or face to face at their places of residence. This was done due to the COVID pandemic that was in South Africa at the time. Households were defined as individuals who usually live together

and usually share the same bundle of income. Interviews were conducted with the head of households which were defined by the households themselves.

A questionnaire was formulated and used as an instrument to collect primary data in this study. The questionnaire consisted of a set of questions designed by the researcher, including demographic questions and questions pertaining to the household to better understand the farmers. Thereafter, a standardized household food insecurity access scale (HFIAS) was administered to the respondents to determine the food insecurity levels of the households. This is because the HFIAS ensured validity and reliability of the information acquired in answering the research questions as it gave responses specific to the aim of the study. Lastly, information on activities related to livestock production were also collected using a designed questionnaire which comprised a set of formulated questions.

3.5 Ethical considerations

The study received ethics approval from the UNISA-CAES Health Research Ethics Committee on 12 April 2021 and was conducted following the UNISA ethical guidelines for research involving human participation. The considerations included: autonomy, a participant's right to informed consent, anonymity, confidentiality and to discontinue participation. Farmers were read the ethical statement before the commencement of any interview, which outlined their options, and they were given the choice of whether to continue or not with the interview. The ethics statement depicting their rights approved by the UNISA Ethics Committee was read to each willing participant who were given the opportunity to indicate if they require the results of the study. To participants who wished to be informed about the results of the study, copies of the results are to be made available upon completion of the study.

3.6 Data analysis

After acquiring the demographics of livestock farmers in the area and the contributions that livestock production contributes to households, the quantitative answers provided by participants in the interviews were transformed to categorial or dummy variables (Table 3.2) where the appropriate descriptive and simple data analysis was performed on the categorial and numerical values (Graefe, 2008). The SPSS version 28 software tool was used to analyze the data.

Table 3.2: Variables

Variables	Variable Explanatory							
Current age	Years in numbers (Continuous)							
Age group	0= 20-30	1= 31-40	2= 41-50	3= 51-60	4= 61-70	5= 71-80	6= 81-90	
Gender	0 = Male or 1 = Female							
home language	0= Isizulu	1= Ndebele	2= Sesotho	3= Swazi	4= Tsonga	5= English	6= Other	
Other	Type of Language (Alphabetic)							
employment status	0= Employed 1= Self Employed 2= Unemployed							
type of livestock	0= Cattle	1= Goats	2= Sheep	3= Swine	4=poultry	5= Other		
Other Specify	Type of livestock (Alphabetic)							
Livestock contribute Financially	0= yes 1 = no							
does the money contribute to the buying of food	0=yes 1=no							
other benefits	0 Social	1 Inter- Agricultural	2 Waste Prevention	3 Other				
Other Specify	Other contribution (Alphabetic)							
Sufficient food worries	0 = No (skip to Q2) 1=Yes							
Frequency	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)							
Presence of Food Variety	0 = No (skip to Q3) 1=Yes							
Frequency	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)							

Limited variety of foods due to a lack of resources	0 = No (skip to Q4) 1=Yes
Frequency	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
Limited food preference	0 = No (skip to Q5) 1=Yes
Frequency	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
Reduced Food portion	0 = No (skip to Q6) 1=Yes
Frequency	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
Reduced meals in a day	0 = No (skip to Q7) 1=Yes
Frequency	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
No food variety	0 = No (skip to Q8) 1=Yes
Frequency	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
Hunger for one night	0 = No (skip to Q9) 1=Yes
Frequency	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)

Hunger for one day and one night	0 = No (End of questionnaire)	1=Yes
Frequency	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	

The responses to the demographic questions and the questions about livestock production were collated and categorized and grouped according to the different responses using SPSS version 28.

The United States Agency for International Development (USAID) is an independent agency of the United States federal government and is primarily responsible for developmental assistance and administering civilian foreign aid (USAID, 2020). It has a Food and Nutrition Technical Assistance (FANTA) project which has supported different research initiatives that test and explore the different options available for obtaining simple, but methodologically rigorous, indicators of household food insecurity, referred to as the household food insecurity access scale (HFIAS) that can be used to monitor, guide and evaluate program interventions (FANTA, 2007). The FANTA project created a set of questions that can be used in different countries and different cultural environments to differentiate food secure from insecure households. The questions represent universal concepts of household food insecurity (access) experience and can be used to assign households and populations in a continuum of severity, from food secure to severely food insecure (FANTA, 2007).

To determine food security status and their levels, the Household food insecurity access scale (HFIAS) version 3 questionnaire, a pre formulated set of questions used to determine the food security state of the chosen households was used. It is similar to the approach used in estimating the status of food insecurity in the United States of America on an annual basis. This method is based on the idea that the experience of food insecurity causes predictable common reactions and responses which can be recorded and quantified through a survey and summarized in a scale to determine food security status along a status continuum (FANTA, 2007). This method was effective in determining whether households were food secure or not.

The HFIAS questionnaire comprises a series of nine questions about the past four weeks behaviors and attitudes that relate to the food security of the household, which are each followed by “severity of occurrence” questions that ask how frequent the particular occurrence took place (Coates *et al.*, 2007). The HFIAS is then scored, using the severity of occurrence questions, whereby the respondent is asked if a particular occurrence happened rarely (once or twice), sometimes (three to ten times) or often (more than ten times) in the past four weeks. The HFIAS is scored from the answers given for the severity of occurrence questions as follows (FANTA, 2007):

- Rarely is given a score of 1
- Sometimes is given a score of 2
- Often is given a score of 3

This should give a total score from 0-27; the lower the total number the better the household food security and access situation and the higher the number the worse it is. This means that those scoring lower had a better food security and access situation in their households and the higher score means that the household food security and access situation would be worse. Therefore, the HFIAS has a scale that measures the food security situation in a particular household and at the point of completion of the questionnaire the outcome is analyzed with households being assigned a category in the scale of (Coates *et al.* 2007):

- Food secure - Does not or rarely worries about food shortages.
- Mildly food insecure - Sometimes or often worries about having enough food.
- Moderately food insecure - Sacrifice quality more frequently.
- Extremely food insecure - Cutting down meal size of the number of meals.

For the purposes of this study, households were divided into two groups, in order to differentiate between food secure and food insecure. The food secure households were those found to have been categorized as rarely or not worrying about food shortages. This is similar to a study by Khumalo and Sibanda (2019).

CHAPTER 4

RESULTS AND DISCUSSION

The current section describes the results and discussion of the study conducted. First the demographic results of the respondents are presented, followed by their food security status determined using the food access questions that were conducted through the HFIAS questionnaire, followed by the discussion of the results. The results of the financial contribution of livestock production in the respondents' households are last, accompanied by a discussion.

In this chapter the findings of the study are presented and discussed according to the four objectives listed in chapter one section 1.4.2. The analysis is based on the following objectives:

- Demographic and socio economics characteristics of the respondents
- Status of food security of respondents
- The contribution of peri-urban livestock farming on food accessibility of the respondents
- The financial contributions acquired through livestock production.

4.1 Socio economic characteristics and demographics of the respondents

The information gathered regarding the demographics of the group of livestock farmers, was interpreted as follows:

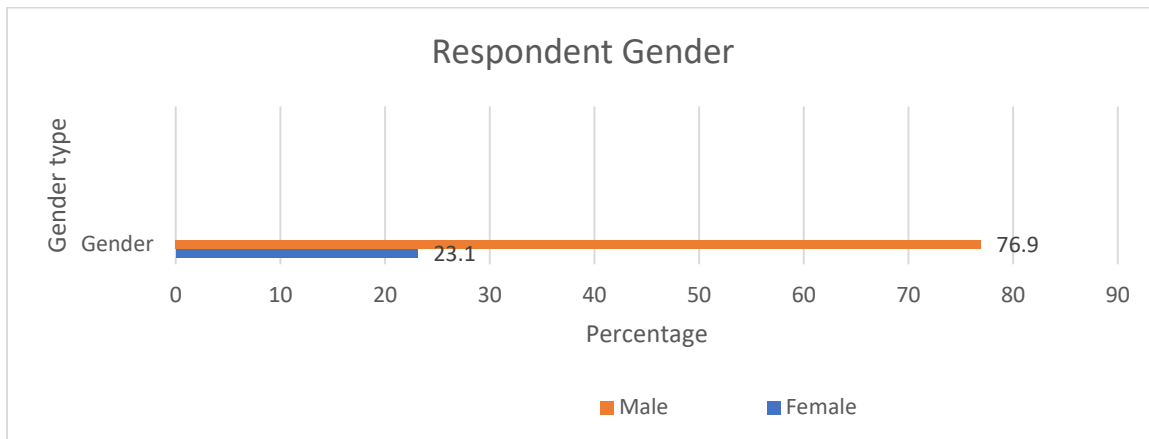


Figure 4.1: Gender dynamics of the respondents

Figure 4.1 depicts that the gender dynamics of the respondents was 23.1% women which were 25 in number. It also showed 85 were males which was 76,9%. This shows that the majority of the respondents were males and that females were least. This is prevalent in most cases where livestock production is involved and was also the case in a study by Yotas and Vuyiseki (2022), where it was found that men were more involved in livestock farming in comparison to women. Males have been the primary care givers and owners of livestock in traditional households and females in most cases receive ownership consequentially, for example, through the death of a spouse. The difference in numbers is large between the two genders.

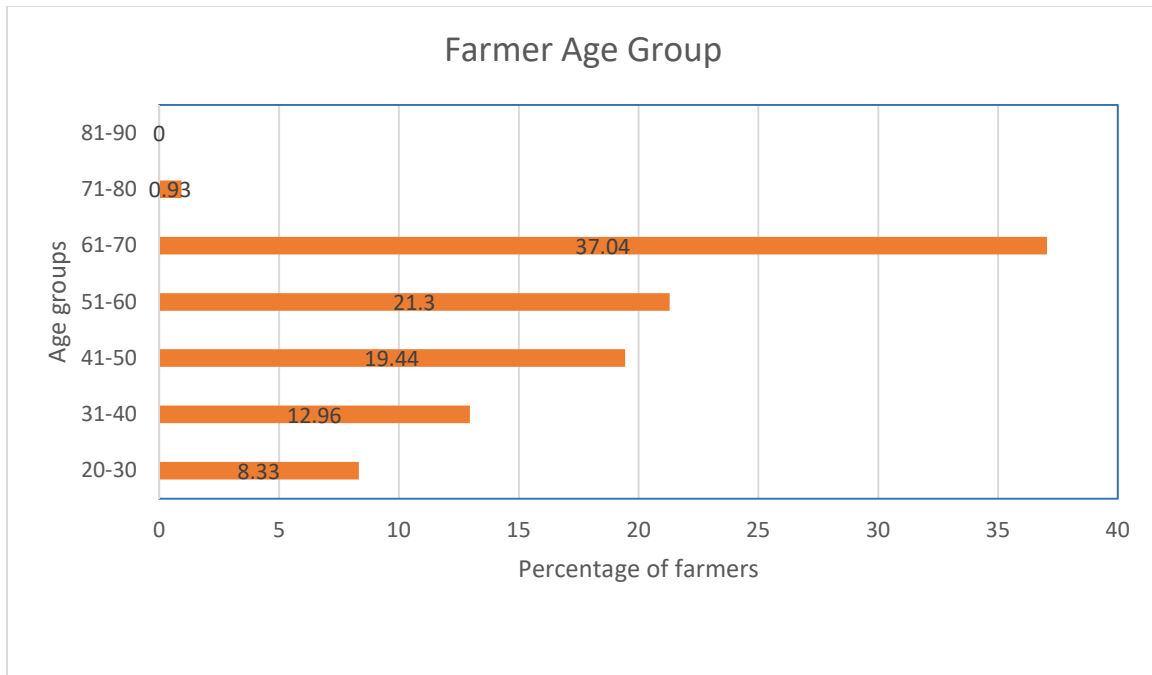


Figure 4.2: Percentage of age group of the respondents

Figure 4.2 which shows the age dynamics, reflected that the majority of the farmers/ livestock owners were in the age group between 61-70 years which are mostly retired elders in the community at 37.04%, followed by 51-60 years at 21.30%, then by 41-50 years which accounts for 19.44 % of the respondents, and then by the 31-40 age group with 12.96%. The next group was 20-30 years which had the least number of respondents at 8.33%, reflecting a low interest in livestock production amongst the youth of the area. The group that followed was 71-80 years which had one respondent which accounted for 0.93%. It showed also that zero respondents were reported above 81-90 years.

The results show that youth are lacking in livestock production in the area, the number of youths is few compared to adults, which is a concern for the future of livestock practice in Botleng. The reason could be because youth don't view the practice positively as a viable career and livelihood option. This is consistent with the findings of Molieleng (2022) and Bahta (2022) where youth were much less than adult livestock farmers. This was also found by Metelrkamp *et al.* (2019), where less youth were farming and they were preferring other industries in a study conducted in another area in South Africa.

Table 4.1: Statistics of the current age of the respondents (n = 108)

Current age		
N	Valid	108
	Missing	0
Mean		51.95
Std. Error of Mean		1.265
Mode		61 ^a
Std. Deviation		13.142
Minimum		20
Maximum		70

Source: Field Research data (2021)

As shown in Table 4.1 the average age that was found was 51.95, which could be rounded off to 52 years of age. This was also found to be the average age by Bahta and Vuyiseki (2022). This shows that the majority of the respondents are adults who are either retired or nearing retirement. It was found that the youngest in the group was 20 years old and the oldest was 70 years old. The standard deviation between the ages was high at 13.142 years which could be rounded to 13 years. This shows that middle aged individuals are less in numbers while individuals in the mature years are the major partakers.

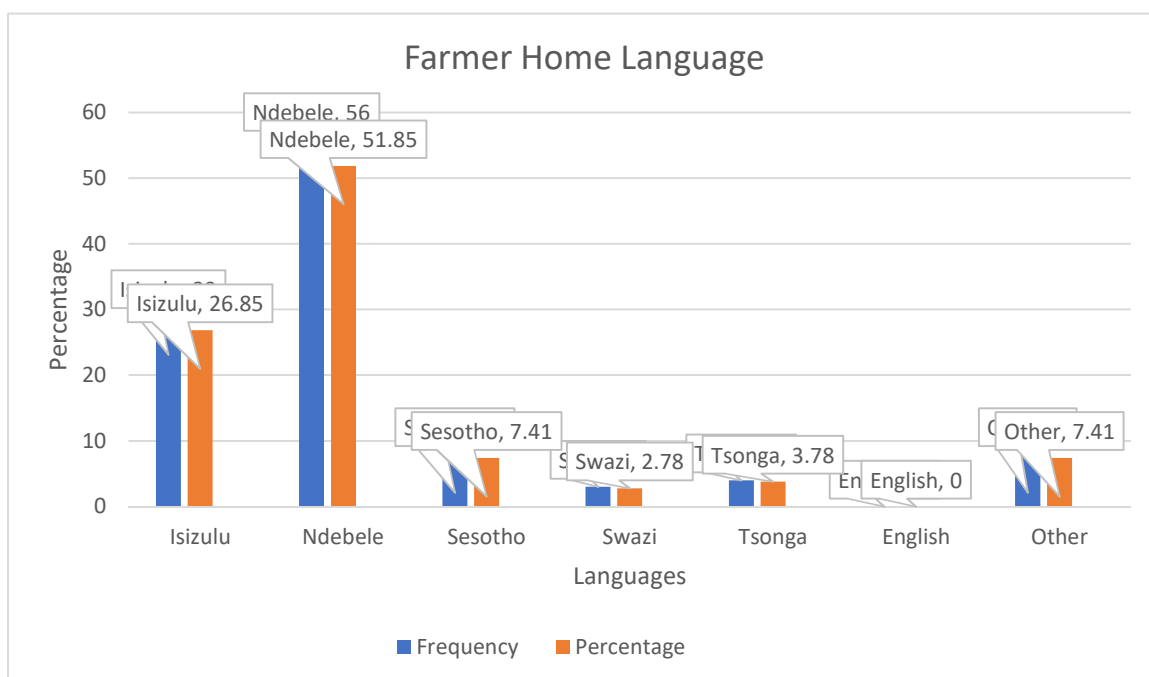


Figure 4.3: The home language of the respondents

Figure 4.3 reflected that most of the respondents spoke Ndebele, which was 56 of them, which made up 51.85 % of the respondents. The next was isiZulu which were 29 respondents and which made up 26.85% of the respondents. Following this were eight Sotho respondents which made up 7.41%. Then was the Tsonga language with four respondents, at 3.70% of the total. This was followed by the Swazi language with three respondents, which made up 2.70% in the total. Other languages not listed made up 7.41%, which was eight respondents. This is not surprising as the area is predominantly occupied by Isizulu and Ndebele speaking individuals (Census, 2011) and the mix in languages is because the Victor Khanye Municipality is based near the provincial border that separates the Mpumalanga and Gauteng provinces.

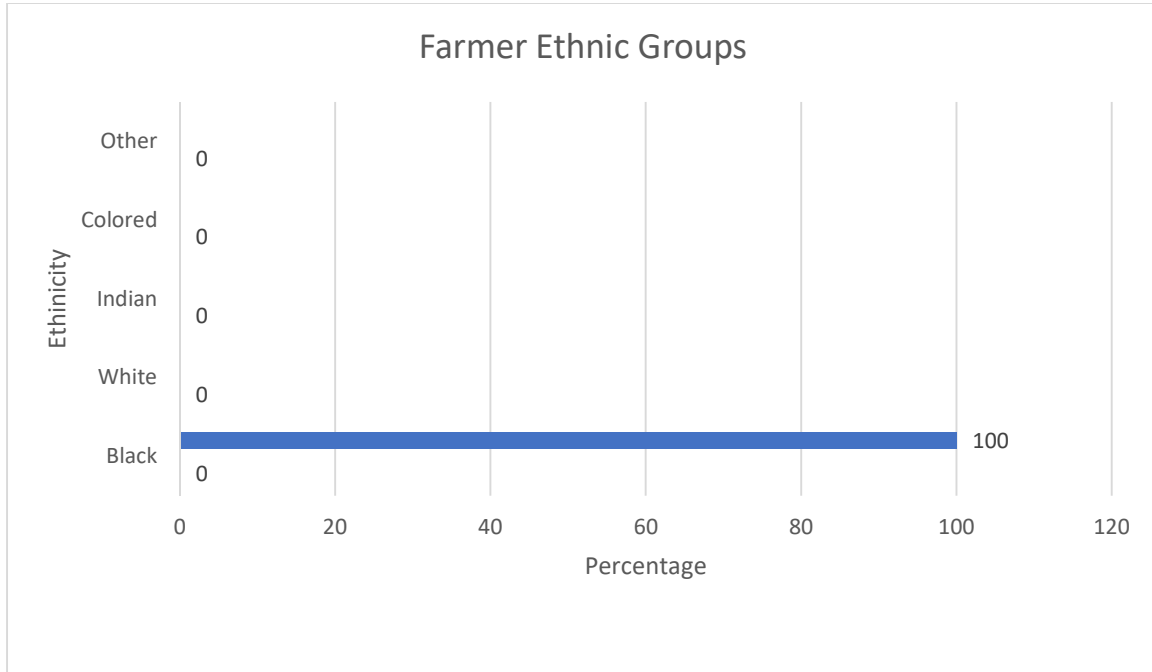


Figure 4.4: The ethnicity of the respondents

Figure 4.4 showed that the only racial group that was found was black which comes as no surprise as the area is predominantly a black community (Census, 2011). Therefore, all 108 of the respondents were black, which accounts for 100%. This is consistent with the results of Molieleng (2022) which focused on livestock farmers in a peri-urban area in South Africa. These areas are ones that are predominantly occupied by black South Africans due to racial segregation that exists in the residential areas of the country, stemming from the previous apartheid years.

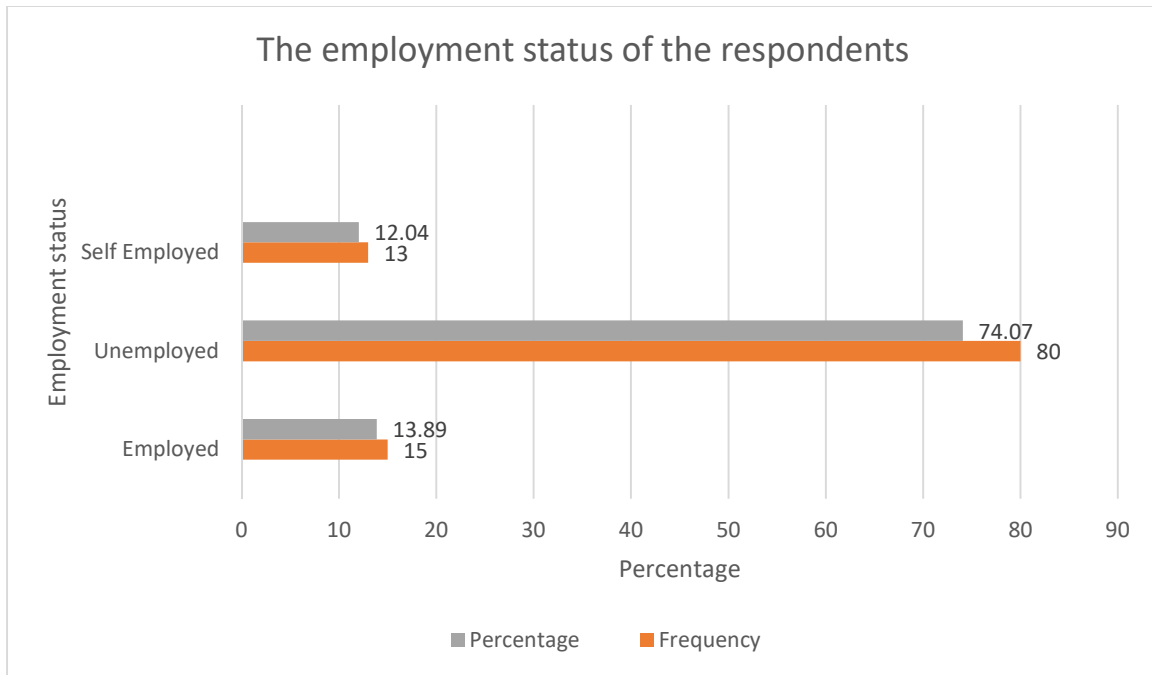


Figure 4.5: The employment Status of the respondents

Figure 4.5 showed the majority of the respondents were unemployed at 74.07% followed by the employed which were at 13.89%. Those that were self-employed were found to be at 12.04%. This means that most of the unemployed residents of the Botleng area use livestock farming as means to have household income and make a living from the sale and slaughter of livestock for food.

This is consistent with the results attained by Molieleng (2022), where 72% of the livestock farmers in her study were not formally employed nor ran businesses, and received income from livestock practices, and some with the assistance of other sources such as social grants. This is also consistent with the results of Myeki and Bahta (2021), which stated that farming was treated as a business entity and found that 86% of the livestock farmers in their study depended solely on farming as their means of income. This implies that if the conditions are right (proper markets) farmers use livestock production as a business and use it for the livelihoods of their families. This was also the case with the farmers in the Botleng area, the markets were in place and more farmers were conducting the practice as a business rather than just owning cattle but using the practice to make an income for themselves.

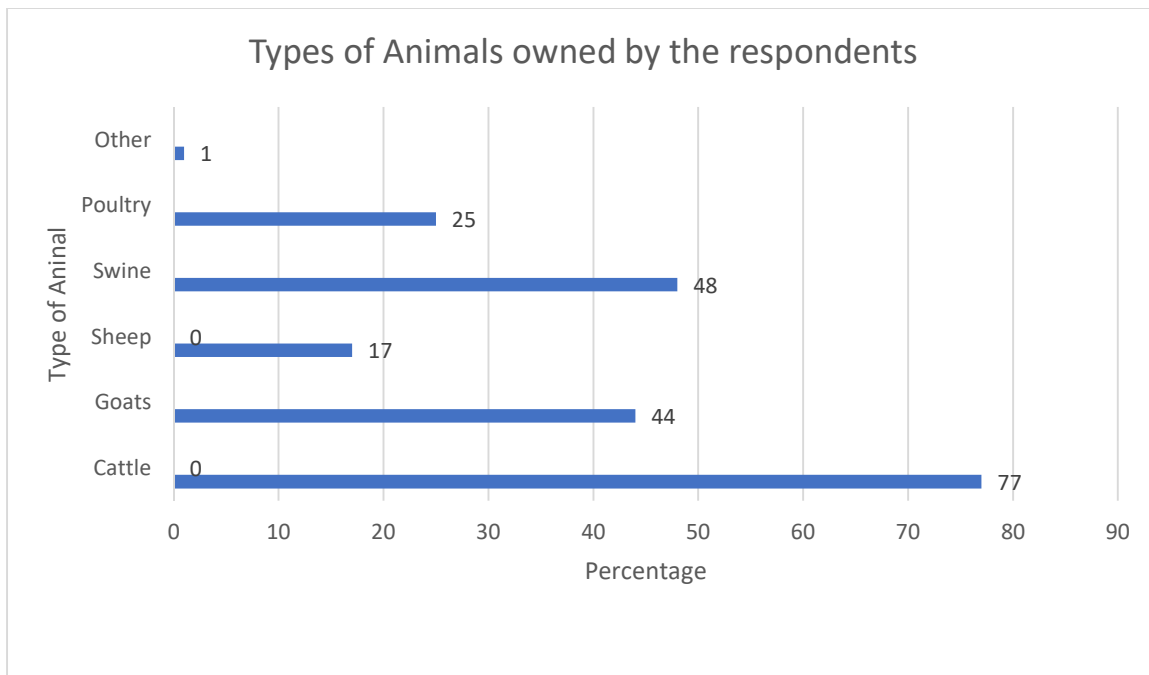


Figure 4.6: Types of Animals owned by the respondents.

Figure 4.6 showed that the majority of owned livestock in the area were beef cattle which made up 77% of the respondents, followed by pigs which was 48%, goats at 44%, poultry owners at 25%, then sheep at 17%, and 1% of the respondents owned other types of livestock besides the animals included on the questionnaire. The top two owned were cattle and swine which were also owned together in a lot of the cases as farmers mostly owned a combination of animals rather than a single type. This is consistent with the findings of Taruviga *et al.* (2022), that stated that cattle and swine were mostly found together because they share a lot of related production activities and costs and these can be spread between them to create positive synergy.

4.2 The food security status of the respondents

The HFIAS questionnaire is a prepopulated questionnaire that was formulated to determine the food security status of a household through determining the level of food access of a particular household. It has questions that assess the household member's level of food anxiety with regard to the household's food access (FANTA, 2007). It was developed by the Food and Nutrition, Technical Assistance (FANTA) project because formerly, information on household insecurity was difficult and costly to collect (Kennedy and Haddad, 2011).

The questionnaire offers a set of nine questions about the occurrences in the household in the past four weeks or a month, which require a yes or no answer on occurrences related to food access and anxiety related to food access in the household. Each question is then followed by a severity question of how often a particular incident occurred, in the order of rarely, sometimes and often. Table 4.2 details the nine questions in the questionnaire:

Table 4.2: The nine occurrence questions of the HFIAS

Question no.	Occurrence question
1	Anxiety about insufficient food
2	Unable to consume preferred food
3	Consume a restricted variety of food
4	Compelled to eat certain food
5	Eat smaller meals
6	Eat fewer meals a day
7	The household does not have any food of any kind
8	Go to bed hungry
9	Eat nothing for a whole day and a whole night

Source: Bahta (2022)

For the main questions no score is given, as it is the severity questions that are given scores with rarely scored as 1, sometimes as 2 and often scored as 3. At the end of the questions a score out of 27 is calculated. In determining food security status, for the scale from 0 to 1 the household is considered to be food secure and 3 to 27 the household is considered to be food insecure. For those that are food insecure the HFIAS then further groups respondents on whether they are mildly food insecure, moderately food insecure and severely food insecure, but for the purposes of this study only two categories were considered which are food secure and food insecure. The respondents were asked the questions and the nine questions were divided into three different themes which are (Coates, 2004; FANTA, 2004; Devereux and Tavener-Smith, 2019):

- A measure of anxiety about access to food (Question 1).
- A measure of adequate quality of the diet (Questions 2-4).
- A measure of adequate food consumption (Questions 5-9).

After the results are described, the discussion will follow and will be based on the three themes. Figure 4.7 is a representation of the respondent's responses to each of the occurrence questions, and their severity:

4.2.1 Theme 1: A measure of anxiety about access to food (Question 1)

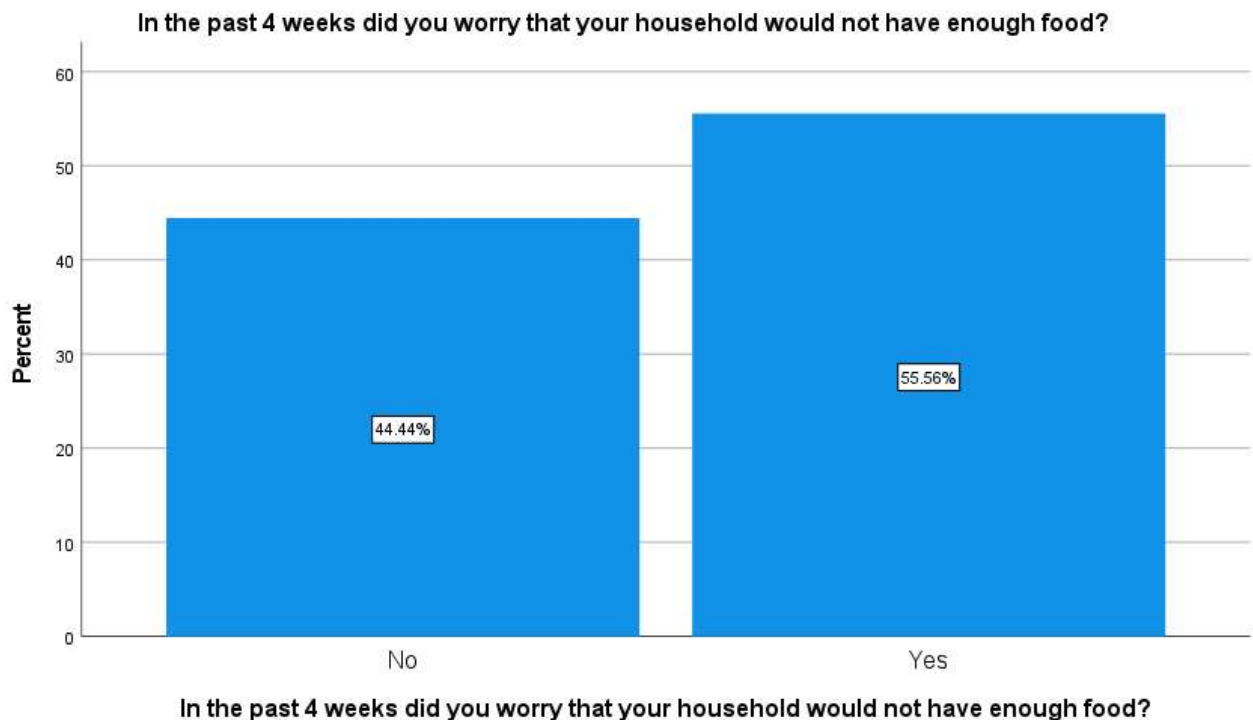


Figure 4.7: In the past 4 weeks did you worry that your household would not have enough food?

In Figure 4.7 respondents were asked whether or not they had to worry that their household would not have enough food in the past four weeks and 44.44% were found to have indicated no and 55.6% indicated yes, they did worry. This suggests instability in the consistency of food access in the households of the area. This suggests 55.6% of the respondents had a level of anxiety, concerning their households' ability to access food while 44.4% did not experience this.

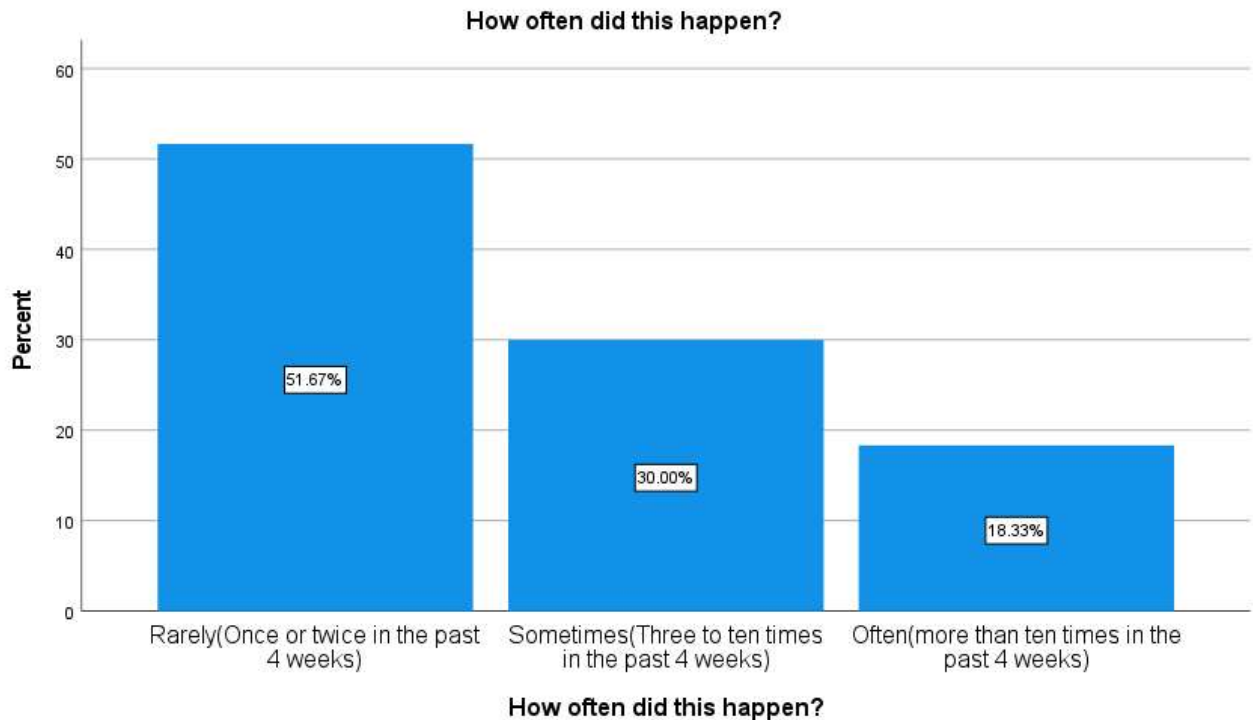


Figure 4.8: How often did this happen?

In Figure 4.8 the respondents that indicated that they did worry in the past four weeks, were further asked how often they had to worry. It was found that 51.7% of them indicated that this rarely happened, 30% indicated that this happens sometimes, and 18.3% indicated that this happens often.

4.2.1.1 Discussion of theme 1: Measure of anxiety about food access (Question 1)

This question is a measure of the anxiety of the respondents' anxiety surrounding their households' ability to access food (Masekoameng, 2015) using the conceptual idea that food insecurity causes universal experiences and reactions which can be measured, coded, and used to measure the households' level of anxiety around food security (Sakyi, 2012).

It was found that more than half of the respondents (55.6%) indicated that in the past four weeks they did worry that their households would not have enough food. This is consistent with the results attained by Modibedi (2018), in another urban area in South Africa. Similarly, Bahta (2022), also conducted research on livestock farmers in South Africa and found similar results where most of the respondents were anxious as to where their next meal would come from in the past four weeks. This was due to the

inconsistency of food being received by the household which increased anxiety amongst the respondents as to whether the household will receive food on a constant basis. This can also be due to livestock production not being a daily trade but more of a seasonal trade i.e., when livestock has reached a point of ready for sale. Furthermore, some of respondents were also not employed so had limited means to receive income to buy more food should the need occur.

In the severity question 51,67% of the respondents responded that this took place rarely, 30% reported that this took place sometimes and 18.33% responded that this took place often. This showed that worry regarding food access amongst communities that are impoverished is usually observed and this could leave them vulnerable because of this instability (Owino *et al.*, 2014). The results of this section reveal moderate food insecurity which is consistent with the results of Modibedi (2018), which showed that respondents who experienced anxiety was also just above half but was contrary to the results of Masekoameng (2015) and Bahta (2022) where the food insecurity was found to be higher.

4.2.2 Theme 2: Measure of adequate food quality (Question 2-4)

The following set of three questions are centered around the theme of measuring the adequacy of the food in terms of its quality in the respondents' households in the past four weeks. Respondents were asked questions related to:

- Food preference
- Food variety in the household
- Food restrictions due to lack of resources (Devereux and Tavener-Smith, 2019).

Respondents were asked these questions based on their experience in the household in the past four weeks. Their responses were shown as follows in Figure 4.9:

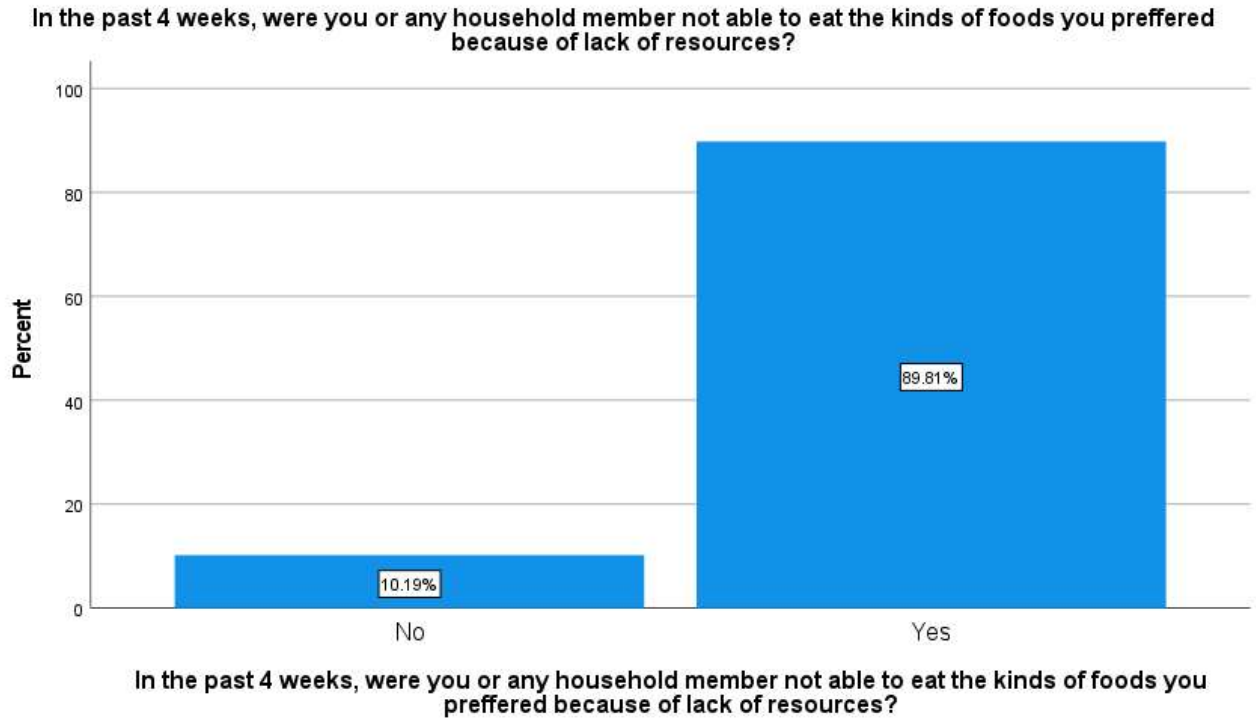


Figure 4.9: In the past 4 weeks, were you or any household member not able to eat the kinds of foods you preferred because of lack of resources?

In Figure 4.9 respondents were asked if in the past four weeks, were they or any household member not able to eat the kinds of preferred foods because of lack of resources. Their response was recorded, and it was found that 89.8% said they were not able to eat the kinds of foods they preferred because of lack of resources and 10.2% indicated that they did not experience this.

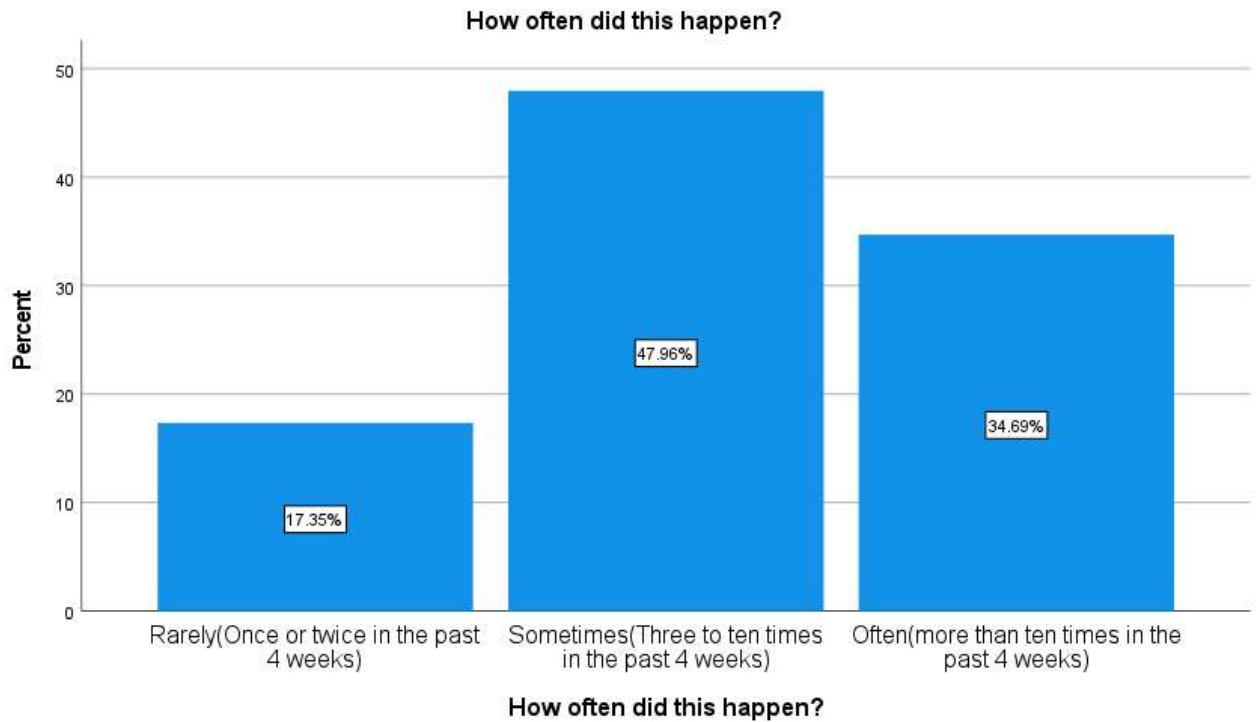


Figure 4.10: How often did this happen?

With respect to the question “In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of lack of resources?” Figure 4.10 showed that of those that indicated that they did experience this, that 17.3% rarely experience it. A further 48% indicated that they experienced this sometimes and 34.7% experienced this often, which is more than ten times in the past four weeks.

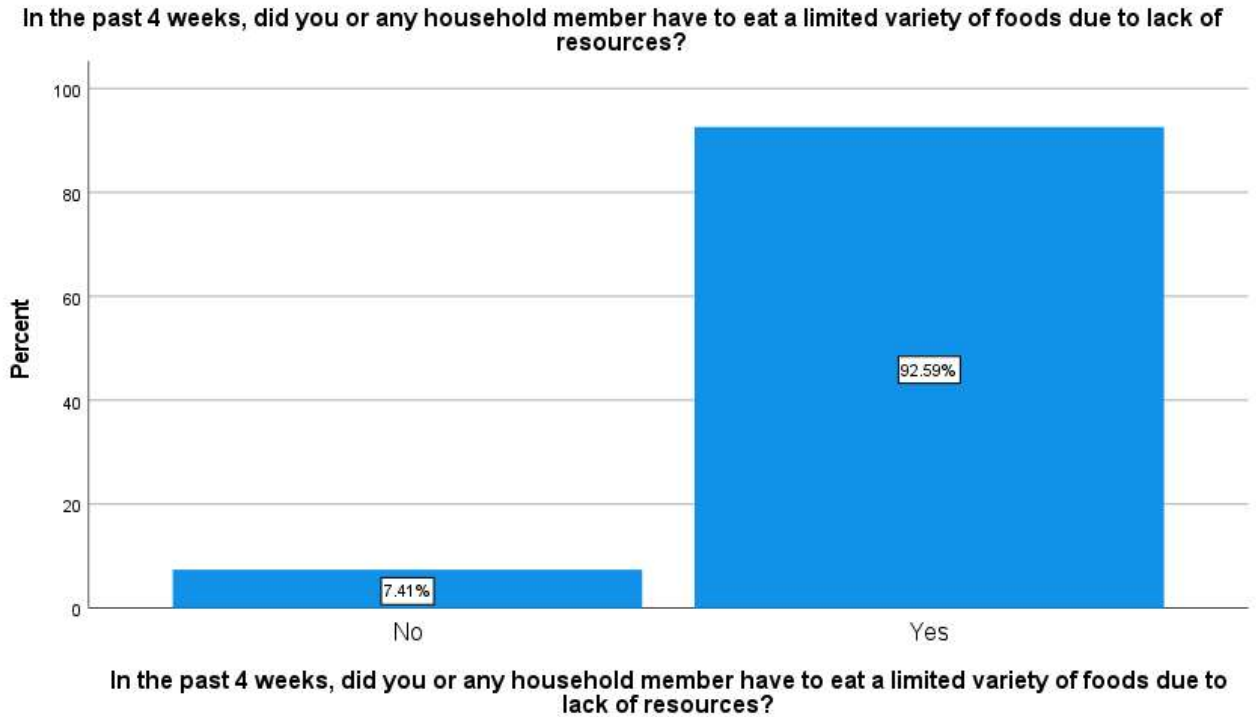


Figure 4.11: In the past 4 weeks, did you or any household member have to eat a limited variety of foods due to lack of resources?

In Figure 4.11 respondents were again asked whether in the past four weeks, did they themselves or any household member have to eat a limited variety of foods due to lack of resources. The responses were recorded and the outcome was 7.4% indicating that they did not experience this and a further 92.6% indicated that they did experience this.

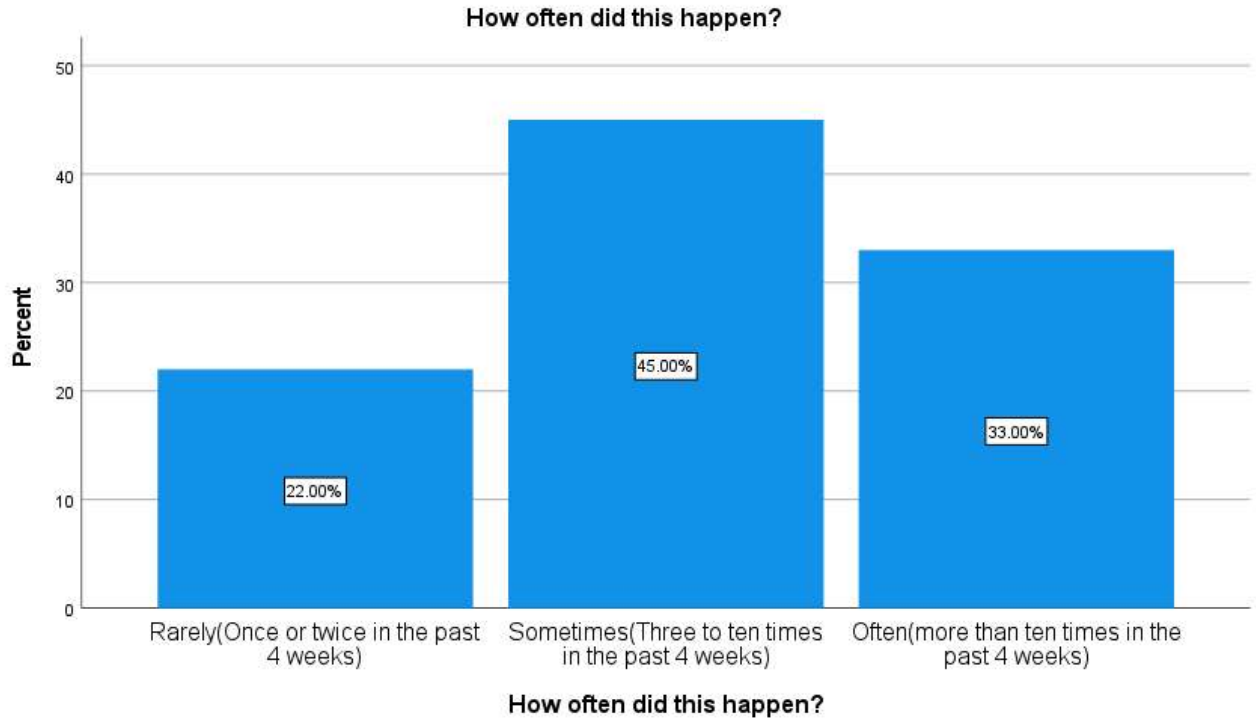
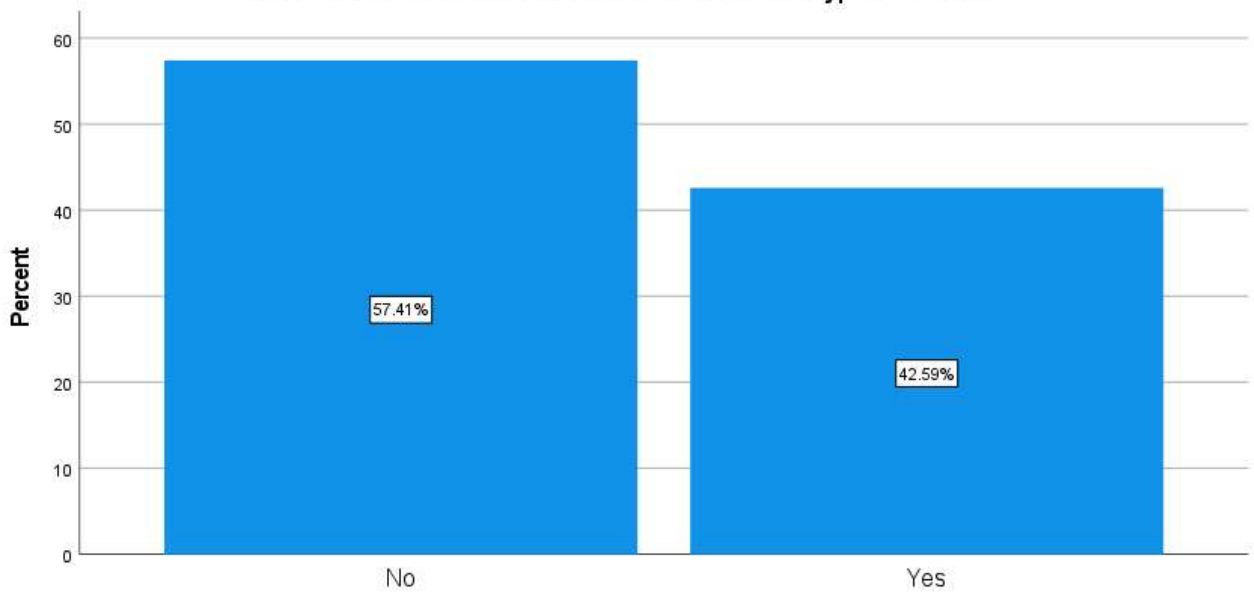


Figure 4.12: How often did this happen?

With respect to the question “In the past four weeks, did you or any household member have to eat a limited variety of foods due to lack of resources?” Figure 4.12 showed that of those that indicated that they did experience this, 22% indicated that this occurred rarely, meaning only once or twice in the past four weeks. Furthermore, 45% indicated that this happened sometimes, meaning that it happened three to ten times in the past four weeks and 33% indicated that it happened often, which is to say it occurred more than ten times in the past four weeks.

In the past 4 weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of foods?



In the past 4 weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of foods?

Figure 4.13: In the past 4 weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of foods?

In Figure 4.13 respondents were asked if in the past four weeks, did they, themselves or any household member, have to eat some foods that they really did not want to eat because of a lack of resources to obtain other types of foods. Responses were recorded, and the data analyzed, and it was found out that 57.4% had not experienced this and a further 42.6% indicated that they had experienced this. The majority had not experienced this.

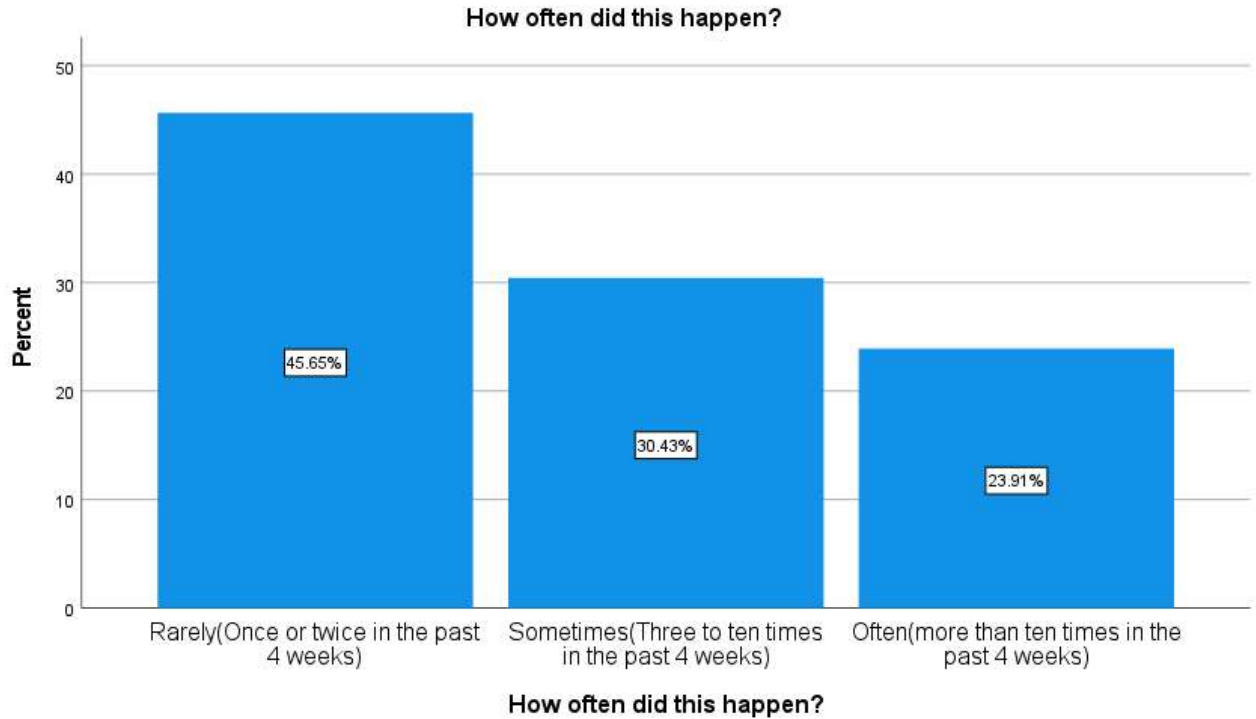


Figure 4.14 How often did this happen?

Regarding the question “In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of foods?” Figure 4.14 showed that of those that indicated that they did experience this, 45.65% indicated that this occurred rarely, meaning only once or twice in the past four weeks. Further, 30.4% indicated that this happened sometimes, meaning that it happened three to ten times in the past four weeks and 23.9% indicated that it happened often, which is to say it occurred more than ten times in the past four weeks.

4.2.2.1 Discussion on Theme 2: Measure of adequate food quality

(Question 2-4)

The questions in this theme of the HFIAS are the results shown in Figures 4.9 to 4.14 which were asked to the respondents. To the question of food preference asking if the household were not able to eat the foods they preferred due to lack of resources 89.8% of the respondents indicated that they were not able to do this while 10.2% indicated that they did not experience this. The severity question followed and 17.35% indicated that they rarely experienced this, 47.96 indicated that they sometimes experienced this and a further 34.69% said they often experienced this. The following question

asked the question if the respondents had to eat a limited variety of food due to limited resources and 92.6% of respondents indicated yes and 7.4% of them indicated no. The severity question followed where 22% indicated that they experienced this rarely, 45% indicated often and 33% indicated very often. The majority experienced these three to ten times in the past four weeks. The third question asked respondents if in their households they had to eat some foods they did not really want to eat due to lack of resources and 42.6% responded with a yes indicating they had experienced this and 57.4% indicated a no which meant they had not experienced this.

The findings of these results are consistent with those of Masekoameng and Maliwichi (2014) where 94% of the respondents had limited access to food variety. In a study by Bahta (2022) the majority of the respondents also experienced this. This was a result of the farmers having limited resources to buy a greater variety of foods and had to resort to a monotonous diet especially from the middle of the month to the end of the month when food starts to deplete within the household. Respondents had to stick with the same type of food that they could afford (De Cock *et al.*, 2013). In the current study it was found that farmers tended to resort to buying a limited variety of food to ensure that there is food to eat in the households in order to accommodate other household expenses that also needed a financial allocation. These results indicate severe food insecurity in the majority of the households of the livestock farmers and is consistent with the results of Masekoameng and Maliwichi (2014).

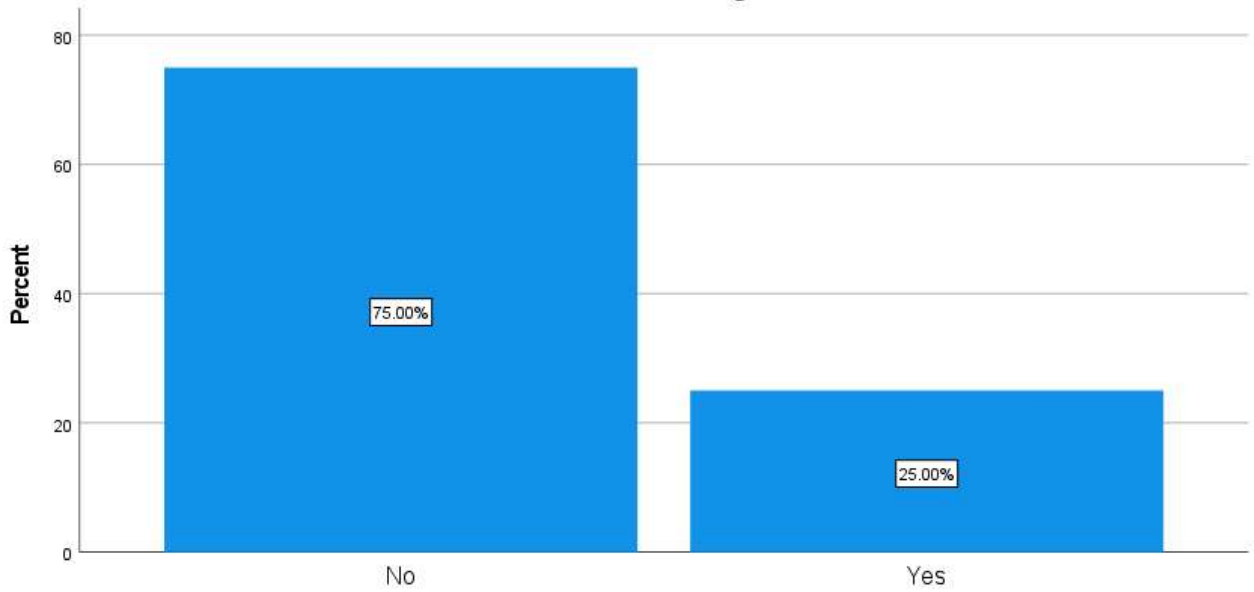
4.2.3 Theme 3: Measure of adequate food quantity (Question 5-9)

The following set of five questions are centered around the theme of measuring the adequacy of the food in the respondents' household, in terms of food quantity in the past four weeks. This is where respondents were asked questions about:

- Eating smaller meals
- Eating fewer meals in a day
- Foods of any kind not being there
- Going to bed hungry
- Eating nothing for a whole day and a whole night

The following are the results from the respondents:

In the past 4 weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?



In the past 4 weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?

Figure 4.15: In the past 4 weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?

In Figure 4.15 respondents were asked if in the past four weeks, did they or any household member have to eat a smaller meal than they felt they needed because there was not enough food. The responses were recorded and results analyzed and it was found that 75% of the respondents said they did not experience this, while 25% indicated that they did. The majority in this case did not experience this.

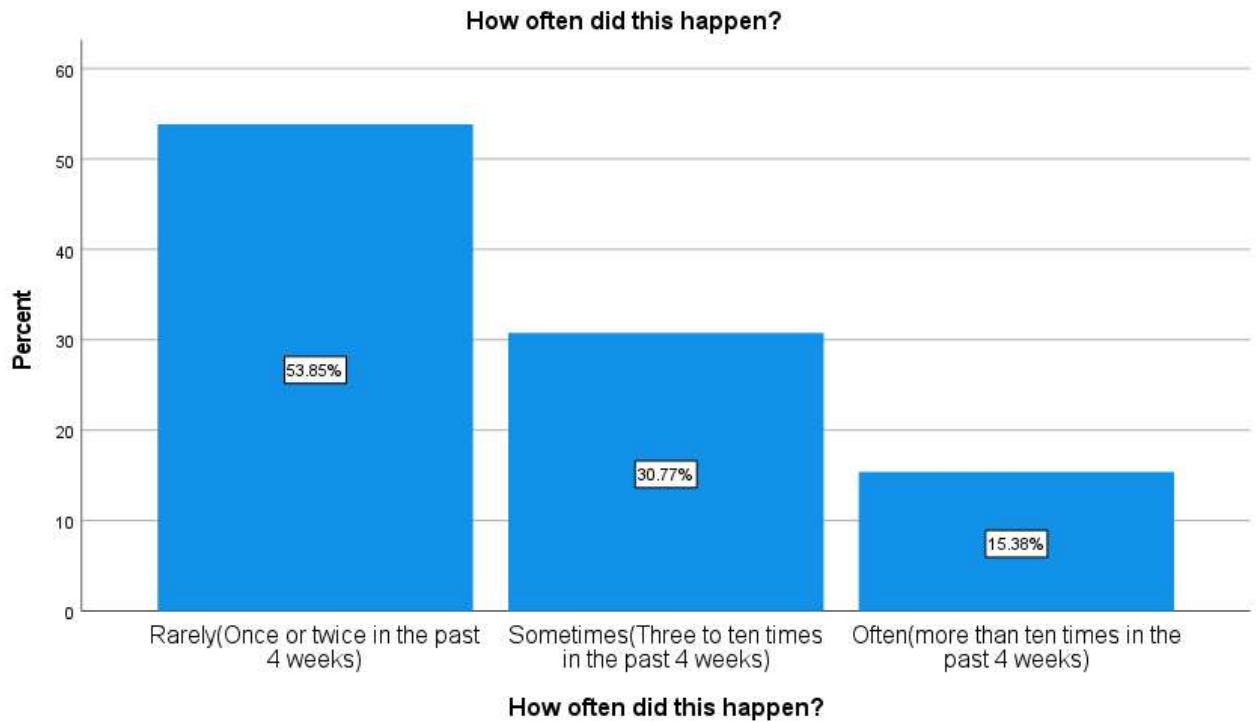
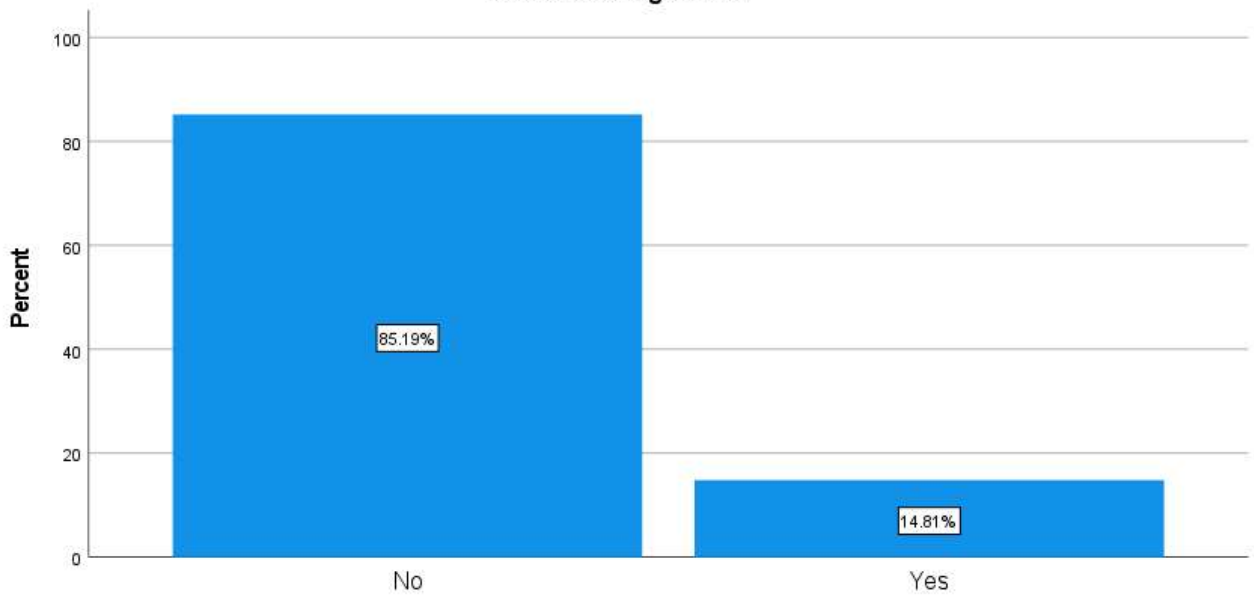


Figure 4.16: How often did this happen?

Regarding the question “In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?” Figure 4.16 showed that 53.8% indicated that this occurred rarely, meaning only once or twice in the past four weeks. Furthermore, 30.8% indicated that this happened sometimes, meaning that it happened three to ten times in the past four weeks and 15.4% indicated that it happened often, which means it occurred more than ten times in the past four weeks.

In the past 4 weeks, did you or any other household member have to eat fewer meals in a day because here was not enough food?



In the past 4 weeks, did you or any other household member have to eat fewer meals in a day because here was not enough food?

Figure 4.17: In the past 4 weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?

In Figure 4.17 respondents were asked if in the past four weeks, did they or any other household member have to eat fewer meals in a day because there was not enough food. Of the 108 respondents 85.2% responded with a no, indicating that they had not experienced this. Another 14.8% responded with a yes, indicating that they had experienced this. The majority of the respondents did not experience this.

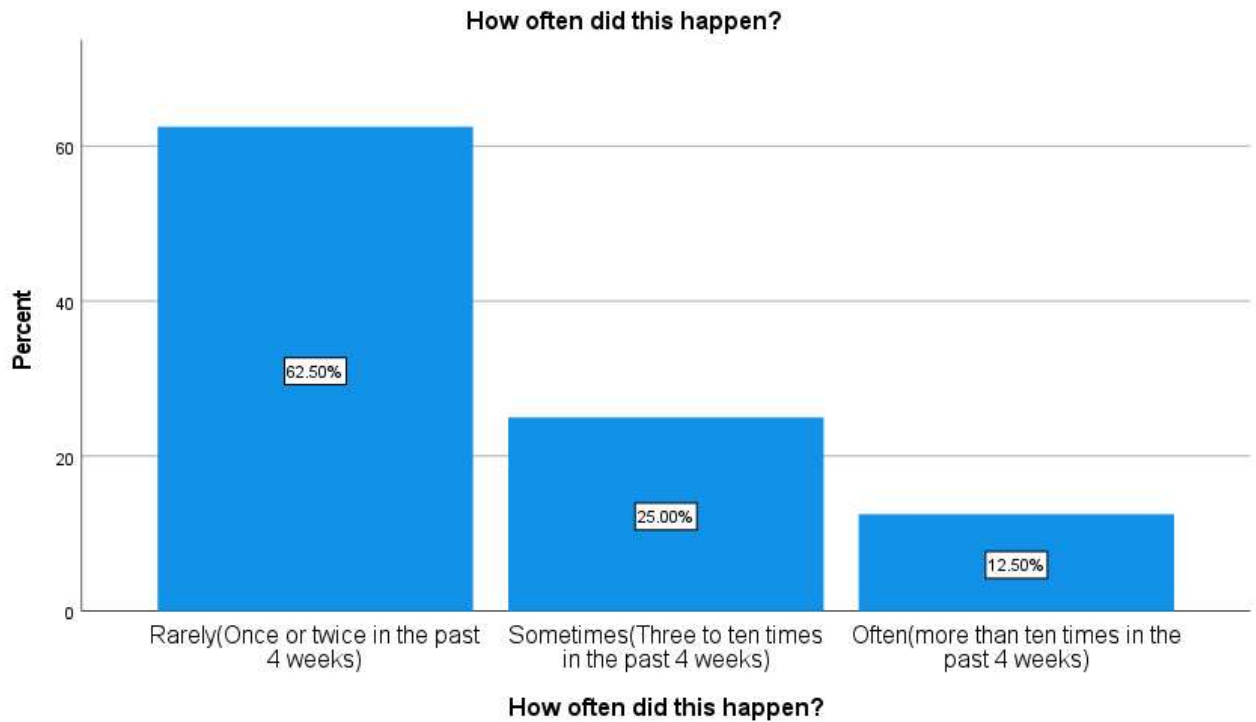
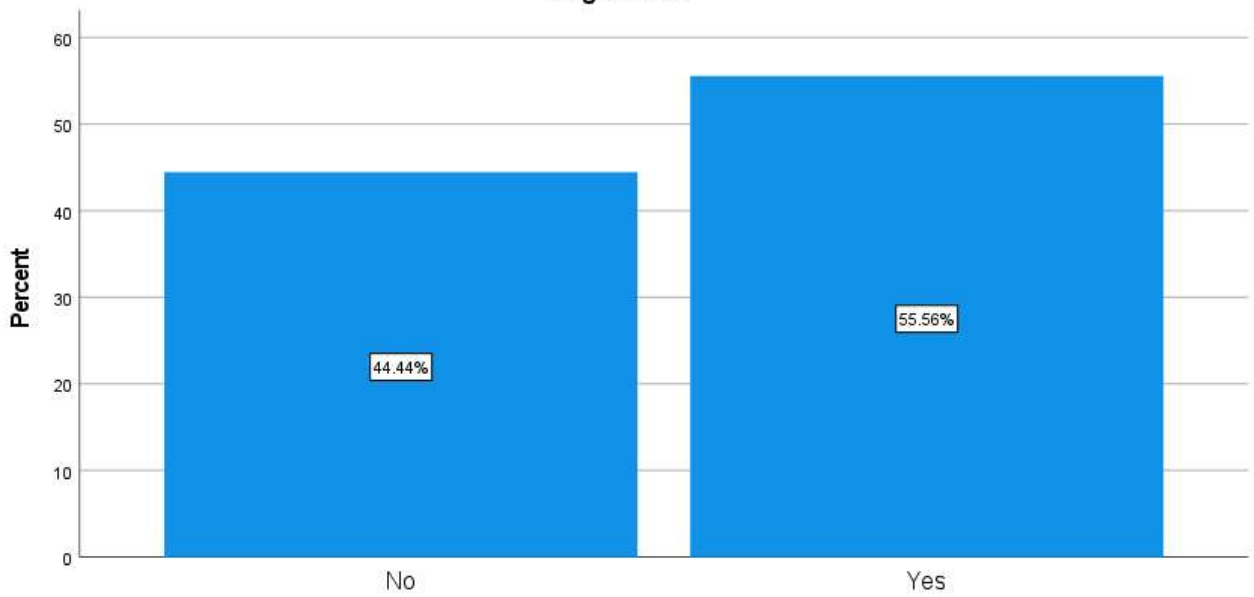


Figure 4.18: How often did this happen?

Regarding the question “In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?” Figure 4.18 showed that for those that indicated that they did experience this, 62,5% indicated that this occurred rarely, meaning only once or twice in the past four weeks. Furthermore, 25% indicated that this happened sometimes, meaning that it happened three to ten times in the past four weeks and 12.5% indicated that it happened often, which means it occurred more than ten times in the past four weeks.

In the past 4 weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?



In the past 4 weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?

Figure 4.19: In the past 4 weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?

In Figure 4.19 respondents were asked whether in the past four weeks, was there ever no food to eat of any kind in their household because of a lack of resources to get food. The responses were recorded and results analyzed and it was found that 44.4% of the respondents had not experienced this and the balance, which was 55.4% indicated that they did. The majority had experienced this.

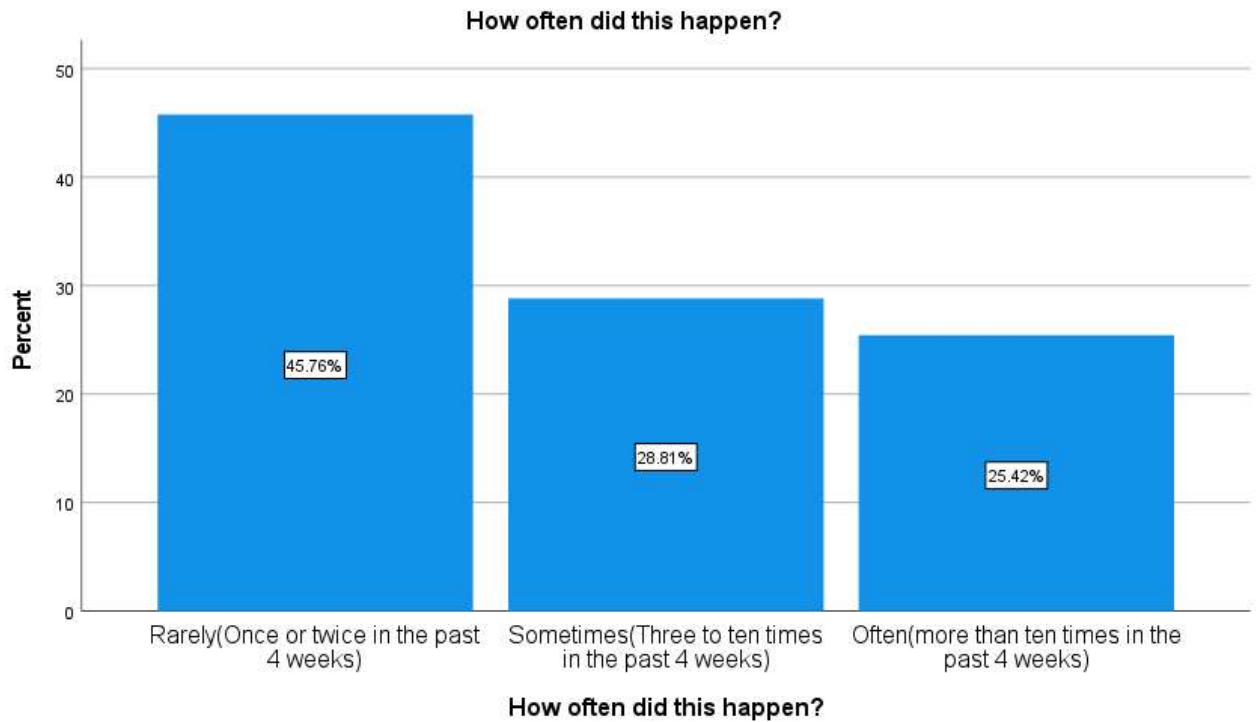


Figure 4.20: How often did this happen?

With regard to the question “In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?” Figure 4.20 showed that of those that said that they did experience this, 45.76% indicated that this occurred rarely, meaning only once or twice in the past four weeks. Furthermore, 28.8% indicated that this happened sometimes, meaning that it happened three to ten times in the past four weeks and 25.4% indicated that it happened often, which means it occurred more than ten times in the past four weeks.

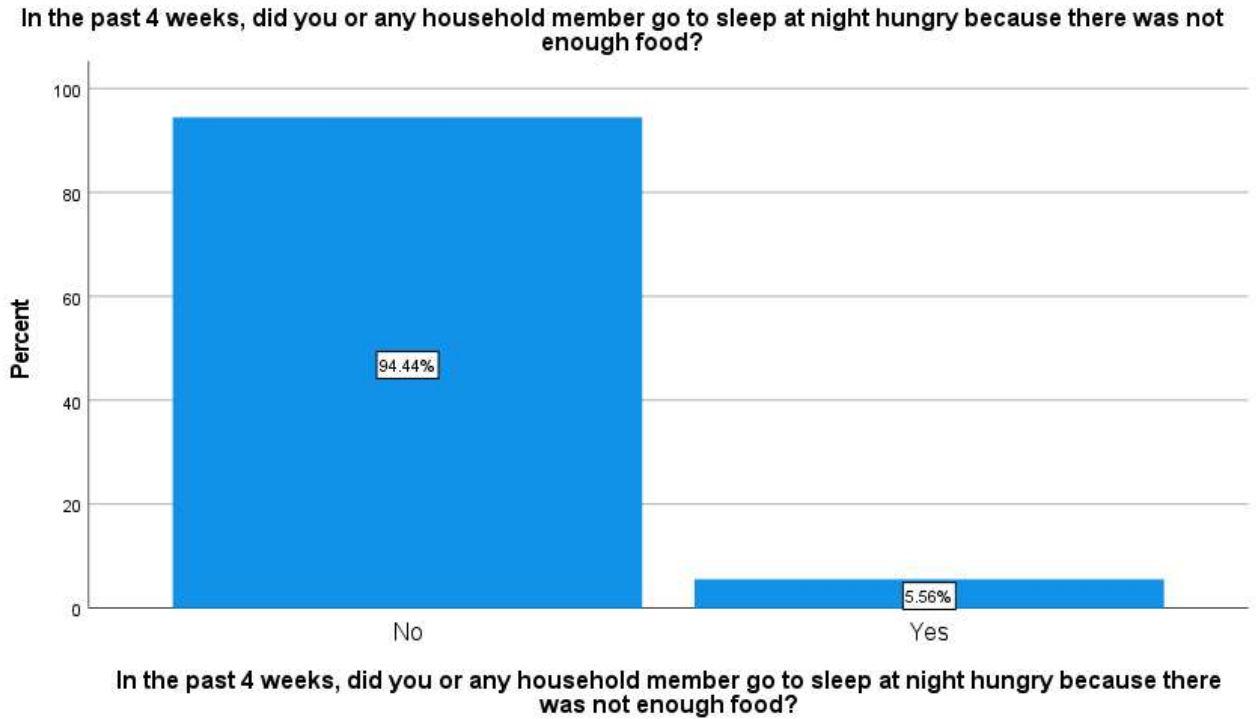


Figure 4.21: In the past 4 weeks, did you or any household member go to sleep at night hungry because there was not enough food?

In Figure 4.21 respondents were asked if in the past four weeks, did they or any household member go to sleep at night hungry because there was not enough food. Responses were recorded and the results analysed, and it was found that 94.4% said they had not experienced this and the rest, which was 5.6%, responded with a yes, indicating that they had experienced going to sleep hungry due to not having enough food. The majority of the respondents had not experienced this.

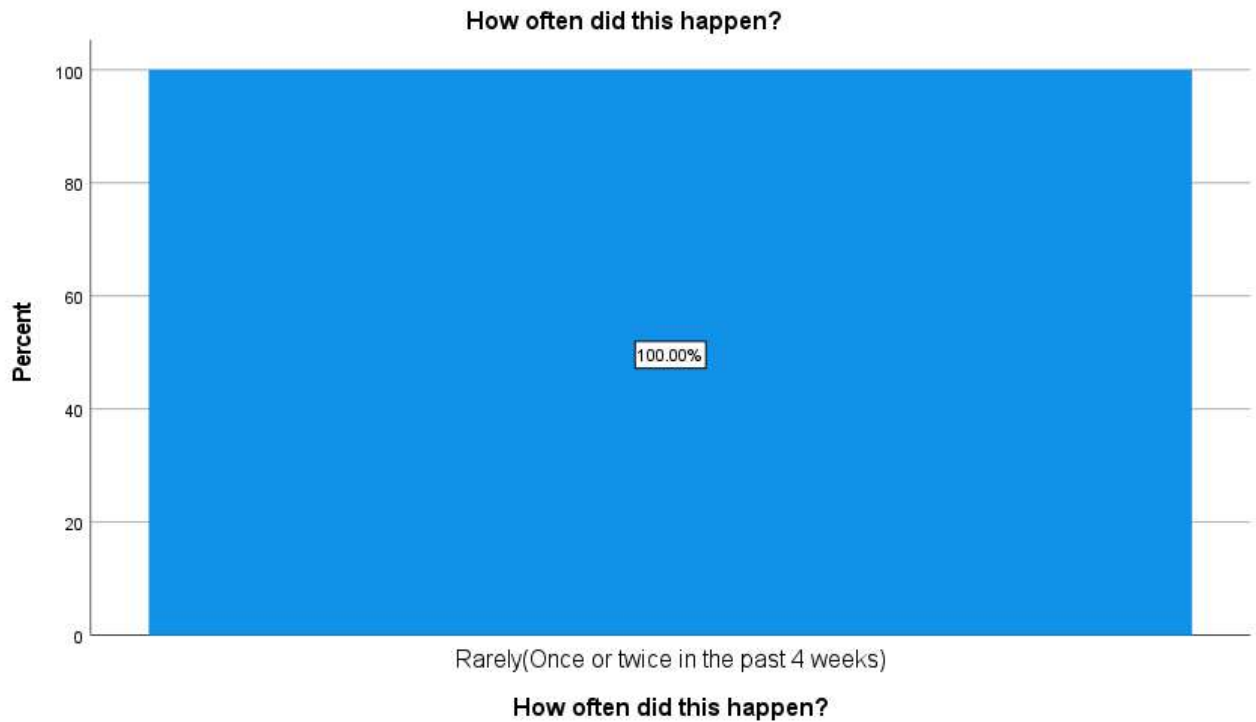


Figure 4.22: How often did this happen?

Regarding the question “In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?” Figure 4.22 showed that of the respondents that indicated that they did go to sleep hungry because of having nothing to eat, 100% of them indicated that this took place rarely which is to say that it occurred once or twice in the past four weeks.

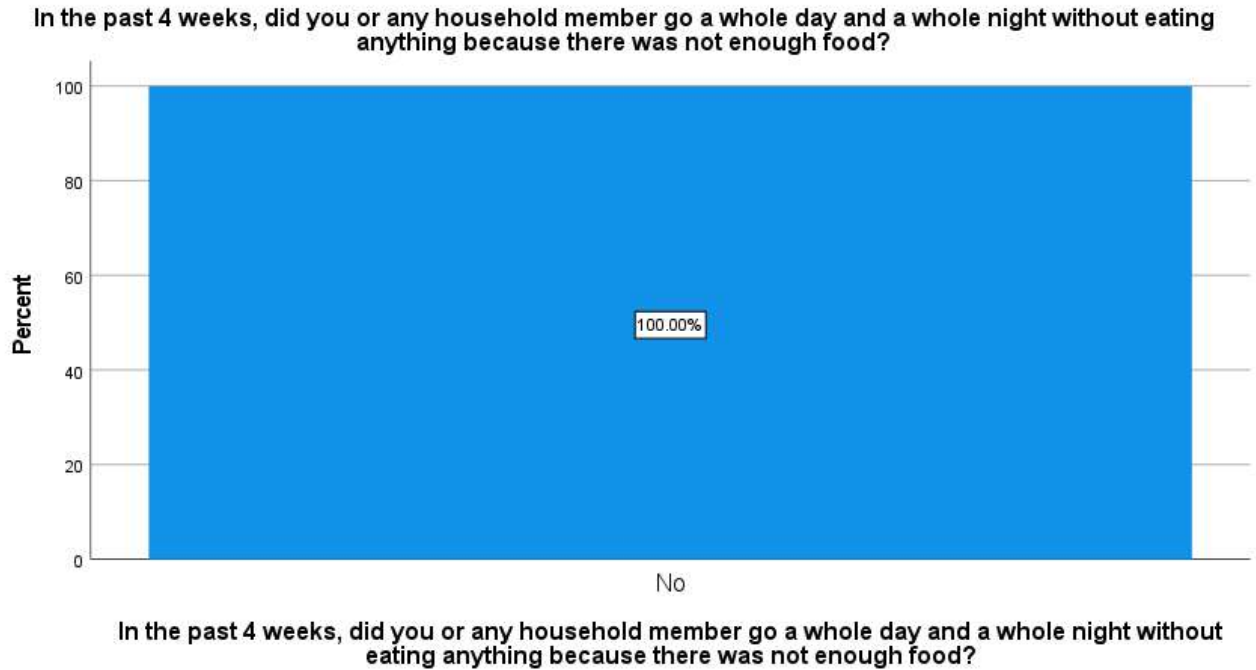


Figure 4.23: In the past 4 weeks did you or any household member go a whole day and a whole night without eating anything because there was not enough food?

In Figure 4.23 respondents were asked if in the past four weeks if they themselves or any household member went a whole day and a whole night without eating anything because there was not enough food. The responses were collected and analysed and it was found that 100% of the respondents did not experience this.

4.2.3.1 Discussion of Theme 3: Measure of adequate food quantity (Questions 5-9)

The questions in this theme of the HFIAS were asked to the respondents and their answers are reflected in Figures 4.15 to 4.23. In this theme questions were asked as to whether the respondents food quantity was affected due to lower food access. To these questions there was a lower numbers of “yes” responses as shown in figures 4.15-4.23 related to these quantity questions. This means that most of the respondents did not cut down on their regular meal numbers and on food portions, due to not having enough food. This theme of questions reflected a more severe consequence of food insecurity and the number of respondents responding yes to this was significantly low. For example, to the question of whether anyone in the household had to eat fewer meals than they felt they needed due to there not being enough food, 75% of the respondents answered no, while for the severity question that followed 58.85% of the

respondents reported that they experienced this rarely (1-2 times in the four weeks), 30.77% experienced this sometimes, and 15.38% experienced this often.

Respondents were also asked if any of the household members went to sleep hungry, which was a harsher occurrence question and the results were that 94.44% responded saying that they did not experience this and 5.56% of respondents responded with a yes. It was observed that fewer respondents were experiencing harsh food insecurity situations. This was also observed throughout the five questions of the food quality theme, in that lower numbers of farmers experiencing this were recorded. In the harshest occurrence question, which was the farmers going a day and a night without food, none of the farmers experienced this in the past four weeks.

This implies that few livestock farmers experienced severe food insecurity levels and the majority did not experience this. This was consistent with the results of Ndondo (2013) when measuring food security in the Free State Province, South Africa, where a majority of the farmers did not experience this more severe situation with less than a third of their respondents that experienced this. This is also similar to the results of Bahta (2022) where most of the respondents (63.6%) did not experience going to sleep hungry.

With that in mind, it should also be stated that this result may also be attributed to other financial contributors in the household contributing financially and to food access in the household, although livestock production played a role in the respondents not experiencing severe levels of food insecurity, especially those that were not employed. This is also stated by Bahta (2022) who studied the households of livestock producers and found that most of the households they interacted with of livestock producers, were using the sale of livestock as a coping mechanism to mitigate the shocks of food insecurity. These findings are also consistent with Acosta *et al.* (2021), where they studied the part livestock play as a strategy used by a household for coping against climate shocks; and discovered that livestock portfolios contribute as buffers against the effects of drought, supporting household consumption and income.

4.2.4 HFIAS outcome

The HFISA questionnaire was completed by the respondents. The questionnaire was based on the premise that food insecurity causes universal reactions and experiences that are uniform across the board. These can be measured, coded, and used to assess

the food insecurity status of households in an easy and straightforward manner (Coates *et al.*, 2007). The answers to the HFIAS were coded and analysed according to the answers of the “frequency of occurrence” questions and the households of the farmers were then categorized according to their responses. The HFIAS has a scale of outcome which is as follows (Coates *et al* 2007):

- Food secure (does not or on rare occasions worries about running out of food)
- Mildly food insecure (sometimes or often worries about running out of food)
- Moderately food insecure (sacrificing food quality frequently)
- Extremely food insecure (cutting down on the meal sizes and cutting down the number of meals).

For the purposes of this study a simpler approach, similar to Khumalo and Sibanda (2019), where only food secure and food insecure categories are applied, and where respondents’ households that responded as not or rarely worried about food shortages were marked as food secure and those with harsher results were marked as food insecure. The results were analyzed and were as follows:

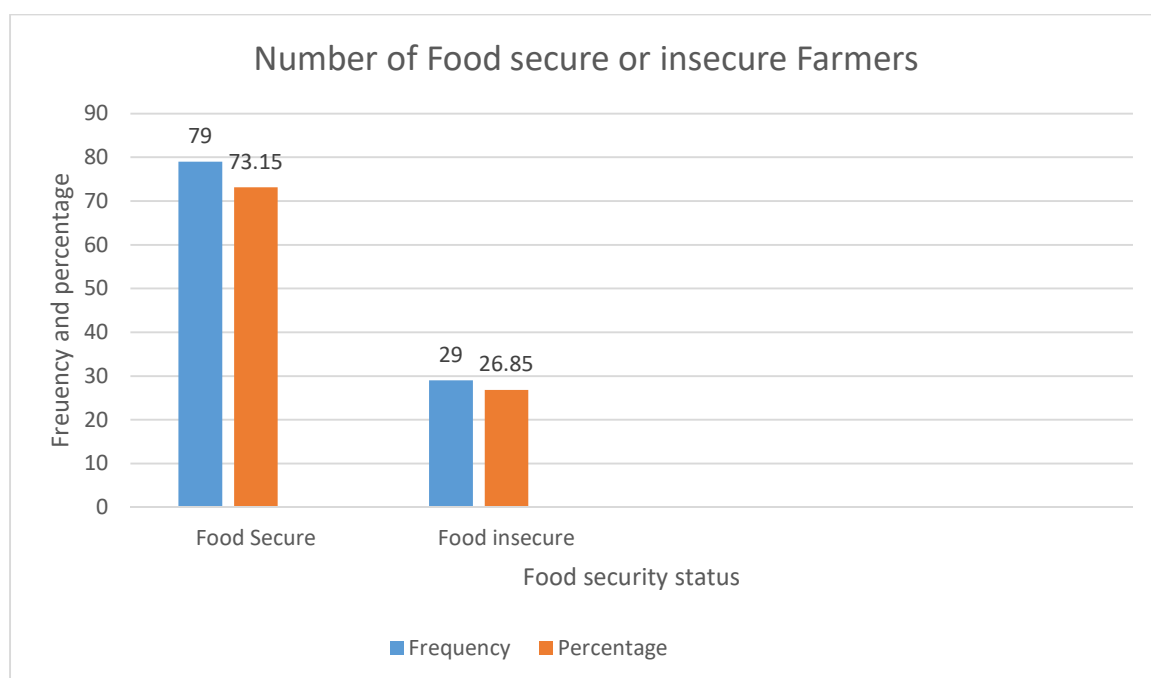


Figure 4.24: Number of food secure or food insecure farmers

Figure 4.24 reflected the results of the HFIAS scores of each household and how they were categorized whether their households would have enough food and were found

to be food insecure. The figure showed that 73.15% of the households were found to have rarely or not worried at all about the food access of their households and were found to be food secure, while 29 households which make up 26.85% were found to have been worried sometimes (three to ten times) and often (more than ten times) in the past four weeks.

This implies that the majority of the households were food secure which is a food security percentage of 73.15% in the area. This makes up more than two thirds of the households of the respondents. This is consistent with the results of Khumalo and Sibande (2019) where peri-urban farmers in another area of South Africa were found to be food secure at 71.6% and Bahta (2022) where livestock farmers were mostly found to be food secure at 61%.

Table 4.3: Statistics of the food security score of the respondents (n = 108)

Total		
N	Valid	108
	Missing	0
Mean		7.30
Std. Error of Mean		0.389
Median		6.00
Std. Deviation		4.042
Range		21
Minimum		0
Maximum		21

Source: Field research data (2021)

The findings shown in Table 4.3 reflect that on average the HFIAS score of the respondents was 7.30, which could be rounded off to 7. This means that the majority of the respondents scored below 11, i.e., their HFIAS score was less than or equal to 11 and they were therefore said to be food secure. These results are consistent with a recent study in another peri-urban area of South Africa on smallholder farmers (Ndlovu *et al.*, 2022) where they found the average HFIAS score to be 7.21 and the majority of the respondents were also food secure.

It was found that the lowest score in the group was 0 i.e., food secure, and the highest score was 21 i.e., food insecure. Therefore, the results showed both food secure and food insecure farmers that varied in severity. The standard deviation between the scores was low at 4.042 as most of the respondents scores did not differ too far from each other. This means that the food security status of most of the residents should

be similar, and indeed it was, as most were found to be food secure, with differing severities.

Table 4.4 One sample test of the food security score

Test Value = 11							
	T	df	Significance		Mean Difference	95% Confidence Interval of the Difference	
			One-Sided p	Two-Sided p		Lower	Upper
Total	-9.521	107	<0,001	<0,001	-3.704	-4.47	-2.93

Source: Field data (2021)

A one sample test was conducted on the food security status scores of the farmers to determine the significance value (p-value). The test value was placed at 11 which was the break point. Table 4.4 shows the results with the significance value of < 0.001 which is statistically significant and therefore can be used to predict the threshold as it can be trusted to produce the same results. This confirms that we can reject the null hypothesis of the study as most of the households that participate in livestock keeping in the area of Botleng were food secure or experience low levels of food insecurity. This leads to the questions on whether livestock production played a role in the food security status of these farmers and whether it contributed to the food access of the households of these livestock producers. Further investigation around whether livestock practices contributed to the food security status of these farmers is addressed in the following section.

4.3 The contribution of peri-urban livestock farming on food accessibility of the respondents.

The study sought to determine whether livestock production played a financial role in the households of livestock owners. Therefore, farmers were asked questions pertaining to this. Finding out which farmers were food secure and which had livestock financially contribute to the buying of food in the households, would assist in determining whether farmer's households did positively benefit from livestock production, in terms of increasing food access and contributing to households being food secure.

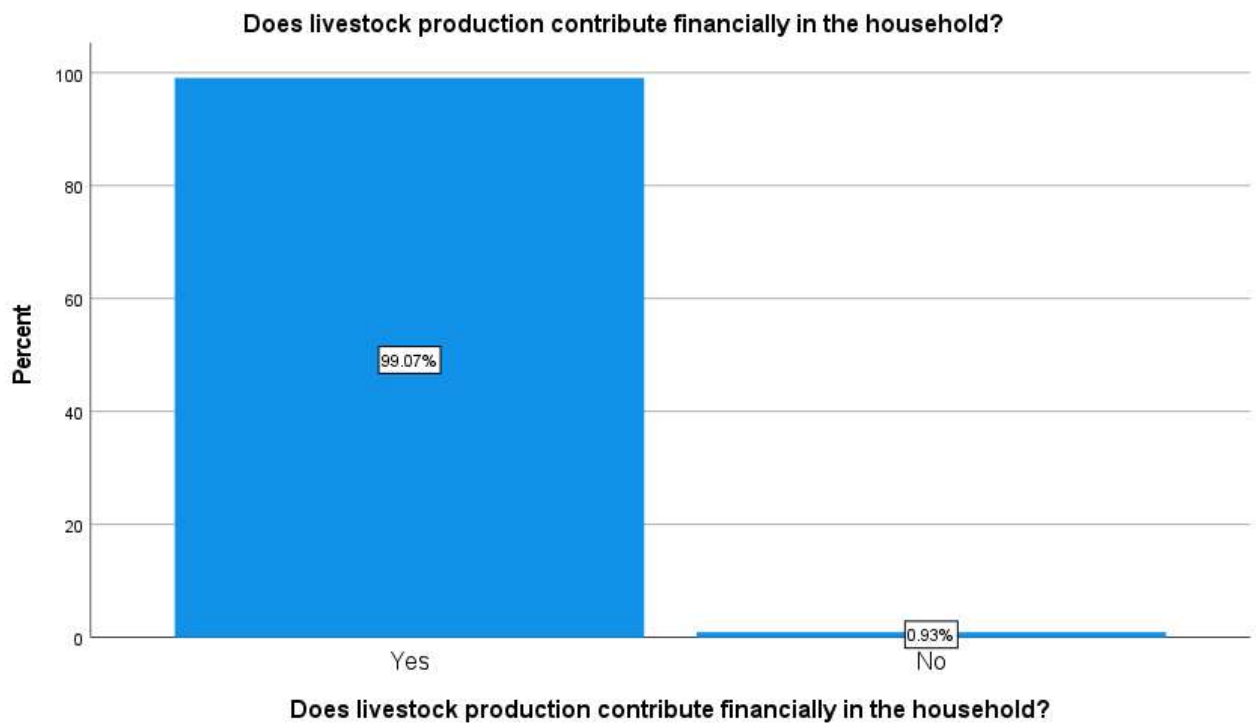


Figure 4.25: Does livestock production contribute financially in the household?

Figure 4.25 reflects on the question participants were asked about if their livestock activities contribute financially in the household, that is, do the farmers make any money from rearing livestock through sales. The results showed that 99.1% of farmers responded with a yes and 0.9% of them responded with a no, that is, they do not make any money from the livestock. These results are consistent with the statement that peri-urban farmers are increasingly now pursuing more income for their farming practices (Guendel, 2004). It was also stated that livestock production in and around cities is increasingly becoming more and more commercially oriented, and this includes large holdings/herds and different livestock species in African cities (Amadou *et al.*, 2012). This is strongly supported in this area by the advantages which are market developments that favour urban livestock production, whereby there is close proximity in the area to markets that have increased demand on their livestock in the area such as multiple auction houses and traditions that require livestock slaughtering (“imisebenzi” - rituals) and exchanges i.e., lobola (Guendel, 2004).

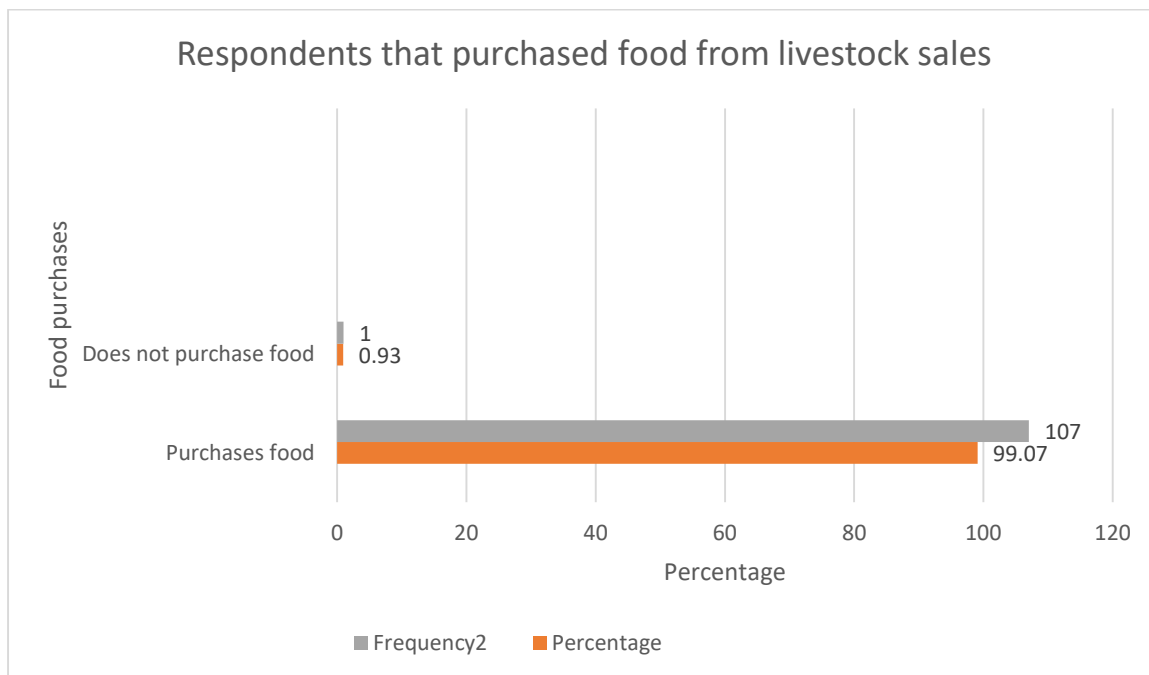


Figure 4.26: Respondents that purchased food from livestock sales.

Figure 4.26 reflects the number of respondents that buy food of the total number of respondents that said that they do get an income from livestock sales. The result showed it was the whole group (100%). This means that when considering the pillars of food security, specifically the food access pillar, the study found that food access is increased through the income gained from livestock sales. Thus, farmers gain greater food access, not only through the actual animal in slaughter but also the livestock sales which allows for the purchase of other food needed in the household. This was so for 99.07% out of the total respondents.

In the area of Botleng, Delmas, a vibrant predominantly agricultural town, livestock producers have access to a number of auction houses that are readily available to purchase the producer's livestock. This assists producers to regularly access an agricultural market where they are able to sell livestock and attain much needed income. With the majority of the livestock farmers being unemployed this money assists in contributing to household needs (primarily food). Therefore, we see a high number of farmers that purchase food with money received from livestock sales. The results of this study tell us that livestock producers use income from livestock sales to increase the food access of their household. This is consistent with the findings of Acosta *et al.* (2021) who found that livestock producers use livestock as buffers in supporting the household with income and consumption.

4.4 Determining other contributions acquired through livestock production.

Livestock production means more than just the keeping of animals to the households of livestock producers in peri-urban areas. It contributes more than only consumption for the producers that participate in it. The following section sought to determine whether this was true or not. Three options were given to the respondents and they were allowed to choose any option or all of them if they were relevant to them. The results were shown on Figure 4.27:

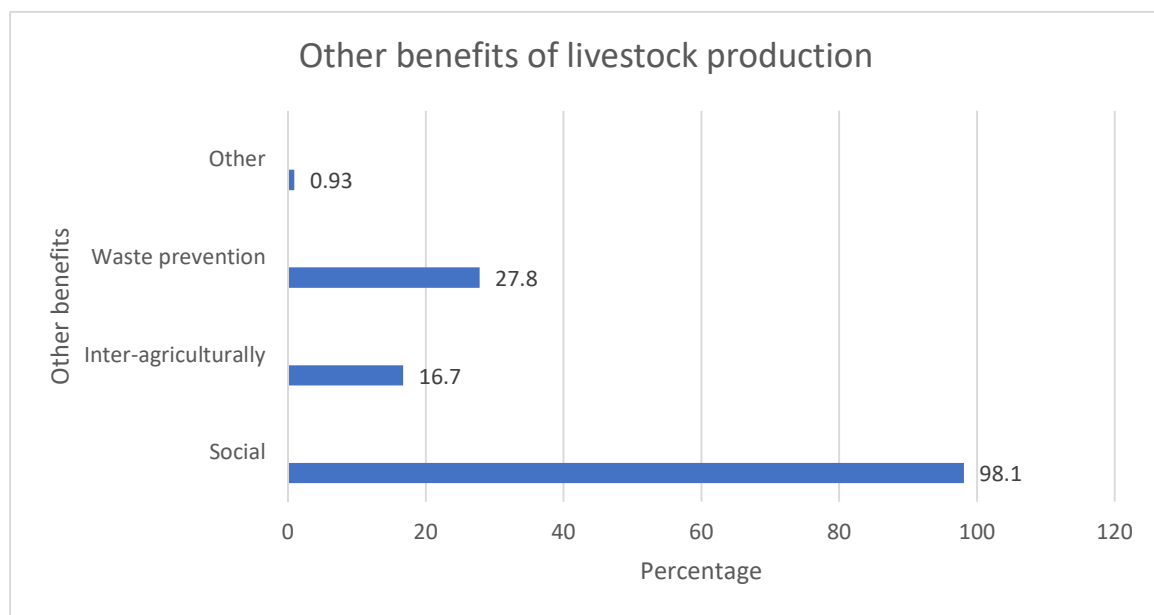


Figure 4.27: Other benefits of livestock production

Figure 4.27 reflects the results when farmers were asked what other benefits, they received from being involved in livestock production. A majority of 98.1% indicated yes to benefitting socially, 16.7% responded yes to benefitting from inter-agricultural use, where by-products from one farming practice contribute to another farming practice in the household, 27.8% responded with a yes when asked if owning livestock assisted their households in waste prevention and 0.93% said they benefitted in other ways, which the participant indicated as stress relief. This is consistent with the study by Pica-Ciamarra *et al.* (2011), that stated that there are a number of benefits to livestock production namely, food source for the household (meat, eggs and milk), household income, manure, transport and draft power. In addition, there are indirect benefits to

livestock production such as social status, collateral security, insurance and a form of savings.

These results are also consistent with Chagomoka *et al.* (2015), which found that livestock producers experienced significantly less waste compared to those that did not practice it. The results are also consistent with those of Falvey (2015) where the uses of livestock production to peri-urban farmers were listed as different from the commercial farmers but that the peri-urban farmers also viewed the livestock as not only food but used for ploughing, traction, manure, fuel, construction material, packing and working with mills, while providing a regular small income from the sale and consumption of milk, eggs, blood and hair.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In this chapter, a review of the results is conducted and conclusions are outlined as per the findings and consequently recommendations made. This is guided by the objectives of the study which were aimed at determining whether livestock production contributes to the food security of farmers in the Botleng township of Delmas, South Africa. The following were the study objectives:

- Determining the demographic and socio-economic characteristics of farmers in the township of Botleng, Delmas, South Africa.
- Determining the food security status of the farmers in the study area.
- Determining the contribution of peri-urban livestock farming on food accessibility of farmers in the study area.
- Determining other contributions acquired through livestock production in the study area.

Data were collected in the study area and presented in the previous chapter as per the objectives and conclusions drawn based on the information received.

5.2 Conclusions

The following section presents the conclusions as outlined from the study:

5.2.1 Demographics

The study collected information and found that majority of the livestock farmers were male with women in the minority. The gap was found to be wide as males were more than double the number of women. This is concerning and means that women need to be encouraged to take part in livestock ownership which has in the past mostly been viewed as a male endeavor in households leaving the women to tend to other household duties. This leaves females having limited knowledge about livestock production and would leave animals vulnerable should for any reason the males be no longer able to tend to them. Women are then left with a tool they cannot continue to use to contribute to the food security and financial situation in their families. Therefore,

it is recommended that capacity building be conducted to equip more females and give them knowledge on livestock production practices and encourage them to become involved in livestock production. This will be a positive contribution to households that already own livestock.

The study also found that the majority of farmers in the area were retired individuals over the age of 50 years. Youth of the ages between 20 to 35 years, were the least. This implies that livestock practices are not encouraged in the youth and is seen by the youth as an activity practiced by elders in their families and communities. This is a concern as the youth are not considering livestock farming as a viable career option and a means to make a living or even supplement income. This is also particularly concerning in the households of farmers that are aging and would no longer be able to perform the physical activities required in livestock production. In households that experience the death of primary givers of the livestock, this leaves livestock vulnerable. This is a wasted opportunity for the youth, especially as employment opportunities are a challenge in South Africa. This is an opportunity that the youth could use to better their lives. Therefore, it is recommended that participation of young individuals be encouraged so that the youth get the chance to improve their lives and those of their families through income opportunities presented by livestock production.

The study further found that the majority of the farmers were Ndebele speaking, Zulu was the following language to be spoken by the majority, followed by Sesotho, Swati, Tsonga and then the other languages found were Xhosa, Northern Sesotho and Sepedi. This comes as no surprise as the area is predominantly a Ndebele area and the mix in languages is due to the town being at the border of the Gauteng and Mpumalanga Provinces. It was also found that 100% of the farmers were black in ethnicity and this is also not surprising for townships in South Africa, as they were structured this way. The majority of the farmers in the study (74.07%) were found to be unemployed and others were self-employed (12.04%) and employed (13.89%). This means that most of the farmers use this practice to obtain income for their households. Farmers that were working used the practice to supplement their income.

The types of animals owned by the farmers comprised cattle, of which 77% of farmers owned them, and the least was sheep which was 17%. This shows that farmers in the area believed in integrated agriculture with combined different types of livestock, especially livestock that would be co-dependent on one another. Farmers also wanted

animals that were more traditionally owned livestock for financial gain in the local auction houses. There was a variety in the types of livestock owned and farmers owned more than one type of animal in most cases which shows that they were able to obtain an income at regular intervals due to integrating different types of livestock with varied maturity stages which would broaden income intervals. This implies that farmers in the area did not wait too long between selling livestock.

These results illustrate that farmers still require encouragement to practice better livestock principles so that they can get more out of their farming practices. With the area having a high number of farmers that are unemployed this shows that this is a means for them to make income. It would be beneficial to offer farmers more training that would assist them in improving their skills in farming practices. Better skilled farmers would assist in producing higher quality animals which could potentially mean higher prices for their animals and subsequently more income for the households. Farmers in these peri-urban areas are mostly neglected and use outdated knowledge that limits their growth potential. This has been a problem due to the areas where they farm, being primarily used for residential areas. Addressing this and equipping them with better knowledge, as they have been practicing livestock farming for years and don't intend to stop, will assist in them to maximise the earning potential within their herds and assist in fresh meat being supplied to the peri-urban areas making them self-sufficient in supplying their own growing meat needs.

5.2.2 Food security status of the farmers

The study found that 86.1% of the farmers that participated in livestock production were food secure and that 13.9% (14) were food insecure. Of those that were found to be food insecure, they were categorised by insecurity levels. It was found that from the overall total (n = 108) that 1.9% were mildly food insecure, 8.3% were moderately food insecure and 2.8% were severely food insecure. This means that whilst there are farmers that experience food insecurity, the majority of the farmers that practice livestock production in the Botleng area, were food secure and significantly so ($p < 0.001$). The percentage of those that are food secure is higher at 86.1%. This is a positive indication for the farmers that are livestock producers. The next step was to determine whether livestock production does play a part in what was investigated, which was the food access of the farmers.

5.2.3 The contribution of livestock production to food security of the farmers

This section relates whether livestock production contributed financially to the household and whether the money acquired was used to buy food in the household. It was found that 99.1% of the farmers said that the livestock did contribute financially to the household and only 0.99% responded with a no. Furthermore, 99.07% of farmers responded that they do use the money to buy food in the household and only 0.03% responded with a no. This shows that the majority of the farmers are food secure, with 13.9% who were not, and a bigger percentage admitted to livestock production contributing financially and those finances being used to buy food in the household. This has answered the research question that the study aimed to answer that livestock production contributes to the food security of farmers in the area of Botleng, Mpumalanga Province, South Africa. Livestock production has achieved this through increasing food access in the households that practice it through slaughter and sales that enable the household to buy needed food.

5.2.4 Other contributions acquired through livestock production in the study area

The study proceeded to find out if farmers benefited in other ways beside financially and farmers indicated that they benefitted in four other ways which were:

- *Socially*: Farmers were able to come together in the community and build strong social bonds as they were able to work together in aspects of livestock production. Farmers had the chance to socialize with each other on a regular basis. This practice built social cohesion in the area.
- *Inter-agriculturally*: Farmers benefited from livestock production through being able to use the byproducts of other farming practices such as using manure for gardens and using excess and decaying garden produce for feeding animals. This also assisted farmers in not having to buy manure for gardens and saving money for other uses.
- *Waste prevention*: Farmers were able to use excess vegetables and decaying vegetables that would have otherwise gone to waste had there not been livestock that consumed them. Farmers were also, in the case of pig production, able to use waste food to feed pigs that consumed such food, food which would have otherwise been discarded.

Stress relief: Some farmers indicated that being involved in livestock production assisted them in being able to relieve their stress, in getting away from daily household stresses and being able to focus on matters that relieved them.

5.3 Recommendations

The following section outlines the recommendations of the study. They are as follows:

5.3.1 Encouraging youth involvement

The study determined that there was little involvement by the youth in livestock production and that more participants were older and retired. It is therefore recommended that youth involvement be strongly encouraged. This begins at the household level where such practices are still alive, whereby parents and grandparents encourage youth to participate and physically get them involved at young ages. It further puts a responsibility on communities and government whenever they host meetings that involve the youth to educate these youth on the benefits of livestock production so that these practices are kept alive in the next generation.

5.3.2 Capacity building for women

The study found that women were less involved in livestock production than their male counter parts. This is in contrast to the women empowerment principles of modern-day society. Therefore, it is recommended that women be encouraged to participate in this practice by government departments and society, especially for the benefit of households, as most South African households are headed by women and this would assist them financially. This would also assist in changing the perception that livestock production can only be practiced by males. Women should be targeted and trained in these practices by government departments. Current incentives such as women awards are already playing a positive role in encouraging women in agriculture and should specifically target women involved in livestock related agricultural practices.

5.3.3 Better livestock practices

This study found that farmers were not maximising their potential by practicing proper livestock practices. Farmers use outdated information and were missing opportunities to maximise profit. Therefore, it is recommended that farmers receive training to improve their livestock practices. In addition, farmers should receive updated information, that is relevant to changing times and situations that would better prepare them for the current economic and natural conditions of the area.

5.3.4 Better governmental assistance

Farmers in peri-urban areas are often overlooked by government due to them practicing livestock production in peri-urban areas, which are predominantly residential areas. Therefore, farmers that reside in peri-urban areas need to be given attention and not overlooked because of by-laws, as they continue to farm in these areas regardless of the laws. They need assistance in improving infrastructure, especially to keep them safe when attending to their cattle. They should be assigned with more animal health care workers and extension officers from governmental departments.

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APPENDIX 1: QUESTIONNAIRE

QUESTIONNAIRE

BACKGROUND

My name is Nompumelelo Xaba, and I am conducting research for my Master's Degree at the University of South Africa (UNISA). It is aimed at gathering information about farmers in Botleng township and to determine whether they are food secure or not. It also aims to determine whether livestock production assists in food security of farmers in the area. In order to collect representative data, I would like to ask you questions to understand the food security status of your household. This should take approximately 20 minutes of your time.

INSTRUCTIONS

The document is divided into the following four sections:

WHAT IS COVERED

SECTION A Biographic details that gather certain characteristics about you, the participant.

SECTION B The HFIAS Questionnaire to determine the food security status of your household,

Please go through the sections and where relevant:

1.1 Mark your choice with an "X" in the box provided

1.2 Use the rating system provided in the section to indicate your preference in the box provided

2. Please note that some questions require a single response, while others may require multiple responses

3. The input you provide will be treated confidentially and only used towards the completion of the afore- mentioned qualification

Thank you, your co-operation is highly appreciated.

SECTION A: USER PROFILE INFORMATION

1. Current age

Please indicate your age group

20-30	31-40	41-50	51-60	61-70	71-80	81-90

2. Please indicate your gender

Male	Female

3.1 Please indicate your home language

Isizulu	Ndebele	Sesotho	Swazi	Tsonga	English	Other

3.2 If other, please specify: _____

4. Please indicate your employment status

Employed	Self-employed	Unemployed

5. What type of livestock do you own?

Cattle	Goats	Sheep	Swine	poultry	Other

--	--	--	--	--	--

5.1 If other, please specify: _____

6. Does livestock production contribute financially in the household?

Yes	No

6.1 If yes does the money contribute to the buying of food for the household?

Yes	No

7. What other benefits do you receive from owning livestock?

Social	Inter-Agricultural	Waste Prevention	Other

7.1 If other, please specify: _____

SECTION B: HFIAS QUESTIONNAIRE

1. In the past four weeks, did you worry that your household would not have enough food?

0 = No (skip to Q2) 1=Yes

....|___|

1.a How often did this happen?

1 = Rarely (once or twice in the past four weeks)

2 = Sometimes (three to ten times in the past four weeks)

3 = Often (more than ten times in the past four weeks)

....|___|

2. In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?

0 = No (skip to Q3) 1=Yes

....|___|

2.a How often did this happen?

1 = Rarely (once or twice in the past four weeks)

2 = Sometimes (three to ten times in the past four weeks)

3 = Often (more than ten times in the past four weeks)

....|___|

3. In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?

0 = No (skip to Q4) 1 = Yes

....|___|

3.a How often did this happen?

1 = Rarely (once or twice in the past four weeks)

2 = Sometimes (three to ten times in the past four weeks)

3 = Often (more than ten times in the past four weeks)

....|___|

4. In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?

0 = No (skip to Q5) 1 = Yes

....|___|

4.a How often did this happen?

1 = Rarely (once or twice in the past four weeks)

2 = Sometimes (three to ten times in the past four weeks)

3 = Often (more than ten times in the past four weeks)

....|___|

5. In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?

0 = No (skip to Q6) 1 = Yes

....|___|

5.a How often did this happen?

1 = Rarely (once or twice in the past four weeks)

2 = Sometimes (three to ten times in the past four weeks)

3 = Often (more than ten times in the past four weeks)

....|___|

6. In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?

0 = No (skip to Q7) 1 = Yes

....|___|

6.a How often did this happen?

1 = Rarely (once or twice in the past four weeks)

2 = Sometimes (three to ten times in the past four weeks)

3 = Often (more than ten times in the past four weeks)

....|___|

7. In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?

0 = No (skip to Q8) 1 = Yes

....|___|

7.a How often did this happen?

1 = Rarely (once or twice in the past four weeks)

2 = Sometimes (three to ten times in the past four weeks)

3 = Often (more than ten times in the past four weeks)

....|___|

8. In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?

0 = No (skip to Q9) 1 = Yes

....|___|

8.a How often did this happen?

1 = Rarely (once or twice in the past four weeks)

2 = Sometimes (three to ten times in the past four weeks)

3 = Often (more than ten times in the past four weeks)

....|___|

9. In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?

0 = No (questionnaire is finished) 1 = Yes

....|___|

9.a How often did this happen?

1 = Rarely (once or twice in the past four weeks)

2 = Sometimes (three to ten times in the past four weeks)

3 = Often (more than ten times in the past four weeks)

....|___|

End of Questionnaire...

APPENDIX 2: ETHICAL CLEARANCE



UNISA-CAES HEALTH RESEARCH ETHICS COMMITTEE

Date: 12/04/2021

Dear Ms Xaba

NHREC Registration # : REC-170616-051
REC Reference # : 2021/CAES_HREC/061
Name : Ms NST Xaba
Student # : 47875836

**Decision: Ethics Approval from
08/04/2021 to 31/03/2024**

Researcher(s): Ms NST Xaba
47875836@mylife.unisa.ac.za

Supervisor (s): Dr MR Masekoameng
masekmr@unisa.ac.za; 011-471-3102

Mr MJ Mamashila
mamasmj@unisa.ac.za; 011-471-2440

Working title of research:

The contribution of peri-urban livestock production on food security of farmers in the township of Botleng, Delmas, South Africa

Qualification: MSc Agriculture

Thank you for the application for research ethics clearance by the Unisa-CAES Health Research Ethics Committee for the above mentioned research. Ethics approval is granted for three years, **subject to further clarification and submission of yearly progress reports. Failure to submit the progress report will lead to withdrawal of the ethics clearance until the report has been submitted.**

The researcher is cautioned to adhere to the Unisa protocols for research during Covid-19.

Due date for progress report: 31 March 2022

Please note the points below for further action:



University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

1. The researcher indicates that a farmer database will be acquired from which participants will be randomly selected. How will this database be acquired? What personal details will the database contain? What measures will the researcher take to protect the personal information contained in the database?
2. More detail is required on the research population. Are the units (farmers) homogeneous, or is there a difference in the number and type of livestock that they have, for instance? The researcher must describe the population in more detail and ensure that the sampling method is appropriate for the type (e.g. homogeneous or heterogeneous) of population.
3. More detail is required on the data analysis. What is meant by "simple data analysis"? The researcher should indicate how the data collected to address each objective will be analysed. Identify the statistical model that will be used for each, and identify the variables that will be applied.

*The **low risk application** was reviewed by the UNISA-CAES Health Research Ethics Committee on 08 April 2021 in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher will ensure that the research project adheres to the relevant guidelines set out in the Unisa Covid-19 position statement on research ethics attached.
2. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
3. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the Committee.
4. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
5. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
6. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal



URERC 25.04.17 - Decision template (V2) - Approve

University of South Africa
 Preller Street, Muckleneuk Ridge, City of Tshwane
 PO Box 392 UNISA 0003 South Africa
 Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.

7. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
8. No field work activities may continue after the expiry date. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

*The reference number **2021/CAES_HREC/061** should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Yours sincerely,



Prof MA Antwi
Chair of UNISA-CAES Health REC

E-mail: antwima@unisa.ac.za
Tel: (011) 670-9391



Prof SR Magano
Executive Dean : CAES

E-mail: magansr@unisa.ac.za
Tel: (011) 471-3649

APPENDIX 3: EDITING CERTIFICATE



103 Kieser Street
Rietondale
Pretoria
Gauteng
0084
South Africa

29 January 2023

To Whom It May Concern,

RE: Language Editing of MSc dissertation to be Submitted

This letter serves as confirmation that the dissertation titled below, has undergone professional language editing. The following items were reviewed and corrected: spelling, grammar, punctuation, sentence structure, and phrasing of the document.

Title: 'THE CONTRIBUTION OF PERI-URBAN LIVESTOCK PRODUCTION ON FOOD SECURITY OF FARMERS IN THE TOWNSHIP OF BOTLENG, DELMAS, SOUTH AFRICA'

Author: NOMPUMELELO SILINDILE THOBILE XABA

Copies of the manuscript with markup can be made available upon request. Should you require further information, kindly contact me on AbedaDawood7@gmail.com.

Yours Sincerely,

Abeda Dawood
Academic Editor
(Professional Editors' Guild Membership No: DAW005)