Investigating the Impact of Home Gardens on Household Welfare and Multidimensional Poverty: The Case of Limpopo Province, South Africa

By

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ABSTRACT

South Africa, despite achieving food security at the national level, faces significant household-level food insecurity and poverty challenges, particularly in rural areas. This stark contrast is notably visible in provinces like Limpopo, where food insecurity persists despite the country's overall food surplus. Home gardens present a potential solution to alleviate poverty and address food and nutrition insecurity in these regions. This study investigated the role of home gardens in enhancing household welfare and reducing multidimensional poverty in Limpopo Province, South Africa. The specific objectives were: (i) to identify factors influencing rural household participation in home gardening, (ii) to assess home gardens' contribution to food security, (iii) to evaluate home gardens' role in improving household nutrition security, and (iv) to examine home gardens' impact on multidimensional poverty in rural households.

The study employed a stratified random sampling technique to select 2,043 participants from Limpopo Province. Data analysis utilized various econometric models and indices, including the probit model, endogenous switching Poisson regression model, multidimensional poverty index, and endogenous switching probit model. The Household Food Insecurity Access Scale (HFIAS) measured food security, while the Household Dietary Diversity Score (HDDS) served as a proxy for nutrition security. The Multidimensional Poverty Index (MPI) assessed poverty levels in rural households.

Results revealed that 46% of households were food secure, while 24% experienced severe food insecurity, 17% moderate food insecurity, and 13% mild food insecurity. Several factors positively influenced food security, including household size, land access, agricultural assistance, participants' market proximity, and non-participants' employment status. Conversely, negative impacts were associated with household head age, social relief dependency, and certain socio-economic conditions for both participants and non-participants. Home garden participation significantly reduced multidimensional poverty, with older household heads and larger households experiencing lower poverty levels. Major deprivations included education, with 78% of households lacking members who completed at least six years of schooling, high undernourishment rates (89%), and child mortality (77%). Home gardens proved crucial in addressing these challenges by providing fresh produce and enhancing nutrition awareness.

The study concludes that home gardens significantly contribute to food and nutrition security and poverty reduction, though socio-economic barriers persist. To maximize home gardening benefits, recommendations include strengthening agricultural education, improving land accessibility, and enhancing support programs. Policymakers should prioritize initiatives that promote home gardening, transform land into income-generating assets, and encourage youth participation in education and agricultural activities. These interventions could effectively address poverty and improve household welfare, targeting critical food and nutrition security challenges in rural South Africa.

DECLARATION 1

I, Mbalenhle Gwacela, declare that:

i. The research reported in this dissertation, except where otherwise indicated, is my original research.

ii. This dissertation has not been submitted for any degree or examination at any other university.

iii. This dissertation does not contain other people's data, pictures, graphs or other information unless expressly acknowledged as being sourced from those people.

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a) Their words have been re-written sources, but the general information attributed to them has been referenced;

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v. This dissertation does not contain text, graphics or tables copied and pasted from the Internet unless expressly acknowledged, with the source(s) detailed in the thesis and the references section.

Student's signature: Date: 24 December 2024

Mbalenhle Gwacela

As the candidate's supervisor, I, Professor Mjabuliseni Ngidi, agree to the submission of this dissertation for examination.

Supervisor's signature:  Date: 22/02/2025

Professor Mjabuliseni S.C Ngidi

DECLARATION 2: PUBLICATIONS

Publication 1 – Chapter 4.

Gwacela, M.; Ngidi, M.S.C.; Hlatshwayo, S.I.; Ojo, T.O. 2024. Determinants of rural households' participation in home gardens in Limpopo Province of South Africa (Under preparation to be submitted to a journal)

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ACRONYMS AND ABBREVIATIONS

ATE	Average Treatment Effects
ATT	Average Treatment Effects on the Treated
ATU	Average Treatment Effects on the Untreated
DAFF	Department of Agriculture, Forestry and Fisheries
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization
GHS	General Household Survey
HDDS	Household Dietary Diversity Score
HDI	Human Development Index
HFIAS	Household Food Insecurity Access Scale
IFSS	Integrated Food Security Strategies
LATE	Local Average Treatment Effects
MPI	Multidimensional Poverty Index
SAVAC	South African Vulnerability Assessment Committee
SDG	Sustainable Development Goals
SPSS	Statistical Software for Social Sciences
Stat SA	Statistics South Africa
UNDP	United Nations Development Programme

CHAPTER ONE

GENERAL INTRODUCTION

1.1. Background

Food and nutrition security is a human right enshrined in the Bill of Rights for all South Africans, as food security is identified as a basic need for all citizens. Food and nutrition security, as a term, has evolved in its definition over the years. Food and nutrition security encompasses four critical pillars: availability, accessibility, stability and biological utilisation (McClain-Nhlapo, 2020). Governments and organisations have adopted the definition reviewed by the United Nations as "a situation that exists when all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and quality to meet people's dietary needs and food preferences for an active and healthy life" (Food and Agriculture Organisation) FAO, 2010).

At the national level, South Africa boasts a food-secure status. However, the exact status of food security differs for many households and individuals. Currently, food security in the country remains a big concern as there is a wave of high levels of food price inflation, along with many other low- and middle-income countries (Stats SA, 2024). Inflation for food items is notably higher than general inflation. This further exacerbates South Africans' ongoing economic challenges, including high unemployment, the ongoing energy crisis, and poverty, which strain household budgets and nutritious food accessibility (Stats SA, 2024; World Bank, 2024).

According to Statistics South Africa, approximately 17.3% of South Africans were affected by moderate to severe food insecurity in 2019, and this situation was further worsened by the ripple effects of the COVID-19 pandemic as it disrupted the key supply chain and economic activity. A few years after the pandemic, these challenges persist, as seen in the increasing number of households that continue to experience hunger and insufficient access to food. Food security is a multifaceted issue often examined from various professional perspectives. Sociologists might analyse it through the lens of cultural and societal influences, considering how population growth impacts food security levels and household malnutrition. Economists may focus on the income-expenditure ratios that affect dietary habits. Politicians might address

food security through policy changes driven by public sentiment and the challenges people face. Urban planners could explore the dynamics of rural-to-urban migration and the resulting food accessibility issues influenced by shifts in population dynamics.

Efforts to address food insecurity include governmental and private organisations and international initiatives focusing on improving agricultural productivity and stabilising food prices so households can afford nutritious foods. However, efforts towards significant improvements still need to be made with obstacles that include climatic conditions that adversely affect agricultural output and socio-economic factors that greatly limit purchasing power.

Home gardens in South Africa are sometimes referred to as "backyard gardens" or "household food gardens," have always been a significant feature in rural households in South Africa, serving as an essential strategy for food accessibility, income generation and social resilience (Shackleton *et al*., 2009). These are typically small-scale gardening projects, usually set up in the backyards or around the homes within walking distance (Faber & Laurie, 2010). In the contexts of poverty and limited access to economic opportunities, home gardens play a significant role in reducing food insecurity and enhancing dietary diversity (FAO, 2010; Shackleton et al., 2009). Within the Limpopo province, where the current study focuses, rural communities face high levels of unemployment, low income and limited access to commercial food markets; home gardens have emerged as a sustainable, community-based approach to address these challenges. Research in South Africa has shown that home gardening contributes to dietary diversity enriched with essential micronutrients – a vital factor to consider in rural areas where access to fresh produce is often constrained (Faber *et al.*, 2002).

Home gardening in South Africa has been associated with improved food security metrics, including the Household Food Insecurity Access Scale (HFIAS) and the Household Dietary Diversity Score (HDDS), thus making it a critical component of rural food systems (Altman, Hart & Jacobs, 2009). In recent findings, Mabhaudhi *et al*., (2016) state that these metrics highlight the role of home gardens in addressing both the availability and accessibility dimensions of food security. These gardens play a crucial role in providing a variety of fruits, vegetables, and livestock produce at times, which is beneficial to the household's food and nutrition security status.

South African rural households, particularly in provinces like Limpopo, face many challenges that impede food insecurity and poverty reduction. These challenges are deeply rooted in historical, economic and social contexts (Aliber, 2003), including the legacy of apartheid, unequal land distribution and limited access to resources and infrastructure (Aliber, 2003; Altman *et al.*, 2009). However, it is essential to acknowledge the diverse experiences within rural communities. Different regions, ethnic groups, and socioeconomic backgrounds encounter unique challenges that necessitate tailored interventions. For instance, geographic differences influence access to water for agriculture, while cultural practices may shape land use and crop selection. Addressing these variations requires context-specific policies and programs that account for the distinct needs of different communities (Shisanya & Hendriks, 2011; Stats SA, 2022). In addition, limited access to essential resources such as water for irrigation, fertilisers, quality seeds, and land poses limitations to home gardening for rural households in South Africa.

Additionally, socioeconomic factors, including employment commitments, educational attainment, and household size, may influence participation in home gardening activities, according to Shisanya and Hendricks (2011). The scarcity of agricultural extension services and support further exacerbates these challenges, making it difficult for households to maximise the potential of home gardens. Through investigating and supporting the potential of home gardens, development practitioners can take meaningful steps towards addressing rural challenges and fostering sustainable livelihoods and self-sufficient communities.

1.2. Statement of the research problem

While home gardens have been recognised for their potential to enhance food security and welfare and alleviate multidimensional poverty, rural households continue to face persistent challenges in effectively leveraging their home gardens and resources. The study aims to explore how home gardens influence household welfare and address multidimensional poverty in rural Limpopo while identifying the socio-economic and institutional factors that shape their effectiveness. Research has identified socio-economic factors affecting home gardens as a livelihood. A study explored the relationship between home gardening and household food security and income. Findings confirmed a significant contribution towards total household income from home garden produce; however, a negative correlation was found between home gardens and food insecurity access scores (Nontu & Taruvinga, 2023). This further suggests that home gardens alone may not always sufficiently address household food insecurity, and

there are reasons for further investigation of the potential challenges presented within home garden practices in rural areas. need to be investigated further. This will contribute to understanding how income, education and land ownership influence home garden practices and their effectiveness in improving food security (Mdiya & Mdoda, 2021). One of the chapters in the current study investigates the factors correlated with home gardening in Limpopo province in South Africa, aiming to address the existing literature gap. In addition, studies have also identified a lack of in-depth analysis of how socioeconomic factors, including gender roles, cultural practices, and access to resources, influence the suggestions and the sustainability of home gardens. Although some studies, such as those undertaken in the Eastern Cape province, highlight some socio-economic factors that significantly affect home gardens as a livelihood strategy, there is a lack of comprehensive insights (Adekunle, 2013).

The current literature does not sufficiently analyse why home gardens fail to enhance food security and dietary diversity. More detailed analysis is needed to identify specific constraints and develop tailored interventions to address these challenges (Du Toit *et al.*, 2022). Similarly, there is a shortage of literature assessing home gardens' long-term sustainability and resilience, especially in the face of climate change and economic fluctuations. Understanding how these factors affect home gardens over time is important for developing meaningful research that will contribute to the effective development of policies.

Existing literature is limited on the role of home gardens in enhancing resilience to climate change and environmental benefits, such as biodiversity conservation and sustainable land use. Through understanding these aspects, the case for promoting home gardens as a multi-faceted solution can thus be enhanced (Nontu & Taruvinga, 2023). Addressing these literature gaps through targeted research can provide a more nuanced understanding of the role of home gardens in improving food security, household well-being and the improvement of effective policy formation and implementation in South Africa

1.3. Rationale and study significance

Home gardens have become a feature in many rural and urban settings globally but are more prevalent in developing countries. Home gardens serve multiple functions, including providing nutritious and safe foods, medicinal plants, and income generation for surplus produce used for various household uses. Within Limpopo, which this study focuses on, the role and impact of

home gardens are identified as a key activity due to the province's socio-economic conditions and high reliance on agricultural activities.

South Africa faces high levels of food insecurity at the household and individual levels, which hampers the quality of life of those who are at the disadvantaged end. Home gardens provide a source of fresh fruits, herbs, vegetables, and medicinal plants, all of which contribute significantly to the household's dietary requirements. This is particularly important in areas where household income is relatively low, or there are high levels of unemployment, which limits the purchasing abilities of most store-bought food items. Home gardens enable the production of a wide range of fruits and vegetables, which contributes towards a diverse diet, thus limiting or preventing malnutrition and associated health issues brought on by a lack of a diversified diet. This is especially useful in households with women and children as they are among the most vulnerable community groups (FAO, 2010).

When rural households engage in growing their food, the grocery bill can be significantly reduced, which can then allow for funds to be redirected to other key needs of the household. This study is important as it will contribute towards increasing the understanding of home gardens, their role in rural household well-being, and how the practice can be enhanced to be more sustainable for households.

Home gardens also contribute towards health and well-being as participation aids in physical activity, connection with nature, and communities at large (Van den Berg & Custers, 2011). Regular body movements from tending to the home garden are vital for overall health as one promotes movement (Soga et al., 2017). Home gardens can also utilise organic farming methods, reducing reliance on store-bought fertilisers and pesticides, which have a sustainable environmental benefit (Galluzzi et al., 2010a).

Home gardens, often overlooked in broader agricultural discussions, offer a promising pathway for alleviating poverty and improving food and nutrition security outcomes. Since Limpopo province is characterised by higher levels of food insecurity and poverty than the rest of the country, home gardens can play an important role in decreasing the severity of these challenges by providing food and nutrition (Bvenura & Afolayan, 2015). Since women are the primary caregivers of home gardens, women's empowerment can be seen through gardening as it involves decision-making power within the household and communities (Galhena et al., 2013).

This study is significant as it will show an in-depth understanding of home gardens to effectively inform policies and programs that promote sustainable agriculture and food security in rural areas. This way, programs, governments, and developmental organisations can be equipped with empirical knowledge on addressing food insecurity and poverty challenges by effectively implementing home garden initiatives in rural areas.

1.4. Aims and Objectives

The study aims to investigate how home gardens contribute to household welfare and whether they can address food insecurity and poverty in rural communities of Limpopo province, South Africa. The specific study objectives were to:

- Determine the factors that influence home garden participation in rural households
- Assess the contribution of home gardens to household food security among rural households
- Assess the contribution of home gardens to household nutrition security among rural households
- Determine the effect of home gardens on multidimensional poverty among rural households

1.5. Sub-problems

- What contributing factors influence households' decision to participate in home gardens?
- Does participation in the home garden improve household food security?
- Does participation in the home garden contribute to household nutrition security?
- What is home gardens' contribution to the multidimensional poverty index of rural households?

1.6. Definition of terms

Home gardens – Plots of cultivated vegetable crops, fruit trees, herbs, medicinal plants, and sometimes even small livestock are typically maintained near the household or individuals with self-arranged land access. Home gardens can range from small plots of land to extensive backyard plots (Peyre et al., 2006).

Food security - The United Nations Food and Agriculture Organization defined food security as "a situation that exists when all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and quality to meet people's dietary needs and food preferences for an active and healthy life" (FAO, 2010). Numerous countries have adopted this definition, including South Africa.

Nutrition security – Consistent food accessibility that is in sufficient quantities and quality and is of a diverse nature that meets the dietary needs of individuals for an active and healthy life. It extends beyond food availability, emphasising the importance of food quality and diversity (FAO, 2012).

Multidimensional Poverty Index – A measure that captures the multiple deprivations people face as they live their daily lives. The Multidimensional Poverty Index considers factors including education, health and living standards in its measurement. It evaluates the dimensions of clean water accessibility, electricity, education, nutrition, and sanitation, thus providing a comprehensive overview of poverty within a specific community (Alkire et al., 2015).

1.7. Outline of the thesis

This study is separated into eight chapters, including this introductory section as the first chapter. The second chapter provides an in-depth literature review that includes evidence from other related studies about home gardens and their various contributions to household well-being, food security, and the potential to tackle poverty in households. Chapter 3 outlines the methodology and materials used in the study's data collection process. Four studies were then conducted, which comprise this thesis's remaining chapters. Each of the four studies was dedicated to answering a particular objective of the overarching research question. The last chapter presented the conclusion of the study and policy implications based on the study findings, as well as recommendations for further research. The following chapters form the core aspect of the study.

CHAPTER FOUR: ***Factors correlated with Limpopo Province, South Africa home gardening.***

The Probit Model and descriptive analysis were used to analyse the factors influencing household participation in home gardening.

CHAPTER FIVE: ***The contribution of home gardens to household food security in Limpopo Province, South Africa.***

The Household Food Insecurity Access Scale and descriptive analysis were used to analyse home gardens' contribution to household food security.

CHAPTER SIX: ***The contribution of home gardens to household nutrition security in the Limpopo Province, South Africa.***

The Household Dietary Diversity Score and the Endogenous Switching Poisson Regression Model were used to analyse home gardens' contribution to nutrition security in Limpopo Province.

CHAPTER SEVEN: ***The impact of home gardens on multidimensional poverty of rural households in Limpopo Province, South Africa.***

This chapter utilised the Multidimensional Poverty Index and descriptive analysis to describe home gardens' impact on multidimensional poverty.

CHAPTER EIGHT: ***Conclusions and Recommendations:*** The study concludes with the conclusions and policy implications derived from the presented findings.

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CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

Home gardens have acquired increasing attention as a multifaceted strategy for enhancing household welfare within agriculture and food security. Firstly, this chapter will provide an overall description of rural household's home garden production. This chapter will also include the various factors that influence the establishment of home gardens. This includes environmental, socioeconomic, and cultural factors facilitating or hindering garden implementation. The contribution of home gardens to household food security will be assessed. In addition, this chapter will also include the role of home gardens in enhancing household nutritional security. The impact of home gardens on multidimensional poverty will be presented. The chapter will conclude by reviewing the study's analytical techniques and theoretical and conceptual frameworks.

2.2. Description of rural household's home garden production

Home gardens are predominantly small-scale agricultural production systems primarily involving subsistence farming and are found in rural and urban areas. The root of modern agriculture can be traced back to subsistence production that started in small garden plots around the homestead. These gardens have persisted throughout history with food production and additional household income (Marsh, 1998). There have been elaborative contributions towards studying and defining home gardens since the 1930s, emanating from early research by Dutch scholars Oschse and Terra's study on mixed gardens in Indonesia (Ochse & Terra, 1934). Home gardens are one of the oldest agroecosystems in the world's cultivatable regions. Throughout the years, it has gained multiple definitions highlighting different aspects of the home garden based on various contexts and research objectives. Based on observations and research undertaken by Ninez (1989) from five continents, the following home garden definition was formulated:

'*The household garden is a small-scale production system supplying plant and animal consumption and utilitarian items either not obtainable, affordable, or readily available through retail markets, field cultivation, hunting, gathering, fishing and wage earning. Household gardens are close to dwellings for security, convenience, and special care. They*

occupy land marginal to field production and labour marginal to major household economic activities. Featuring ecologically adapted and complementary species, household gardens are marked by low capital input and simple technology.' According to (Odebode, 2006), home gardening refers to cultivating a small portion of land around the household or within walking distance from the home. A rural home garden is often found in less developed countries. It forms a crucial constituent of the household's food and nutrition security. Like the above definitions of a home garden, rural home gardens involve small-scale cultivation of different plant species near the home. The household not only utilises these gardens for subsistent living; home gardens in rural areas also provide additional income from surplus produce. Rural home gardens are important for achieving sustainable livelihoods in disadvantaged areas. Mitchell and Hanstad (2004) describe rural home gardens as multifunctional areas where food production is combined with other beneficial activities, thus enhancing food security and environmental benefits, including essential ecosystem services such as biodiversity, soil conservation, and microclimate regulation. Rural home gardens are crucial as they form a significant part of the local diet and economy, making them an important cornerstone for rural sustainability and resilience.

Rural home gardens from different parts of the world all possess similar characteristics. Some of the essential fundamental characteristics of home gardens are that they are (1) located near the home; (2) they contain diverse plant species; (3) production is supplemental rather than the primary source of food and income for the family; (4) they occupy a small plot of land and (5) home gardens are a system of production easily accessible by poor people(Mitchell & Hanstad, 2004a).

2.3. The importance of home garden production and its contribution to rural household livelihoods

With food cultivation, home gardens are crucial in supporting rural households in several ways. They provide a diverse selection of food for households, thus ensuring food accessibility throughout the year. Food accessibility is crucial to food security, as home gardens can supplement staple diets with fruits, vegetables and livestock products, which are all critical components of a balanced diet and nutrition security (Talukder, Kiess, Huq, de Pee *et al.*, 2000). The diverse production of fruits, vegetables, herbs, and medicinal plants in home garden production in rural areas contributes significantly to the diversified diets of rural households.

The provision of essential vitamins, minerals and antioxidants all contribute towards the nutritional improvement of rural households (Govender et al., 2017, 2021; Webb, 2011).

Home gardens contribute towards household income as many rural households sell surplus produce (Mitchell & Hanstad, 2004). Income helps acquire necessities that cannot be created or acquired from home. For example, income can be used for medical care, payment of school fees and home improvements that will benefit the well-being of the household. As a result, home gardens are encouraged and seen in many developing countries as a livelihood strategy to alleviate poverty with the additional food and income gained from cultivating crops. Although rural home gardens may be viewed as a less intensive food production system, they can be structured to be efficient, primarily by producing higher-value crops and rearing animals (Ranasinghe, 2009).

Women play a significant role in food production in many cultures; however, their value and input are somewhat undervalued. Women from rural communities can be empowered in many ways by participating in home gardens. Home garden participation gives women control over the household's food security and economy, a crucial role women display by sharing knowledge, skills and abilities in caring for their families (Nzama & Ntini, 2022). Through home gardening practices in rural areas, women have developed increased proficiency in crops and garden practices, enabling them to become better managers within their households and the environment. Women's participation in home gardens varies, but in some cultures, they are the sole caretakers of home gardens (Galhena *et al*., 2013; Patalagsa *et al*., 2015). A study by Brun looked at home gardens in Senegal and found that the contribution of home gardens was minor when addressing nutrition status and food consumption; home gardens did, however, home gardens appear to elevate women's income and societal status as they were more knowledgeable of food habits (Brun *et al*., 1989). Rowe (2009) further confirmed the importance of home food gardening for women-headed households for food consumption and market sales.

Due to limited resources, many rural areas are susceptible towards external shocks – economic or climatic shocks alike. Home gardens enhance the household's resilience against these shocks. In addition, the diversified crop nature of home gardens reduces risk because the success of another crop can offset the failure of one type of crop.

Home gardens have been shown to provide various environmental and ecological benefits. Cultivating food at home significantly reduces the need for transportation to shops for purchasing food, contributing to decreased greenhouse gas emissions linked with increased transportation use. Home gardens reduce waste as households use food waste as compost to enrich the soil, reducing landfill waste and methane emissions. Only what is needed to be consumed or sold is harvested, thereby further reducing food waste by households, compared to voluminous store-bought food that may go to waste when unconsumed or through long shelf-life. Home gardeners often use fertilisers and chemical pesticides as they opt for more organic methods, which are less harmful to the environment. The reduced toxic runoff from harmful chemicals into water paths improves the water quality and overall environmental health (Amenu, 2017).

Apart from increasing self-sufficiency and reducing reliance on external food sources that require money, home gardening fosters social interactions and combined efforts towards environmental stewardship. It is an educational tool where adults and children can learn about the environment, ecology and the origins of food – thus fostering a holistic, mutually beneficial relationship with the environment (Mitchell & Hanstad, 2004b). Home gardening promotes an active lifestyle involving physical activity that can further reduce stress, contributing to overall well-being.

2.4. **Challenges and factors that influence home garden production**

Home gardening remains one of the essential methods of acquiring additional food and income for most communities in the developing world. Home gardening contributes significantly to the households' nutrition and social and financial well-being. Several factors influence rural households' decision to participate in home gardening, such as climatic, socio-economic, and cultural practices. A study (Qange & Mdoda, 2020) identified three main benefits to households' subsistence farming. These provided food for consumption, income generation, and employment during harvesting. Several demographic, institutional and socioeconomic variables influence households' participation in home garden food production. Some of the standard variables or determinants that may affect home garden production include gender, age, the size of the household, household income, employment status, access to grants, educational level and access to land and credit. The current study emphasised these variables influencing home garden participation in rural Limpopo.

Within the South African landscape, gender roles can significantly influence home garden participation in rural areas especially (Nzama & Ntini, 2022). Studies have documented how women often play a central role in home gardening, thus contributing towards household food security and nutritional diversity. A Nepalese study showed how women significantly contributed towards household nutrition and income generation from their involvement in home gardens (Gautam *et al*., 2009). Age is a factor that influences home gardening. Older individuals have more experience in gardening than their younger counterparts, and they have more time to dedicate to home gardens. Hawkins *et al*. (2013) highlight how different age groups engage in gardening and other household activities, thus emphasising the roles and contributions of family members at various stages of life. Larger household sizes have more people to help with home gardening labour, which can increase production, the amount of food available, and income (Galhena *et al*., 2013). Larger households can divide gardening-related tasks, allowing for specialisation and more impactful coordination when managing different aspects of the home garden (Yen & Duong, 2019). In addition, larger households can benefit from sharing skills and knowledge related to home gardening, which will contribute to better practices and outcomes in crop production (Winarno & Syawal, 2016). Unlike smaller households, larger households have higher consumption needs, which can counter the benefits of a large household.

Income becomes an essential factor when considering home food gardening production. Households that receive higher incomes can have increased access to gardening services, including seeds, fertilisers, and various tools, which enhance productivity. On the other hand, low-income households may rely more on home garden production for subsistence (Galhena *et al*., 2013). The employment status of household members dramatically affects how much time and effort individuals can invest in home gardening. Individuals who are unemployed or underemployed might rely more on gardening for food security. In contrast, employed individuals may use gardening as a supplemental food source besides what they purchase (Dossa *et al*., 2011). Access to grants and financial support provides necessary resources for home garden production and growth, improving productivity and sustainability (Oduro-Ofori *et al*., 2014).

Accessibility to sufficient and arable land is fundamental for productive home gardening. Secure land tenure is essential for long-term investment in home gardening. Households with

access to land and larger family sizes showed a reduced probability of being food secure compared to households with little or no land and fewer family members, possibly due to the increased demand for food within larger households and the limitations of small-scale land productivity in supporting food security (Herrera *et al*., 2021). Land ownership enhances participation in home gardens in rural areas. A study by Bahta *et al*., (2018) assessed the involvement of home food gardening and household land ownership. The study showed that those farmers with farmland accessibility were likelier to participate in home food garden programmes.

Education can play a role in influencing home gardening practices through better knowledge of production techniques and resource management, which can lead to higher success rates in home gardening and sustainability. Extension and agricultural-related assistance in educational programs are often insufficient to meet the needs of small-scale farmers in rural areas (Mzimkhulu & McLachlan, 2017). An increase in education could help household heads and members understand the benefits of home gardening. Households with formal education tend to participate more in home gardening than those with informal or no education (Akerele *et al*., 2017).

Due to a p rural households face, home gardening is thus seen with the decline in participants in South Africa (Yanga, 2021). The challenges experienced by home gardeners can significantly impact success and sustainability. Leadership limitations, limited farming implements, and mechanised tools are challenges faced by rural home dwellers. Due to home gardens producing on more minor scales, the growth potential for food production for rural households is limited. (Altman *et al*., 2009). In addition, climate change poses further obstacles for families to participate in home gardening by increasing the frequency and intensity of extreme weather events including floods and droughts – which have dire consequences, disrupting planting/harvesting season and reducing crop yields (Ziervogel *et al*., 2014). Water is a critical requirement for home gardening. However, many South African regions face scarcity issues brought on by drought conditions, infrastructure limitations and competition for water resources (Baudoin *et al.*, 2017). Soil quality is a factor that significantly affects crop growth. Households with poor soil quality, soil fertility, and erosion experience great hindrances in crop growth. Ineffective soil management techniques further worsen these issues, reducing home gardeners' agricultural productivity (Mokoena & Mutanga, 2020).

Several studies have documented rural households in South Africa that have successfully implemented home gardens, yielding notable benefits in food security and income generation. A study involving 200 households in Eastern Cape, at Ingquza Hill local municipality, showed that participation in home gardening contributed to an average of 10.4% increase in household income. Even though home garden participants experienced modest food security outcomes, households reported experiencing a positive correlation with increased revenue, suggesting that home gardens designed for cash crop production may enhance food security more effectively in comparison to households that focused solely on home consumption (Nontu & Tarivunga, 2023). Another study involved the investigation of three villages in the Eastern Cape Province that demonstrated how home gardening significantly enhanced household food security. Households experienced improved access to a wide variety of foods, which was beneficial as it improved nutrition and overall well-being (Adekunle, 2013). Within the Umdoni Municipality in KwaZulu-Natal province, households that successfully practised home gardening reported how, despite challenges such as shifting rainfall patterns and pest issues, their home gardens could provide sustenance and supplementary income through the sale of surplus crops.

2.5. **The concept and state of welfare and food security in South Africa**

South Africa is characterised by significant socio-economic disparities that show themselves in the welfare and the severe food insecurity issues faced by people. Although South Africa is said to be a middle-class income country, the country still faces profound challenges in ensuring all people have access to sufficient, safe and nutritious foods. This section will explore the concept and state of welfare and food security and the underlying factors contributing to food insecurity in South Africa.

South Africa has one of the most extensive welfare systems, including various social grants to alleviate poverty and address inequality. This reflects the country's commitment to achieving social justice and fundamental human rights. Primary forms of social grants include the Old Age Pension Grant, the Disability Grant, and the Child Support Grant. According to the South African Social Security Agency (SASSA), more than 18 million people in South Africa are grant recipients, with child support grants occupying the most recipients. There are other grants aimed at specific vulnerable groups in society. Social support grants are instrumental in providing a safety net and addressing poverty for millions of citizens (SASSA, 2023).

Although South Africa's welfare system is comprehensive, ongoing challenges, including financial sustainability, administrative backlogs and inefficiencies, need much improvement so that the most vulnerable in society receive sufficient support.

The welfare status in South Africa's rural areas, especially, is presented with many challenges, including poverty, food and nutrition insecurity, limited access to clean water and poor sanitation. South Africa's rural areas have food security challenges due to high unemployment and poverty. Although many households practice home gardening as a means to secure food, factors such as climate change, limited access to land and lack of agricultural-related support hinder home garden productivity (Gwacela *et al*., 2024; Tambe *et al.*, 2023). It is due to these reasons that many households in rural areas continue to face food insecurity challenges.

Accessibility to safe drinking water, suitable sanitation and good hygiene are critical components of people's health and survival. Clean water accessibility and appropriate sanitation facilities remain a considerable problem in the province of Limpopo and many other rural areas in South Africa (Murei et al., 2022). A lack of clean drinking water and suitable sanitation facilities characterises most of South Africa's communities. This contributes primarily to waterborne diseases, thus seriously threatening people's health and overall welfare. Although efforts to improve the water and sanitation status quo have been underway, significant gaps must be addressed.

The rural population in Limpopo, similar to other rural areas in the country, continue to face challenges relating to education and health services (Muthelo *et al*., 2023) – which are integral components of welfare. Many areas face insufficient educational facilities and resources, further weakening children's development and future opportunities. The limitations experienced in rural health services continue to show themselves in the poor health outcomes in these communities.

High unemployment rates and low household income are among the significant challenges millions of South Africans face. Those residing in rural households are sometimes far worse off. The socio-economic conditions in Limpopo's rural areas show low employment and income. A significant proportion of the rural population relies heavily on government social grants as a livelihood strategy and to improve their living conditions (Tambe *et al*., 2023). The

lack of women empowerment and gender disparities present more hurdles on the socio-economic landscape.

The Food and Agriculture Organization (FAO) defines food security as a situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 1996). Food security encompasses four dimensions: food availability, food accessibility, utilisation, and food stability (FAO, 2003).

South Africa is faced with overwhelming food security challenges. More than 20% of South Africans have inadequate or severe inaccessibility to food. Poverty, the cost of food in the face of unemployment and extreme inequality further exacerbate food security challenges for rural households. Compared to other middle-income countries, South Africa has the highest levels of absolute poverty. While the country boasts of a food-secure status at the national level, many households remain food insecure.

Food security is multi-dimensional or multi-faceted; making accurate measurements and implementing policies targeting specific goals becomes challenging. It has been said that there is often a misunderstanding between national food security and the reality of the lived experiences of households obtaining food access. There has not been a set or precise composite measure that defines food security, particularly for the South African landscape, to enable the setting of food security goals and specific monitoring systems to measure progress or those targeted goals (Altman *et al*., 2009). However, there is a reliance on borrowed measures and definitions, which may not always apply to the intricate nature of rural households in South Africa that require targeted assistance.

Food security remains a challenge for many South Africans, with approximately 11% of the entire population experiencing severe food insecurity (StatsSA, 2024); much work needs to be done to address food insecurity issues. Several factors contribute to food insecurity in South Africa. These factors include unemployment and poverty, significant income disparities, agricultural challenges faced by smallholder farmers who play a critical role in producing local food, and market access challenges. Although government and private organisations have made significant strides in providing social assistance and developing policies and programs to enhance food security – persistent systemic issues such as inequality, poverty and

agricultural limitations continue to hinder progress. To create a more equitable and food-secure country, determined efforts from all sectors of society, including government, private sector and civil society, are needed to address these deep-seated challenges.

2.6. **The impact of home garden on household welfare**

Welfare typically refers to individuals' or groups' overall well-being, health, and prosperity. Welfare includes economic, social and psychological aspects of people's lives. When considering household welfare, the concepts are living standards, quality of life, and the ability (or lack of) to meet basic needs such as food, shelter, education, and social participation. Channels, including nutrition, income generation, food security and overall well-being, are some ways home gardens impact household welfare.

Home gardens play a multi-faceted role in enhancing household welfare. Home gardens harbour nutritional benefits through the provision of fresh and diverse produce. Some studies have shown that households with home gardens tend to have higher dietary diversity and better micronutrient intake. The added nutritional intake further reduces the risk of malnutrition and related health issues (Tirivayi *et al*., 2019). Home gardens contribute towards household food security by lowering sole reliance on external food sources and avoiding the impact of food price fluctuations from stores. Through the production of various crops throughout the year, home gardens ensure a stable supply of nutritious food for household consumption (Mabhaudhi *et al*., 2019). When households are resilient to external shocks, food security is strengthened, further contributing to sustainable livelihoods in rural communities (Kwena *et al*., 2018). Home gardens significantly enhance household welfare for rural households in South Africa by addressing nutritional deficiencies, generating income, improving food security, and contributing to home garden participants' psychosocial well-being.

2.7. **The contribution of home garden to household food and nutrition security**

There is a pivotal role that is seen in home gardens in household food security, particularly in households from rural areas in South Africa. The multifaceted contributions of home gardens include ensuring that food is available for consumption, increasing accessibility to produce, and utilising food within households, all of which contribute towards improving food security.

Home gardens involve cultivating various crops, such as fruits, vegetables, herbs and medicinal plants. Households with gardens can supplement their meals with nutritious foods that may not always be affordable or readily available from local markets (Kambewa *et al*., 2020). Diverse diets reduce dependence on the same staple foods, thus enhancing dietary diversity and increasing resilience in food shortages. Households participating in home gardening can have a reliable source of food throughout the year and, at times, even during periods of scarcity. The reduced vulnerability is seen through produce availability throughout the year, even when market prices fluctuate (Galluzzi *et al*., 2010b). The practice of staggered planting and crop rotation assists in mitigating the negative impact of climate variability on food production (Almekinders *et al.,* 2018).

Home gardens contribute to nutritional enhancement as garden produce contains high levels of essential nutrients, thus improving nutrition security (Powell *et al*., 2015). Better health of households can be promoted by consuming fresh, locally grown fruits and vegetables. The consumption of home garden produce further addresses various micronutrient deficiencies, particularly among vulnerable groups, including children and pregnant women (Dwivedi et al., 2016). Home gardens include various Indigenous and traditional crops well suited to the local growing conditions and have high nutritional value (Mkansi *et al*., 2019). These include green leafy vegetables, various types of tubers and fruit trees that are dense in sources of essential nutrients (Mabhaudhi *et al*., 2019). Traditional diets play an important role in this regard. Through the cultivation of indigenous foods, home gardens thus ensure enhanced dietary diversity that can improve the overall nutrition security of household members.

In addition to household food and nutrition needs, home gardens also provide a supplemental source of income for families, which further contributes towards overall food security. Home garden surplus produce can be sold in local markets or bartered. The income is used to access additional resources contributing to other livelihood activities (Franzel *et al*., 2014). Home gardens foster a sense of community resilience by promoting knowledge sharing, social networks and collective efforts around food production and distribution (Mkansi *et al.*, 2019). Community-based initiatives and sharing agricultural practices can better equip households to cope with food insecurity-related challenges and promote more sustainable food systems (Nath *et al*., 2020).

2.8. The impact of the home garden on multidimensional poverty

Multidimensional poverty is a concept that includes several dimensions that go beyond the traditional income-based measure of poverty. The Multidimensional Poverty Index (MPI) is a tool developed by Alikire and Foster for measuring multidimensional poverty. The concept of multidimensional poverty considers several factors that contribute towards the deprivation and well-being of people. Multidimensional poverty is different from income poverty, where it only focuses on the lack of monetary resources, but rather, it captures the various aspects of deprivation that impact people's lives (Alkire & Foster, 2011).

Home gardens significantly impact multidimensional poverty through their ability to alleviate various dimensions of poverty. Firstly, home gardens can generate income and foster economic empowerment by selling surplus produce locally or in markets through small-scale agricultural enterprise engagements (Almekinders *et al*., 2018; Franzel *et al*., 2014). When households participate in local markets and sell produce, their financial resilience is thus improved. Additional income enables households to meet their basic needs and pay for education and health care, which lifts them from poverty.

2.8.1. Theoretical framework

A theoretical framework is a framework that is logically developed and has a connected set of concepts and premises that are derived from one or more theories used by researchers to scaffold their study (Varpio *et al*., 2020). Some of the basic rules for the effective and appropriate theoretical framework are that it needs to be underpinned by its usefulness towards the study objectives, and it needs to be valid. Home garden farmers use cost-effective and adaptive means to cultivate in available spaces and provide nutritious and diverse fresh fruits and vegetables for consumption and markets throughout the year. Therefore, this study adopted the Sustainable Development and Food Security Theory.

The sustainable development theory is a concept that holistically encompasses economic growth, social inclusion, and environmental protection. It identifies the interconnectedness of these three elements in ensuring long-term sustainability and well-being for all. Three main concepts underpin the Sustainable Development Theory. Firstly, economic growth. Sustainable development seeks economic growth that is fair and inclusive and that provides

opportunities for all areas of society. The second key concept is social inclusion. Social inclusion emphasises social equity, people's access to essential services, and promoting human rights and social justice. Lastly, environmental protection. For sustainable development to be realised, there needs to be conservation and sustainable use of natural resources, the reduction of pollution, and the overall mitigation of climate change impacts. Sustainable development theory is essential to rural livelihoods as it balances people's sustenance needs without compromising future generations' capacity to meet them. This is an important guiding principle for policymakers, development practitioners and government institutions in shaping initiatives that will have a sustainable future.

The food security concept provides a holistic framework to assess household and individual availability, access, utilisation and stability of food sources. The concept has evolved and cannot be credited to a single individual or organisation as the one that coined the theory of food security. The Food and Agriculture Organisation was pivotal in conceptualising the food security definition we1945 (FAO, 2008). Its development and evolution have been influenced by various organisations, policy frameworks and researchers (Maxwell & Smith, 1992; World Bank, 1986).

The current study drew similarities with other authors in employing the food security concept. An empirical survey by Turnšek *et al*. (2022) examined home gardening and food security concerns during the COVID-19 Pandemic. The study utilised the food security theory and the Protection Motivation Theory and found that the pandemic motivated households to participate in home gardening within the household, especially with educated females who are in the middle-income bracket. An overall 10% increase in home gardening was seen within the first wave of COVID-19 among the sample population. In their publication, Turnšek et al. (2022) asked critical questions about whether or not all stakeholders must intensify their efforts toward refurbishing home gardening in South Africa. The study reviewed key factors of home gardens, including food security, and further suggested a broader theoretical framework. Momenee (2017) advocates for future research where home gardening adopts a framework that focuses on food security to provide a better understanding of food access in urban environments.

2.8.2. Conceptual and empirical framework

The relationships investigated in the current study are demonstrated in the conceptual framework illustrated in Figure 1 below. The framework indicates that a household can produce its food through home gardens. A household can consume food from the garden and sell it to generate extra income to buy food they could not produce. Availability and access to food from one's garden may lead to improved food and nutrition security, poverty reduction and improved livelihoods.

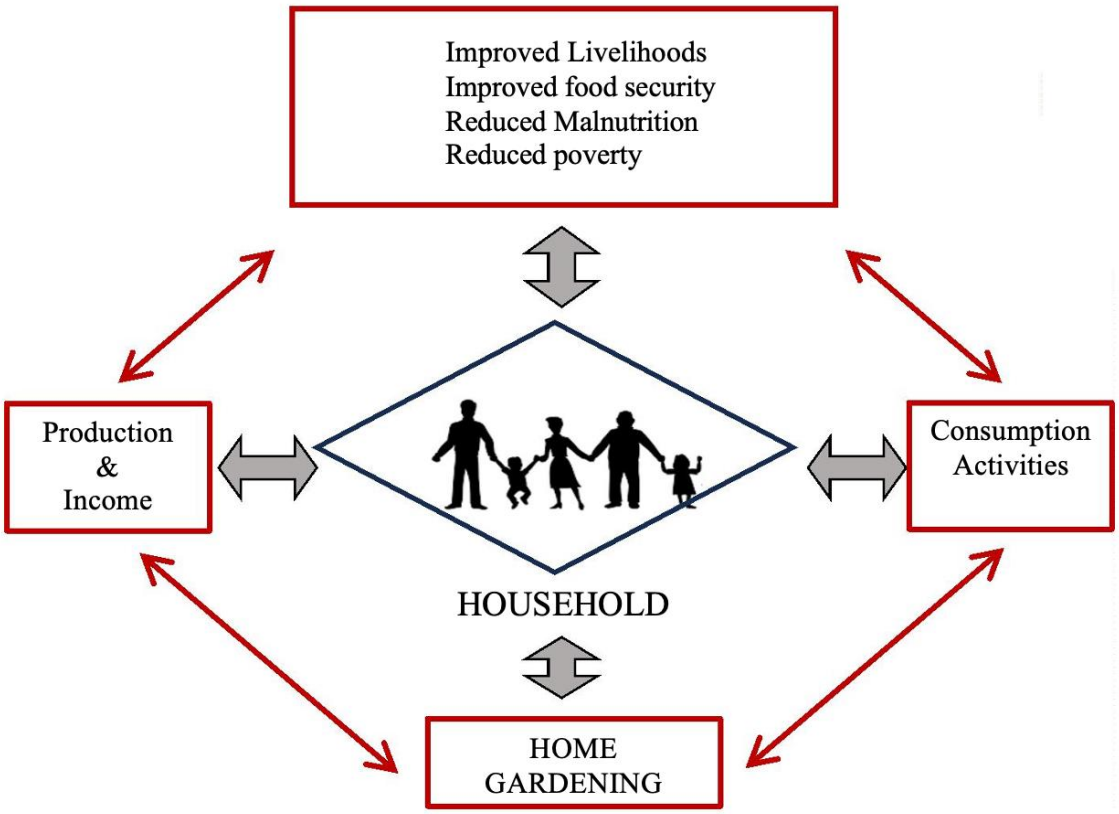

Figure 1: Diagrammatic representation of the conceptual framework

The CARE Livelihood Framework is a conceptual tool developed by CARE International - a global humanitarian organisation geared towards combating poverty. One of the organisation's primary objectives involves implementing programs to enhance household food security and well-being. The framework focuses on the assets, capabilities and activities required for people to make a living and sustain their well-being.

2.9. Conclusion

The study aims to investigate the impact of home gardens on household welfare and multidimensional poverty in rural Limpopo, with the ultimate goal of providing evidence-based

insights for policy and program development. In doing so, several critical knowledge gaps must be addressed to achieve its objectives, including finding the determinants of home garden participation. There is limited understanding of the socio-economic, demographic and contextual factors that influence whether households engage in home gardening. Addressing this gap is essential for designing targeted interventions that foster widespread and equitable participation.

Secondly, understanding the impact of home gardens on Multidimensional Poverty. While the potential of home gardens to reduce income poverty is recognised, their broader impact on other dimensions of poverty such as education, health and living standards – has not been adequately studied. Through the understanding of these mechanisms, more comprehensive approaches to poverty alleviation will be developed. Thirdly, the extent to which home gardens enhance food availability, dietary diversity, and nutritional outcomes for rural households remains underexplored. Filling this gap will provide the necessary evidence to position home gardening as a viable component of food security strategies. By bridging these gaps, this study will advance academic knowledge and contribute meaningful policy and program innovations that improve the quality of life for vulnerable populations in South Africa.

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CHAPTER THREE

STUDY AREA AND METHODS

3.1. Introduction

This study investigates the contribution of home food gardens to household well-being in the Limpopo province, South Africa. This chapter focuses on the areas where the study occurred, the data collection methods used, and the data analysis methods employed. In addition, this chapter will describe and give a brief background on the various models the study utilised.

3.2. Description of study areas

With a population of more than 1.6 million and a total area of approximately 125 754 km^2, Limpopo is located in the northernmost region of South Africa. It is known for its impressive geographic range, cultural heritage, and richness in agricultural-related activities. The province is subdivided into five districts: Mopani, Vhembe, Waterberg and Sekhukhune (DAFF, 2019; Stats SA, 2020). Figure 3.1 below shows the map of South Africa and the map of Limpopo province, and it includes the geographical locations of the regions that were integral to the study.

Mopani district is situated in the northeastern part of the province, and it is known for its arable farming land and favourable climate suitable for agriculture. This region is mainly rural, owing to its popularity for fruit produce, especially bananas, avocados and citrus fruits (Stats SA, 2020) (Limpopo Department of Agriculture, 2017). Vhembe district is located in the province's centre, and it houses the provincial capital, Polokwane. There exists a mix of urban, peri-urban, and rural areas, which then offer a diverse socio-economic landscape. According to the Limpopo Development Agency (2015), the main economic activities within this region include agriculture, trade and services. The Waterberg district is in the western part of the province and is primarily known for its scenic characteristics, which drive agriculture, tourism and mining (Waterberg District Municipality, 2016). Many communities in this region rely heavily on subsistence farming, which makes this area critical for studying the role of home gardens in enhancing food security and household welfare. Lastly, the Sekhukhune district is located in the southeastern region of the province and is known for its semi-arid climate. This poses significant challenges for agricultural production for households and large-scale farmers. Despite the challenging environment, the province still experiences many agricultural

activities, with many families participating in home gardening to supplement food supplies (DAFF, 2019; Sekhukhune District Municipality, 2015). The district's unique socio-economic landscape provides rich insights towards the study objectives like the other provincial regions described. The diversity within the study areas allows for a comprehensive analysis of how home gardens contribute towards food security, nutrition security and overall impact on multidimensional poverty in rural households.

Figure 2: Map of South Africa

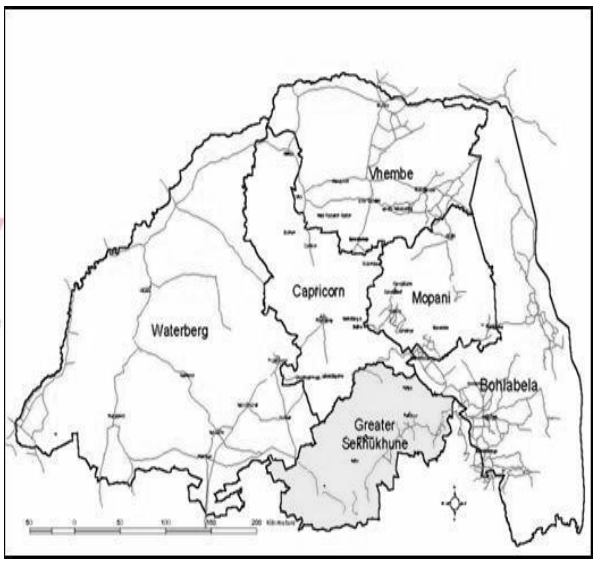

Figure 3: Map of Limpopo province

Source: Ngotho (2010).

3.3. Data Collection Method

This research was part of a more extensive provincial study conducted in 2021. Although the data was collected three years ago, the findings based on this dataset and analysis are still relevant today in improving food security, nutrition security and the well-being of rural households. Furthermore, findings from this study will contribute to the existing critical literature. This study utilised data collected by the South African Vulnerability Assessment Committee (SAVAC) through an extensive data collection effort in the Limpopo province. Through the employment of structured questionnaires, detailed information was obtained from 2043 questionnaires, which informed social, economic, and demographic characteristics, food accessibility, food availability, and survey questions regarding household dietary diversity. The study participants were selected randomly, and a cluster sampling technique was applied.

This method ensured the minimisation of bias and lower costs and time for participant selection and data collection. This method is also accessible and has increased validity and efficiency. Secondary data was thus used for this study through approval from SAVAC (Simkus, 2023).

3.4. Methods of data analysis

This section will provide a brief description of the methods of data analysis used in the study. The model specifications and related formulas will be further outlined in chapters four, five, six and seven of this research paper.

Statistical software packages were used, including STATA (version 13) and the Statistical Software for Social Sciences (SPSS) version 24. Descriptive statistics were analysed to compare the population's socio-demographic factors. Descriptive statistics were examined by calculating the mean, standard deviations, frequencies and percentages of the variables measured in the study. The social and demographic variables included gender, educational level, employment status, salaries and wages, household income and access to land.

3.4.1. Probit Model

The probit model is a technique used when analysing binary outcomes. It was first published in 1934 by an economist, Chester Bliss (Bliss, 1934). The term "probit" is derived from "probability unit", which describes the cumulative distribution function (CDF) of the standard normal distribution. Bliss sought the probit function to model a relationship between a binary dependent variable and a set of independent variables. His work uses binary outcomes widely in various fields, including sociology, public health, economics, and agriculture. The probit model was used to analyse the household survey data.

3.4.2. Probit- 2 SLS

The Probit 2 SLS (two-stage least squares) is an estimation method applied in the context of a probit model. It combines elements of the probit model, which combines binary outcomes with the two-stage least squares method. The two-stage least squares method estimates parameters in models with endogenous explanatory variables (Bliss, 1934). The Probit-2 SLS method is commonly used when other endogenous explanatory variables exist in a probit model. Researchers can then obtain consistent and efficient estimates of the probit model parameters.

The approach is commonly used in empirical research settings where there may be endogeneity concerns. Many authors have used the Probit-2 – 2 SLS when analysing data.

3.4.3. Endogenous switching probit model

The endogenous switching probit model was introduced independently by Heckman (in 1976) and Amemiya (in 1978). The model is a statistical technique for analysing binary outcomes when endogeneity exists in the explanatory variables. It goes beyond the traditional probit model by accounting for self-selection or endogenous treatment effects. In this case, the decision to participate in a particular activity or treatment is influenced by unobservable factors (Heckman, 1976). The model is extensively used within agricultural research and other fields of study. The tool can be used to analyse, for example, the impact of agricultural extension programs, community adoption of conservation practices, or participation in agrarian markets on binary outcomes such as welfare, productivity or income.

3.4.4. Household Food Insecurity Access Scale (HFIAS)

The Food and Nutrition Technical Assistance (FANTA) project developed the Household Food Insecurity Access Scale (HFIAS) to measure the prevalence and severity of household food insecurity (Coates *et al*., 2007; Swindale & Bilinsky, 2006). The adequacy of food access is established by examining the experiences and behaviours of households over one month. The HFIA consists of a questionnaire about various aspects of food insecurity. These aspects include anxiety about food availability, insufficient food quantity and the experience of hunger due to lack of food access. According to the responses to the questionnaire, households are then categorised into different levels of food insecurity, which range from food security to severe food insecurity (Coates *et al*., 2007). Due to the nature of the HFIAS method, studies have indicated that it produces accurate results because of its internal consistency, valid criteria, and reliability (Coates *et al*., 2007; Deitchler *et al*., 2011).

3.4.5. Household Dietary Diversity Score (HDDS)

Some gardens have the potential to contribute significantly to the nutrition security of rural households. However, the consequences of inadequate food supply can contribute to many challenges at the individual and household levels. The study analysed home gardens' contribution to households' nutrition security through the Household Dietary Diversity Score

(HDDS) (Taruvinga & Mushunje, 2013). This is a 12-scale dietary diversity score developed by the Food and Nutrition Technical Assistance (FANTA). This method is widely used in research, policy, and various program implementation programs to assess and monitor household nutrition and dietary issues (Swindale & Bilinsky, 2006).

3.4.6. Multidimensional Poverty Index

This study also analysed how home gardens impact household impact multidimensional poverty. This index incorporates poverty incidence and intensity (Alkire & Foster, 2011). There are 10 indicators included within the MPI, which can be subdivided into three main primary groups: health, education and standard of living. The methodology focuses on undernourished and nourished household members within the health dimension.

Developed by Sabina Alkire and James Foster, the Multidimensional Poverty Index (MPI) is a method which allows poverty to be measured beyond income-based means by capturing multiple dimensions of deprivation in a household (Alkire & Foster, 2011). Individuals or families are identified as multidimensionally poor within the MPI if they are deprived of multiple indicators across the different dimensions. There are 10 indicators included within the MPI, which can be subdivided into three main primary groups: health, education and standard of living. The methodology focuses on undernourished and nourished household members within the health dimension. The different dimensions of well-being that individuals or households are measured include health, education and living standards. The MPI method allows for a comprehensive understanding of poverty as it simultaneously contains various domains of deprivation. It is widely used by international organisations, government departments and researchers as an effective tool for poverty analysis, formulating multiple policies and monitoring progress for goals geared towards reducing poverty.

3.5. Conclusion

The methodological approach adopted in this study is comprehensive and sufficiently rigorous to address its objectives of understanding the impact of home gardens on household welfare and multidimensional poverty in rural Limpopo. By employing robust analytical techniques that account for food insecurity, household participation, and socio-economic dynamics, the study ensures a thorough examination of the complex relationships between home gardening,

food security, and poverty reduction. These methods provide a strong foundation for identifying key determinants and assessing the broader implications of home gardens on welfare, enabling the generation of actionable insights for policy and program development.

3.6. References

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CHAPTER FOUR

DETERMINANTS OF HOME GARDEN PARTICIPATION IN THE LIMPOPO PROVINCE, SOUTH AFRICA

Abstract

Global comparisons identify that Sub-Saharan Africa has the lowest per capita consumption of vegetables. This poor consumption correlates with poor human health and quality of life – signalling the need for directive policy and implementation. The South African government identified home gardens as one of the strategies to improve rural households' food and nutrition security. Rural households rely on locally produced food, mainly from home gardens, to supplement their dietary intake. This study was designed to assess the factors associated with the participation of rural households in home gardening. Secondary data was collected from 2043 households in rural Limpopo and was analysed using descriptive analysis and the Probit regression model to identify factors correlated with participation in home gardening activities. Access to land (3.207) and agricultural-related assistance (-0.603) had a negative and significant correlation with the involvement in home gardening among rural farming households. In contrast, household size (0.045) and the production of fruit and vegetables (0.480) had a positive and significant correlation. The model's constant value was 4.470, which is also substantial. While the findings showed that most households (96.8%) consumed fruits and vegetables, only 24.6% were_found to be producing these fruits and vegetables. Access to land and agricultural-related assistance had a negative and significant correlation with participation in home gardening among rural farming households. In contrast, household size and production of fruit and vegetables had a positive and significant correlation. The study concludes that socio-economic factors are likely to influence participation in home food production, and the provision of community-based assistance through extension advisory services is necessary for the sustainability and success of home gardens in rural areas. The findings urge policymakers to facilitate interventions that promote home gardens, including agricultural skills training, to ensure further that rural home dwellers increase food accessibility, stability and food utilisation within the pillars of food security.

4.1. Introduction

Through the local production and sale of agricultural produce, households can alleviate hunger and improve their food security status. Cultivating one's food is crucial to meeting Sustainable Development Goal 2 of ending hunger and poverty. South African rural households can improve their food security outcomes while earning a livelihood by producing food. In 2020,

a 5.9% GDP growth within the agricultural sector was observed, contributing to overall GDP growth of 13.1% (Stats SA, 2021d). Moreover, this sector is vital for rural livelihoods and contributed to increased employment growth by 5.2% in 2020 (Mthethwa *et al*., 2022; STATSA, 2020). It is also crucial in improving food availability and accessibility among rural households. Rural households rely on locally produced food, mainly from home gardens, to supplement their dietary intake. However, South Africa has not been able to achieve self-sufficiency in local home garden production due to many factors, such as land ownership limitations, lack of farming implements, lack of mechanisation, and the small-scale nature of production (Hlatshwayo, 2022; Obasi, 2013). As with other sub-Saharan African countries, South Africa experiences considerable food shortages (Wudil et al., 2022).

Various approaches are required to address the food shortage and poverty problem rural households in South Africa face (Qange, 2020). Home gardens have been acknowledged as a strategy to improve household food accessibility and well-being (Carstens et al., 2021; Galhena et al., 2013). Home food production in small plots around the house is the oldest long-term form of cultivation (Galhena et al., 2013). South Africa Integrated Food Security Strategy of 2002 (SAIFSS) considers home gardens to be one of the effective strategies to mitigate household food insecurity (Mokone, 2016). Similarly, the Food and Nutrition Security Implementation Plan (2018 -2023) also emphasises the need for households to be engaged in food production. Home gardens being cost-effective is a positive factor due to rural households' insufficient productive resources. Higher levels of unemployment within rural areas lead to malnutrition due to a lack of dietary diversity. Home gardens have been acknowledged as one of the means to combat malnutrition due to the available sources of food (Baiphethi & Jacobs, 2009; Mdiya & Mdoda, 2021)**.** Surplus foods from home gardening production encourage local entrepreneurs to develop and participate in markets.

Additionally, income is generated through increased demand for locally produced foods. The rural economy grows and strengthens, which, in turn, contributes to poverty reduction (Dumont *et al*., 2017). In other words, money brought into the rural communities through purchasing locally produced foods remains within the community. Furthermore, sustainable home gardening production could encourage the employment of family members and community residents, thus enabling more individuals to secure livelihoods for themselves and their households in return (Badghan *et al*., 2020; Hendrickson & Massengale, 2022).

Although there are numerous benefits associated with home food gardening in rural communities, there are also limitations that threaten home gardens' sustainability and productivity (Baiphethi & Jacobs, 2009; Baliki *et al*., 2023; Bushamuka *et al*., 2005; Cabalda *et al*., 2011; Rammohan *et al*., 2019). Some include rapid growth in the population rate, climate change, increasing demand for biofuels, and increases in food prices. The major limiting factors are the lack of access to suitable and sufficient land, land ownership, and usage rights (Chihambakwe, 2014; D. Galhena *et al*., 2013). Other challenges include capital or credit access, water access, seed and farming implementation, and limited extension and advisory services (Mitchell & Hanstad, 2004a). In addition, lack of home garden labour and market access are other constraints that limit the viability of home gardens in many households. In 2022, the global population reached 8 billion, and the numbers are expected to rise to 9.8 billion in 2050 (United Nations, 2019). The growing demand for food will surpass the ability of food supply locally (Food & Agriculture, 2020; United Nations, 2019). Home food gardens may be the required solution for food production in rural areas amidst complexities relating to the rise in population.

Several studies across Southern Africa and within South Africa were conducted, focusing on the commercialisation of smallholder farmers or local producers and how they can broaden their knowledge and skills to merge into commercial farming (Aliber & Hart, 2012; Oguttu *et al*., 2021; Zondi *et al*., 2022). Other studies have focused on rural subsistence farming characteristics (Qange & Mdoda, 2020). For South African rural areas, agricultural production is critical in poverty alleviation and job creation. Empirical studies on local producers and the factors contributing to rural communities' participation in local home garden production are limited. Against this backdrop, this study seeks to explore a more comprehensive understanding of specific factors determining home garden food production in rural Limpopo. This understanding will inform the effective review of existing policies and programs and the development of new strategies to support and enhance home gardens in rural areas.

4.2. Research methodology

4.2.1. Description of Study Areas

Chapter three of this research paper outlines An in-depth description, including a study area map.

4.3. Data collection method

A quantitative research approach was used. The study utilised secondary data from random sampling based on district population size from 2020. Data was collected from 2043 respondents to understand the food and nutrition situation, including food production among rural households. Structured questionnaires were used to gather demographic information. The study participants were selected randomly, and a cluster sampling technique was applied. This method ensured the minimisation of bias and lower costs and time for participant selection and data collection. Data used in this study was extracted from this comprehensive dataset to isolate and understand the determinants of participation in home gardening by rural households. The cluster sampling technique selected households from different municipalities and districts.

4.4. Data analysis

Statistical Package for the Social Sciences (SPSS) Version 24 and STATA were applied to analyse and compare data. Descriptive statistics were computed where applicable, including the means, standard deviations, frequencies and percentages.

4.4.1. Probit model

The objective of this section was to analyse the determinants of home garden participation, and the probit model was chosen as it aligned well with the nature of the research question and the secondary data collected. This model examines the relationship between a binary response – it estimates the probability that a value will fall into one or two possible binary outcomes (Humphreys *et al*., 2015; Long, 1997). Because the probit model is specifically designed for such binary outcomes, estimating the probability of participation as a function of household and contextual factors is possible. A binary dependent variable requires a mode that accounts for the non-linear relationship between predictors and probabilities by using a cumulative normal distribution function to ensure that predicted probabilities lie between 0 and 1 (Taruvinga *et al*., 2016). In addition, using this model enables the researcher to focus solely on the decision-making process – whether or not households decide to participate in home gardening (Kassie *et al.*, 2013). The coefficient and marginal effect for each independent variable against a dependent variable were assessed. This will enable food security experts and policymakers to determine which factors significantly influence participation in home gardening within the rural areas of Limpopo, as well as layout predictive factors that may influence decision-makers in the future. Many researchers in household food

security in developing countries have used probit models as effective methodologies (Mthethwa *et al*., 2022; Obasi, 2013). This is because results from the probit model are directly interpretable in terms of probabilities, thus making it easier to identify the key drivers of participation and provide actionable policy recommendations. The probit model is a widely accepted, theoretically sound choice for modelling binary dependent variables in social and economic research, and its application ensures methodological rigour (Kassie *et al.*, 2013; Kabir *et al.*, 2022).

The underlying latent variable that captures the true farmer's socio-economic characteristics is hypothesised to determine the probability of participation in home garden production (HGP) by rural households (Feder *et al*., 1985; Ojo *et al.*, 2021). The regression Equation 1 indicates the latent variable HGP^*_i=:HGP^*

$$HGP^*_i = \mathrm{X}_i\beta + ei \quad ei \approx Y \tag{1}$$

$$HGP^*_i = 1 \; if \; HGP^*_i > 0$$

$$HGP^*_i = 0 \; if \; HGP^*_i \leq 0 \tag{2}$$

HGP^*_i Takes a value of 1 if rural households participated in home garden production and 0 otherwise. A vector to be estimated is β. A probit model of HGP^*_i Which follows random utility, is expressed as in Equation 2 (Wooldridge, 2002); a Probit model of HGP which follows random utility is defined in equation 3:

$$\Pr\,(HGP_i{=}1|B_i, \alpha) = \oint (B_i, \alpha) + ei \tag{3}$$

HGP_i Equals 1 for households participating in home garden production and 0 otherwise; Xi represents the vector of independent variables; α for the vector of parameters to be estimated. Theφ, standard normal cumulative distribution function: e¡ is a random error term hypothesised to be distributed generally with unit variance and zero means. Table 4.1 shows the definition of variables and prior expectations.

Table 4.1: Definition of variables and prior expectation

Variable	Definition	Expected sign
Age	Total number of years (continuous)	±

Education of household	Educational level of household head (grade 0/R to Doctoral degree)	+
Employment status of household	Categorical; 1=employed full time, 2=part-time employed, 3=self-employed, 4=not employed, 5= full time studying.	+
Gender	Gender of household head (1= male and 2 = female)	±
Household size	Number of family members (continuous)	±
Did work for wages/ salary	If a household head worked for wage/ salary (1=yes, 2=no)	+
Household grant recipients	If a household head received a grant (1=yes, 2=no)	±
Receive any social relief for disability.	If the household head received social relief of disability (1=yes, 2=no)	±
Access to land	If a household head had access to land (1=yes, 2=no)	+
Agricultural related assistance	If a household head received any agricultural-related assistance (1=yes, 2=no)	±
Marital status of household	If a household is married (1=yes, 2=no)	±
Market distance	The distance covered by the household head to get to a market (continuous variable)	±

4.5. Results and Discussion

4.5.1. Demographic characteristics

Table 4.2 below shows the demographic characteristics of study participants.

Table 4.2: Demographic characteristics of Limpopo household

Characteristics	**n**	**%**
Gender		
Male	944	46.2
Female	1099	53.8
Participant household distribution by study site		
Capricorn	382	18.7
Greater Sekhukhune	439	21.5

Mopani	434	21.2
Vhembe	425	20.8
Waterberg	363	17.8
Level of Education		
Grade R/0 to Grade 7/standard 5	464	27.3
Grade 8/ Standard 6 to Grade 12/ Standard 10	716	42.2
NTC 1/N1 to NTC III/N3	30	1.7
NTC4/ N4 to NTC 6/ occupational certificate- NQF level 5	14	.8
Diploma with less than grade 12/std 10	6	.4
Higher/ national/advanced certificate with Grade 12/ std 10	11	.6
Diploma with Grade 12/std 10/ occupational certificate- NQF 1	36	2.1
Higher Diploma/ occupational certificate (b-tech diploma)- N	18	1.2
Post Higher Diploma (Masters Diploma/ Masters degree)- N	4	.2
Bachelor's Degree/ occupational certificate NQF level 7	25	1.5
Honours degree/ postgraduate diploma/ occupational certificate	7	.4
Doctoral degrees (doctoral diploma and PhD)- NQF level 10	4	.2
No schooling	310	18.2
Employment		
Employed full-time	230	15.4
Employed part-time	105	7.0
Self-employed	86	5.8
Not employed	1055	70.7
Studying full-time	16	1.1
Marital status		
Legally married	608	38.0
Living together like husband and wife	102	6.4
Divorced	28	1.8
Separated but still legally married	10	0.6
Widowed	334	20.9
Single but have lived together with someone as Husband/wife	71	4.4
Single and have never been married/ never lived together as husband/wife	466	27.9
Salaries and wages	**372**	**23.2**
Household income		
No income	22	1.5
Less R1500	328	21.7
1501-3000	588	38.9
3001-4500	281	18.6
4501-600	98	6.5
Greater than 6000	195	12.9
Access to land	**666**	**36.0**
Own land	592	88.9
Rent land	7	1.1
Tribal authority	23	3.5
State-owned land	4	0.6
Other	40	6.0
Land used for the production of food and other agricultural products	**551**	**82.5**

Results showed that most participants were African (98.9%), and the dominant gender to participate was females (53.8%). This emphasises the fact that African women play different essential roles in agriculture. These results correlate with Mdiya & Mdoda (2021), who highlighted women's significance and vital role in participation in and management of home gardens. The minimum household head age was 18, and the maximum was 103, with a mean of 53. 90 years. The average household size was 4.59, where the minimum and maximum sizes were 1 and 24, respectively. The results also showed that about 6% of the participants worked on farms, 5.4% worked in the educational sector, and 5.2% worked in the manufacturing sector.

South Africa needs a healthy agricultural industry contributing to rural economic growth and development. South Africa is known and remains a net exporter of farm products, where in 2020, agricultural exports amounted to $10.2 billion (Moore, 2021). However, despite this growth, most rural communities do not share in the country's wealth accumulation. These statistics further exacerbate the economic divide in society between those who have and those who do not. The study showed that 70.7% of home garden farmers were unemployed. Out of 2043 participants (ages 18 up to 103), 1055 had no income source from employment. Of those employed, 15.4% of participants had jobs, which suggests that home gardening was a strategy for additional food and income sources. Many households forgo store-bought foods because of what they already have access to from the food gardens. This aids financial savings and available funds, which families can redirect to other needs. These findings align with Baiphethi & Jacobs (2009), who state that South Africa has incredibly high inequality rates. Regarding education, the results showed that about 42.2% obtained grade 8/std 6 to grade 12/ std 10, followed by 18. 2% did not attend any school, and only 0.2% had a doctoral degree. Most participants did not further their studies, and some were illiterate. Most households (38.9%) had income ranging between R1501-R3000. Furthermore, 38.0% of household heads were legally married, while 27.9% were single (never been married). Regarding land ownership rights, 88.9% of households owned land, while only 1.1% rented land.

4.5.2. Fruit and vegetable availability in home gardens

Table 4.3 below shows fruits and vegetables.

Table 4.3: Fruits and vegetables are grown and consumed by Limpopo household

Fruits and Vegetables	Produced (%)	Consumed (%)
Fruits	10.5	32.6
Vegetables	21.7	96.2
Fruits and vegetables	24.6	96.8

The proportion of fruits and vegetables grown and consumed by home garden households. Most of the land (82.5%) was used for food production and agricultural practices. Households used most of the land for food production and encouraged families to participate in home gardens. The results showed that almost 96.2% of rural households consumed vegetables, while only 21% were involved in their production. Regarding fruit production and consumption, 10.5% of households produced it.

Regarding the availability of fruits and vegetables, the results showed that 96.8% of households consumed them while 24.6% produced them. Even though most did not participate in growing fruits and vegetables, they had access to them. Talukder *et al*., (2000) documented how developing countries have seen increased availability and consumption of food cultivated in home gardens. Most of these food items contributed towards an increase in vitamin-A-rich foods.

4.5.3. Factors influencing participation in home garden production

The results in Table 4.4 present the factors influencing participation in home gardening among smallholder farmers in Limpopo.

Table 4.4: Factors influencing participation in home garden farming

Home Gardening participation	Probit			Marginal effect		
Variables	Coef.	St. Err.	P-value	Dy/dx	Std.	P-value
Gender of household head	0.175	0.106	0.100	0.010	0.007	0.139
Age of household head	-0.003	0.003	0.400	-0.000	0.000	0.413
Employment status of household head	-0.029	0.060	0.627	-0.002	0.004	0.631
Household size	0.045	0.021	0.028**	0.003	0.001	0.059**
Work for wages	0.001	0.129	0.991	0.000	0.007	0.991

Household grant recipien	-0.045	0.120	0.705	-0.003	0.007	0.706
Access to land	-3.207	0.231	0.000***	-0.185	0.043	0.000***
Education of household head	0.001	0.002	0.632	0.000	0.000	0.635
Marital status of household head	0.010	0.022	0.666	0.001	0.001	0.667
Agricultural related assistance	-0.603	0.300	0.044**	-0.035	0.020	0.078*
Market distance	0.001	0.007	0.844	0.000	0.000	0.845
Fruit and vegetables produced	0.480	0.097	0.000***	0.028	0.010	0.004***
Constant	4.470	0.774	0.000***			
Mean dependent var	0.201					
Pseudo r-squared	0.573					
Chi-square	1166.29					
Akaike crit. (AIC)	896.871					
Bayesian crit. (BIC)	969.876					
Prob > chi2	0.000					
VIF	1.235					

* Indicates significance at 10% level,** Indicates significance at 5%, level*** Indicates significance at 1% level.

The marginal results showed that household size (0.003), land accessibility (-0.185), agricultural aid (-0.035), and fruits and vegetables (0.028) significantly impacted home garden farming participation. Production of fruits and vegetables was statistically significant ($p < 0.01$) and positively correlated with home garden farming. Involvement in fruit and vegetable production is associated with increased participation in home garden farming. The production of home-grown foods through home gardens has shown great importance for household food security by reducing the dependence on purchased foods. Pulami and Poudel (2006) alluded that if home garden farmers can thrive and run sustainable and more productive home gardens, this can help improve rural households' livelihoods and education. Furthermore, Talukder *et al.*, (2000) emphasised the importance and need of growing Vitamin-A-rich foods like fruit and vegetables.

Land access is a fundamental natural resource for running a home garden. Unexpectedly, access to land in this study had a negative and statistically significant correlation with home garden farming participation, with a marginal effect of -0.185. The lack of access to land contributed to a decrease in home garden production. Without access to land, economic and physical activity are compromised, and these findings align with the empirical findings of Laney and Turner (2015) and Mokhele (2022). The current study was comprised primarily of women, and it further proved how women still face many challenges with access to land in rural areas, which can be seen as one of the inhibiting factors to home gardens. Nzama & Ntini (2022) stated that despite women's role in agricultural production, they still face discrimination in accessing and owning land – those who have land ownership do so through their husbands and fathers. This dominant land tenure system is seen throughout many Southern African countries, including South African rural areas (Mutangadura, 2004). Women also find themselves deliberately involved in home garden farming to enhance their livelihoods and gain purchasing power; however, in the case of many patriarchal societies within the African context where land is primarily owned and managed by males, land access is a longstanding challenge to home garden food production in rural areas (Mutangadura, 2004).

Agricultural-related assistance had a significant and negative relationship with home garden production with a marginal effect of -0.035 ($p < 0.1$). Rural households were not receiving enough agricultural aid, negatively impacting home garden participation. Faber & Laurie (2010) showed how demonstration gardens were successfully used as training centres to help home gardening focus on provitamin A-rich foods to address the nutritional deficiency in the community in South Africa. New seed varieties and skills were trained using research and medical institutions to help communities own the projects so households can improve their food utilisation and nutritional status. External help providing home garden assistance in the rural areas of Limpopo was deemed successful after households showed improved productivity and overall sustainability in their practices (Mdiya & Mdoda, 2021). Collaborated efforts between rural communities and local government structures can reap positive benefits should they involve agricultural training and education programs to help households acquire skills to thrive in their home garden spaces.

Household size positively and statistically significantly correlated with home garden farming participation, with a marginal effect of 0.003 ($p < 0.05$). Bigger households reported increased involvement in home gardening compared to smaller households. This phenomenon may have

been possible due to more people available to assist in various tasks within the home garden, as opposed to households with fewer members. Parallel to this result, Galhena *et al*., (2013) highlighted the importance of family participation in the home garden. In cases where families need extra people to help and are financially able to pay them, they would hire people. Herrera *et al*. (2021) also showed an association between household size, land size, and food security. Bigger households, owning more extensive land to grow crops on, had less probability of being food secure than families that were smaller in number and land size. Based on the above, one can confirm that in cases where families had more people, there was little to no need for hiring labour, which comes with an added advantage as households can redirect and distribute available resources where they are needed elsewhere.

4.6. Conclusion

Improvement of home gardens not only helps to ensure food availability among rural households, but it also holds the potential to enhance rural livelihoods, boost income, and improve food security. The study intended to determine the factors associated with home garden food production in Limpopo province, South Africa. The results showed that access to land and agricultural-related assistance had a negative and significant correlation with the participation of home gardens among smallholder farmers, with marginal effects of -0.185 and -0.035, respectively. Household size and production of fruit and vegetables had a positive and significant correlation. On the other hand, the results showed that most households consumed fruits and vegetables while only a few produced them.

The study concludes that socio-economic factors are likely to influence participation in home food production. Improved access to land and agricultural-related assistance can improve home garden production. Generally, more women participated in home food garden production than males. The study recommends encouraging rural households to participate in home garden production through various workshops demonstrating the benefits that farming households can get from producing their food. The workshops can also train these households to keep their home garden production viable and sustainable. Demonstration gardens or field schools whereby families and individuals would be shown and trained on how beneficial home gardens can be. Extension workers must ensure that they do not exclude home garden owners from all their extension services to smallholder farmers. Community-based assistance through extension advisory services is necessary for the sustainability and success of home gardens in a rural area of Limpopo.

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CHAPTER FIVE

ANALYSIS OF THE CONTRIBUTION OF HOME GARDENS TO HOUSEHOLD FOOD SECURITY IN LIMPOPO PROVINCE, SOUTH AFRICA

Abstract

The study explored the role of home gardens in enhancing household food security in rural areas of Limpopo province, South Africa. While the nation is food secure, many households face significant food insecurity and malnutrition challenges, particularly in rural communities. Using a quantitative research approach and multistage stratified random sampling, 2043 rural households were selected as study participants. Food security data was collected using the Household Food Insecurity Access Scale (HFIAS). The findings revealed that 46% of participants were food secure, 24% were severely food insecure, 17% were moderately, and 13% were mildly food insecure. The Endogenous Switching Poisson Regression Model identified significant factors impacting food security. Positive influences on food security included the gender profile of household heads (2.164) for home garden participants, employment status (0.90) for non-participants, household size (0.009), working for wage/salary (0.083), access to land (0.114), agricultural assistance (2.483), and market proximity (0.004) for participants. Conversely, negative impacts were noted with the age of household head (-0.003) for non-participants, employment status (-0.40), social relief (-2.109) and agricultural-related assistance (-0.743) for participants, as well as wage/salary work (0.192) for non-participants. These results highlight the nuanced factors influencing food security across participant and non-participant household heads. The study concludes that agricultural training and skills enhancement are crucial to increasing participation in homestead gardening, thereby addressing food security and income challenges. Furthermore, integrating agricultural education into school curriculums is recommended to foster an understanding of food systems, nutrition, and food security from a young age.

5.1. Introduction

Globally, there are ongoing considerations for better and more sustainable ways to feed the growing population. By 2050, the global population is predicted to reach over 9 billion (Galhena *et al*., 2013; IISD, 2020). Some countries will have difficulty meeting the growing demand, which could lead to hunger and food insecurity for many households struggling to cope with food price volatility and local food production limitations. This is the reality for

many families within the lower income range who cannot be guaranteed access to sufficient food (Adekunle, 2013; FAO, 2012). In 2020, Statistics South Africa recorded that 23.6% of South Africans ranged from moderately to severely food insecure, while 14.9% experienced severe food insecurity (Stats SA, 2022). Out of 113 countries, South Africa ranked the most food secure in Africa (GFSI, 2022). South Africa is considered food-safe as it produces enough staple food to feed its population. However, rural households continue to encounter food security difficulties.

Multiple strategies are required to address the growing food production and food insecurity challenge. The success of these strategies relies primarily on socio-political conditions, the economic climate and available resources (Cerda *et al*., 2022). Home food gardening is perceived as a successful strategy that can increase food access. Although home food gardens have evolved over the years as societies go through urbanisation, they have been essential for families providing food worldwide (Ferreira *et al.,* 2018; D. H. Galhena *et al.,* 2013). Home food gardens are described as a family-managed microenvironment within a more extensive farming system that frequently exhibits high levels of species diversity (Rammohan *et al*., 2019; Vavra *et al*., 2018).

Home food gardens are among the most essential food sources in developing countries, as they significantly contribute to households' food consumption needs for improved health and nutrition (Korpelainen, 2023; Musotsi *et al*., 2008). Home food gardening is practised in most rural areas in South Africa as a source of household income and food consumption (Vavra *et al*., 2018). Home garden programs reduced food insecurity (Vavra et al., 2018). In addition, home gardens are considered a community's most adaptable and accessible land resource that significantly reduces household vulnerability while ensuring food security (Department of Justice and Constitutional Development, 1996; Onomu *et al*., 2022). They provide quick access to food that can be harvested, prepared and eaten by family members regularly and easily. To some extent, they are a production system that under-resourced households can easily access. Household farming has the potential to provide a variety of foods that can increase the quantity and improve the quality of nutrients for household diets (FAO, 2010b; Korpelainen, 2023).

Despite the potential benefits and opportunities that home gardening provides to rural households, various factors can hinder production. These factors include lack of farming skills, availability of space and water, security of tenure, availability of time, and pest and disease occurrence. In addition, there is a lack of planting materials, an inadequate supply of quality

seeds (Masipa, 2017) and a lack of finance. Other constraints include a lack of access to water, poor soil fertility, access to agricultural inputs, limited marketing opportunities, and a lack of information and advisory services (Cerda *et al.*, 2022; Onomu *et al.*, 2022). These challenges accelerate food insecurity among low-income households as they affect the production of diversified foods.

South Africa established a food security policy enshrined in the Bill of Rights, Section 27, 1 (b), which highlights that every citizen has a right to access to sufficient food and water and that the state must take reasonable legislative and other measures to achieve this (Department of Justice and Constitutional Development, 1996). The Food and Nutrition Security Implementation Plan was formulated to assist and emphasise the need for households to produce food to address household food insecurity and hunger. In the same light, the objective of the then Department of Agriculture, Forestry and Fisheries (DAFF) (now renamed the Department of Agriculture, Land Reform and Rural Development) was to develop agricultural policies and initiate projects that would ensure South Africans could produce their food to be food secure. This objective is closely aligned with the Food and Nutrition Security Implementation Plan. Both are fundamental for achieving Goal 2 of the Sustainable Development Goal: ending hunger and achieving food security and nutrition (DAFF, 2019; Statistics South Africa, 2019).

For context-appropriate policies and programs to be implemented that enhance home gardening for rural dwellers, there is a need first to determine how home gardens contribute towards household food security and the gaps and opportunities that may present themselves. In the past, South Africa implemented the One Home One Garden initiative to encourage and equip households predominantly in rural areas to cultivate their food, hoping to alleviate hunger and reduce food insecurity (Nesengani *et al*., 2016). Rammohan *et al*. (2019) examined the role of home gardens in alleviating household food insecurity and improving dietary diversity among rural households in Myanmar. Saediman *et al.*, (2021) investigated the contribution of home food gardening to household food security in Indonesia. In addition, Issahaku (2023) examined farmers' decisions to engage in subsistence home gardening and its impact on food and nutrition security among farm households in Rwanda. Although studies were conducted internationally, they demonstrate the gap in the South African context relating to home food gardens and their contribution to household food security. In light of this background, this study

aims to identify how home gardens contribute towards reducing household food insecurity in Limpopo Province, South Africa.

5.2. Methodology

5.2.1. Description of Study Areas

Chapter three of this thesis provides an in-depth description of the study area.

5.3. Data Collection

A total of 2043 respondents were surveyed, using structured questionnaires, to understand the status of food and nutrition security of participating households. Information collected included demographics and household welfare data. The information used in this study was extracted to understand the contribution of home gardening production and household food security. This study used a quantitative research approach and the multistage stratified random sampling technique to select household heads from different municipalities and districts.

5.4. Data Analysis

The quantitative data were analysed using STATA statistical software (version 13) and Statistical Software for Social Sciences (SPSS) version 24. A descriptive statistics analysis compared the sample population's socio-economic factors and food security status between rural households participating in home gardening production. The food security assessment used the internationally accepted food measurement tool, the Household Food Insecurity Access Scale (HFIAS).

The HFIAS evaluates food insecurity (access) (Coates *et al*., 2007). The HFIAS has nine questions based on an individual's food access uncertainty and anxiety. A coded frequency for each of the nine occurrence questions related to household-level food access was used to determine the HFIAS score for each household. The maximum score for each of the nine questions is 3, while the total score has a maximum of 27 and a minimum score of 0. The scores indicate how secure the household's access to food is, with a higher score indicating greater food insecurity and a lower score indicating greater food security (Coates *et al.*, 2007). The HFIAS has four categories: secure, mild, moderate and severe.

5.4.1. Endogenous Switching Poisson Regression Model

Following other empirical studies (Donkoh, 2020; Hasebe, 2020), this study used the endogenous switching Poisson regression model to assess the contribution of home gardens to household food security. There are four primary reasons why the Endogenous Switching Poisson Regression Model was chosen—the nature of the outcome variable or the count data. For example, the household food security indicator is a count variable, such as the number of daily meals or foods consumed. This model was chosen as it is a good choice for modelling such outcomes—secondly, the endogeneity of home garden participation. Household participation in home gardening (the treatment variable) is likely endogenously determined. It may depend on unobserved factors such as resource accessibility, household motivation or cultural factors (Miranda & Rabe-Hesketh, 2006). The unobserved factors may also influence food security outcomes. Thirdly, the study hypotheses two distinct groups. Group 1: households participating in home gardening, and Group 2: Households not participating. The endogenous switching model allows for separate food security outcome equations for these two groups. Lastly, the model enables correcting for bias. By explicitly modelling the treatment decision (home garden participation) and the food security outcome jointly, the model corrects for potential selection bias and provides more accurate estimates of the impact of home gardening on food security (Miranda & Rabe-Hesketh, 2006).

Terza and Miranda designed the model (Terza, 1998; Miranda, 2004), which stated that given the *i*th household from a random sample $I = \{1 \ldots .n\}$ conditional on a vector of explanatory variables X_i, an endogenous dummy C_i and a random term ε_i, the dependent variable Y_i, which is a count, is supposed to follow a standard Poisson distribution as follows:

$$F(Y_i/\varepsilon_i) = \frac{\exp\{-(x_i'\beta+\gamma C_i\varepsilon_i)\}\{\exp(x_i'\beta+\gamma C_i\varepsilon_i)\}^{y_i}}{Y_i} \quad (1)$$

where β and γ are coefficients to be estimated. The error term ε_i measures omitted, as are unobserved variables and any measurement error. Given a vector of explanatory variables Z_i (which may contain some or all elements of) X_i, C_i is characterized by an index process

$$C_i = \begin{cases} 1 \; if \; Z_i\alpha + V_i > 0 \\ 0 \; otherwise \end{cases} \quad (2)$$

where α is a vector of coefficients to be estimated. Suppose that W_i represents all endogenous variables and ε_i and V_i are jointly normal with mean zero and covariance matrix $\sum = \begin{pmatrix} \sigma^2 & \sigma\rho \\ \sigma\rho & 1 \end{pmatrix}$,

given that ε_i , C_i and Y_i are independent. Hence, the joint conditional probability density function of Y_i and C_i, given W_i, can be written as

$$F = (Y_i/C_i/W_i) = \int_{-\infty}^{\infty}\{C_i f(C_i/Y_i = 1, W_i, \varepsilon_i)Pr(C_i = 0/W_i, \varepsilon_i)\} f(\varepsilon_i)C_i\varepsilon_i \quad (3)$$

where $f(\varepsilon_i)$ denotes the probability density function for the random term ε_i.

By operationalising the endogenous switching Poisson regression model in this manner, the study provides robust estimates of the contribution of home gardens to household food security while addressing selection bias and endogeneity. Furthermore, this method ensures that the findings are reliable and reflective of causal relationships rather than spurious correlations (Woolridge, 2010).

5.5. Results and Discussion

This study aimed to analyse the association of home gardens with household food security, with a particular focus on the rural areas of Limpopo province. This is important as it focuses on one geographical region with unique characteristics and needs that could differ from other provinces in South Africa. This section discusses the results obtained from the HFIAS as a standard food security measurement tool and the quantitative data analysed using STATA and SPSS.

5.5.1. Descriptive Results

This study involved 2043 rural households, of which 53.8% were female and 46.2% were male.

Table 5***.1*** displays the demographic characteristics of the study sample. The minimum age of the household head was 18 years old, the maximum was 103 years old, and the mean was 53.9 years old. Women were seen as the dominant gender in home gardening. Table 1 below displays the demographic characteristics of households. This may imply that they are responsible for caring for the family while ensuring sufficient food for their needs, especially for those unable to find formal employment. This study finding was consistent with Oguttu *et al*., (2021) and Bhandari *et al*. (2021), who found rural women more involved in home food gardening than their male counterparts. Adeosun et al. (2020) also found that female-headed households positively influenced households' home gardening and food accessibility more than male-headed households. (Table 1).

Table 5.1: Demographic characteristics of Limpopo households.

Characteristics	n	%
Gender		
Male	944	46.2
Female	1099	53.8
Participant household distribution by study site		
Capricorn	382	18.7
Greater Sekhukhune	439	21.5
Mopani	434	21.2
Vhembe	425	20.8
Waterberg	363	17.8
Level of Education		
Grade R/0 to Grade 7/standard 5	464	27.3
Grade 8/ Standard 6 to Grade 12/ Standard 10	716	42.2
NTC 1/N1 to NTC III/N3	30	1.7
NTC4/ N4 to NTC 6/ occupational certificate- NQF level 5	14	.8
Diploma with less than grade 12/std 10	6	.4
Higher/ national/advanced certificate with Grade 12/ std 10	11	.6
Diploma with Grade 12/std 10/ occupational certificate- NQF 1	36	2.1
Higher Diploma/ occupational certificate (b-tech diploma)- N	18	1.2
Post Higher Diploma (Masters Diploma/Master degree)- N	4	.2
Bachelor's Degree/ occupational certificate NQF level 7	25	1.5
Honours degree/ postgraduate diploma/ occupational certificate	7	.4
Doctoral degrees (doctoral diploma and PhD)- NQF level 10	4	.2
No schooling	310	18.2
Employment		
Employed full-time	230	15.4
Employed part-time	105	7.0
Self-employed	86	5.8
Not employed	1055	70.7
Studying full-time	16	1.1
Marital status		

Legally married	608	38.0
Living together like husband and wife	102	6.4
Divorced	28	1.8
Separated but still legally married	10	0.6
Widowed	334	20.9
Single but have lived together with someone as Husband/wife	71	4.4
Single and have never been married/ never lived together as husband/wife	466	27.9
Salaries and wages	**372**	**23.2**
Household income		
No income	22	1.5
Less R1500	328	21.7
1501-3000	588	38.9
3001-4500	281	18.6
4501-600	98	6.5
Greater than 6000	195	12.9
Access to land	**666**	**36.0**
Own land	592	88.9
Rent land	7	1.1
Tribal authority	23	3.5
State-owned land	4	0.6
Other	40	6.0
Land used for the production of food and other agricultural products	**551**	**82.5**

The average age of the participants was 53 years old; older individuals participated more in home gardening production than younger persons, and the average household had an average of five members. Older study participants were likelier to participate in home gardening than younger participants. Schooling is compulsory for children between 7 and 15 in South Africa. Regarding primary and secondary educational levels, the results revealed that 27.3% had a primary level, 42.2% had a secondary level, and 18.2% had no schooling. At the same time, a lower proportion of participants obtained Matric qualifications. The lower the household's educational level, the less probability of home garden participation. Educational status plays a vital role as decisions are influenced by knowledge of home gardening and its intended

benefits for the family. For example, those with more knowledge about nutritional and economic benefits may contribute towards increased participation and food security attainment (Kongolo, 2009). Akerele et al. (2017) emphasised similar findings where household members with formal education participated in home gardens more than those with informal education.

The quantitative data showed that 70.7% of home garden farmers were unemployed, suggesting that most rural households relied significantly on home gardening for food and income sources. The high unemployment rate in Limpopo was primarily felt in women-headed households, as detailed in a study by Kongolo (2009) and a case study by Wanka (2014). Wanka found most household heads to be unemployed without any source of income, which is also evident in this current study. These findings are characteristic of the statistics that list Limpopo as having the third highest unemployment rate of 49.9%, after North West and Eastern Cape (Statistics South Africa, 2022).

5.5.2. Occurrence of Household Food Insecurity Based on HFIAS Categories

Figure 4 illustrates the occurrence of household food insecurity, which was determined using the Household Food Insecurity Access Scale (HFIAS). The findings indicated that almost 46% of households were food secure, and 13% were mildly food insecure. The results also showed that 17% of households were moderately food insecure, while 24% were severely food insecure. Similar findings were reported in a study by Sibathu and Qaim (Sibhatu & Qaim, 2017), where smallholder farmers were food insecure.

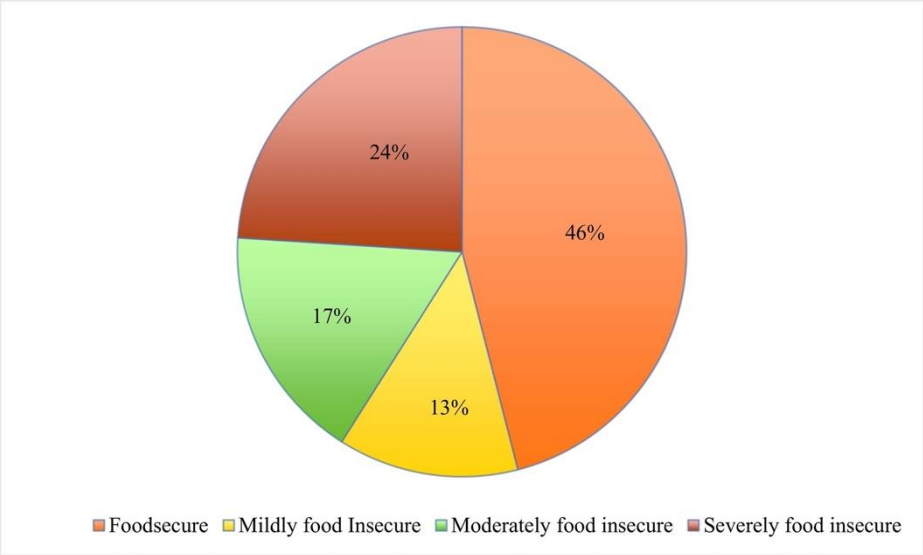

Figure 4: Pie chart showing the Household Food Insecurity Access Scale results

Poverty and food insecurity affect mainly Black Africans, and many are located in rural areas where food insecurity thrives (De Cock et al., 2013). In 2001, more than two-thirds of impoverished households were located in rural areas where food insecurity peaked (Ramkissoon, 2022; Watkinson & Horton, 2001). While the current study takes place almost two decades later, this research reveals minimal changes in terms of the food insecurity experienced by households in the country.

5.5.3. The Contribution of Home Garden Participation to Household Food Security Endogenous Switching Poisson Regression Model

Table 5.2 below displays the impact of participation on household food security. A selection bias was detected and represented by the significant correlation coefficients of the selection equations. The essential results of the sigma (σi), rhos (p) and athrho indicated self-selection problems. A positive athrho value indicates that some unobservable factors affected home gardening participation. However, the endogenous switching regression model addressed the endogeneity issue. The first stage of the endogenous switching regression analysis (the selection model) estimated the household determinants of home garden participation. The second stage estimated the effect of household determinants on the food security of home garden participants and non-participants.

Gender is critical in home garden production, positively contributing to food security. The current study established that the gender of the household head had a positive and significant impact on the food security status of the home garden participants, with a coefficient value of 2.164 ($p < 0.01$). This means that females participated more in home gardening. These findings are consistent with Nzama & Ntini (2022), who showed that women participated more in communal homes than males. Gbedomon et al. (2015) also found that women were more associated with home food gardens than men. Globally, women are renowned for their effective roles in agriculture as they contribute meaningfully to ensuring food security in various households. The studies further explained that women are also caregivers; thus, participating at home could be one significant way women see themselves contributing towards food accessibility for their families, especially in food shortages brought about by lack of income. Although women play an essential role in home gardens by ensuring food access for their families, the unequal distribution of resources in comparison to men makes women and children more susceptible to poverty and food insecurity.

Table 5.2: Impact of participation in home garden to household food insecurity—endogenous switching Poisson regression model.

	Home garden participation			**Food security of participants**			**Food security of non-participants**		
status	**Coefficient**	**Std. err**	**P>z**	**Coefficient**	**Std. err**	**P>z**	**Coefficient**	**Std. err**	**P>z**
Gender_hh	0.161	0.104	0.122	2.164	0.064	0.000***	-0.028	0.051	0.583
Age_HH	-0.003	0.003	0.327	0.000	0.001	0.817	-0.003	0.001	0.065*
Employment Stat	-0.018	0.059	0.761	-0.040	0.013	0.002***	0.090	0.026	0.001***
Household size	0.048	0.020	0.016**	0.009	0.004	0.046**	-0.001	0.009	0.950
Did work for a wage/salary	-0.041	0.128	0.751	0.083	0.032	0.009***	-0.192	0.064	0.003***
Receive any social relief	0.069	0.115	0.551	-2.109	0.063	0.000***	0.086	0.052	0.100
Access to land	-3.323	0.228	0.000***	0.114	0.034	0.001***	-1.690	0.471	0.000***
Agricultural related assistance	-0.743	0.290	0.010**	2.483	0.149	0.000***	-0.092	0.095	0.334
Education	0.001	0.002	0.497	-0.000	0.000	0.705	-0.002	0.001	0.035**
Marital status_HH	0.013	0.022	0.555	0.004	0.005	0.505	0.004	0.011	0.711
Market distance	0.004	0.006	0.578	0.008	0.002	0.000***	-0.023	0.017	0.191
_cons	4.908	0.720	0.000***	-3.660	0.330	0.000***	1.436	0.585	0.014**
/lnsigma0	1.242	0.026	0.000						

/lnsigma1	1.235	0.065	0.000
/athrho0	0.078	0.005	0.000
/athrho1	0.107	0.036	0.000
sigma0	3.461	3.289	3.642
sigma1	3.437	3.024	3.906
rho0	-0.147	0.005	0.000
rho1	-0.172	0.036	0.000
Log-likelihood	-5272.316		
Prob > chi2	0.000		
Wald chi2(11)	1300.68		

* Indicates significance at 10% level,** Indicates significance at 5%, level*** Indicates significance at 1% level.

The age of the household head had a negative and significant (p- = 0.10) impact on the food security status of home garden non-participants. This finding implies that as the age of the household heads increases, their level of participation in home garden production decreases, which leads to food insecurity. Youth tend to have harmful (Mibey, 2015) and, at times, varying perceptions and aspirations regarding agriculture (Chipfupa & Tagwi, 2021; Mibey, 2015). These mixed perceptions may negatively impact households, especially with youthful members not interested in agricultural activities due to preconceived social misconceptions and a lack of skills. On the contrary, study results from Gbedomon et al. (2015) showed a significant proportion of adults and mature-aged people participating at home. The age disparity further emphasises the need to involve younger people in cultivating food and the home garden value chain.

The inception of poverty is seen in a household's inability to meet their basic needs, such as finances, to secure food items and other necessities. The results showed that employment status had a significant impact on the food security of both home garden participants and non-participants, which was also found in studies by Mishra *et al*., (2015) and Reardon (1997), who

emphasised the importance of income on household food security. The employment status positively impacted the food security status of the non-participants, with a coefficient value of 0.090 ($p < 0.01$). At the same time, it negatively affected the food security of home garden participants, with a coefficient value of -0.040 ($p < 0.05$). This implies that households not participating in home gardening production could use earnings to buy food items, contributing to food security. In contrast, households that participated in home gardens were negatively impacted by lack of employment brought on by lack of income for food items, thus negatively affecting their food security. Anderson (2002) found that households produced their food for consumption inadequate for meeting the household's dietary needs, which led to the increased need for off-farm employment to aid in accessing food items, while Mishra *et al*., (2015) documented a positive relationship that was found between jobs and food security—showing similar findings to this current study. Additional research is required to address the nuances and complexities regarding food self-sufficiency in home gardens.

Household size showed a significant relationship with home garden participants with a coefficient value of 0.048 ($p < 0.05$), indicating a positive impact on participation. This finding strongly implies that household size contributes to home garden participation, enhancing food accessibility. Other studies have revealed household size to be one of the determinants of food security (Babatunde & Quaim, 2011; Oluwatayo & Ojo, 2019). Dzanku (2019) shared that smallholder farmers depend on their household members for on-farm or off-farm income generation. Similar to the findings of the current study, Aidoo et al. (2019) concluded that household size is among the factors that affect food security, where the probability of a household being food secure increased with household size, while Sikwela (2008) showed contradicting findings where household size was found to influence household food insecurity significantly due to increase in the demand for food.

Increasing home food production alone might not provide sufficient steady supplies for prolonged periods. This is where additional income plays a critical role. Working for a wage positively and significantly impacted the food security of home garden participants, with a coefficient value of 0.083 ($p < 0.01$). However, it hurt the food security of home garden non-participants, with a coefficient value of -0.192 ($p < 0.01$). This shows that home garden participants also worked to earn supplemental income and buy other food outside home gardens. On the contrary, home garden non-participants who worked for a wage or salary had increased chances of being food insecure, possibly due to solely relying on purchased foods

without access to home garden produce for additional food accessibility. Dzanku (2019) found that the average food availability increases when household members obtain off-farm income. This, in turn, decreases the chances of those households experiencing food insecurity.

Social relief funds had a negative impact and statistically influenced the food security status of home garden participants, with a coefficient value of -2.109 ($p < 0.01$). Ntombela *et al*. (2019) noted how South Africa has a large population (20%) that cannot feed itself due to insufficient resources. Similar findings were documented by Chakona and Shackleton (Chakona & Shackleton, 2017, 2019) by comparing households that received social grants and those that did not: households that were more food insecure were those receiving social grants or relief. Ideally, receiving social relief funds is associated with increased food security, contrary to the findings of this study. To understand the food insecurity dynamics for households in rural Limpopo, these findings suggest that further qualitative investigation is required to ascertain detailed reasons for how and why social relief funds negatively impact household food security.

South Africa has historical backdrops of socio-economic and natural resource inequality, which remains a reality. Access to land plays a significant role in agricultural participation. The findings of this study showed that access to land had a negative impact on home garden participation and food security of non-home garden participants. However, it indicated a positive result for the food security of home garden participants, implying that households with minimal or no access to home gardening land were limited in their ability to participate, negatively affecting their food security. Those who participated could utilise the land they had access to produce and contribute towards their food security. Findings from Onomu *et al*., (2022) revealed that many participants did not grow certain crops due to a lack of available land. Land inaccessibility, especially among women, inhibits food production activity. Land accessibility challenges are not unique to South Africa. In Kenya, the inheritance and ownership of land by women are greatly challenged due to various customary and statutory land tenure systems, which adversely affect women's land rights and land usage, thus further posing a negative impact on the food security status of households (Owoo & Boakye-Yiadom, 2014). Agricultural land availability is a crucial determinant of household food as it directly correlates with land usage activities (Mutangadura, 2004; Onomu *et al*., 2022). Menon *et al*., (2016) further conclude that women's land ownership yields beneficial results for the household and contributes to well-being and higher status.

Agriculture-related assistance results showed a negative and significant impact on home garden participation, with a coefficient value of -0.743 ($p < 0.05$), and a positive influence on the food security of home garden participants, with a coefficient value of 2.483 ($p < 0.01$). Food insecurity is brought about by various factors among rural households, which can be remedied to a certain degree with the facilitation of agriculture-related assistance. This may be in the form of agricultural training, input supplies, availability of extension workers, financial support and resource allocation directed at improving home garden farming. The current study has shown how crucial agricultural assistance, as in Grobler's (2022) finding on the importance of agriculture-related assistance to enhancing household food security, especially encouraging home gardening in Limpopo, contributes to household food security through increased food production.

Lastly, the results showed that market distance had a positive and significant impact on the food security of home garden participants, with a coefficient value of 0.004 ($p <0.01$). Market accessibility impacts rural households' food security more as farmers are manufacturers and users (Munawar et al., 2021). Farmers sell their products at markets and buy food and other items for sustenance (Ahmed et al., 2016). When home gardens reach harvesting season, their produce often exceeds quantities of food usually purchased from the market, providing food access and profits. The findings of this study confirmed the importance of market distance in ensuring household food security. Factors such as long distances may lead to transportation costs related to rising fuel prices, hindering market accessibility and inability to sell produce by home garden farmers. Munawar e*t al*. (2021) also state how expensive transportation costs have contributed towards restricting food access due to the domino effect on food prices.

5.5.4. Treatment Effects of Impact of Home Garden Participation on Household Food Insecurity

This research aimed to see how home garden participation affected household food security. A significant difference in food security between non-home garden participants and participants can be biased and fail to account for potential heterogeneity in the two groups' characteristics. As a result, this study used average treatment effects (ATEs), average treatment effect on the treated (ATT) and average treatment effect on the untreated (ATU) to compare the potential outcomes. Findings from treatment effects are presented in

Table 5.***3***. The ATT had a negative sign (-69.053). Still, it was not significant (p-value = 0.712), meaning that home garden participants did not have any considerable effect on the food

insecurity status of households. The ATE value was negative at -278.44, with a statistically significant p-value of 0.025. This result further supports the idea that home garden participation improves food security. The ATU value showed a negative value of -278.44 (p-value = 0.005), showing that the result is statistically significant, consistent with the claim that home gardens reduced household food insecurity. The LATE estimate (-958.91) indicated a strong negative effect, but the result was not statistically significant (p = 0.119).

Table 5.3: Treatment effects of home garden participation on household food insecurity.

	Estimate	**SE**	**P>z**
ATE (average treatment effect)	-236.38	105.66	0.025
ATT (average treatment effect on the treated)	-69.053	187.52	0.712
ATU (average treatment effect on the untreated)	-278.44	100.39	0.005
LATE (local average treatment effect)	-958.91	615.75	0.119

5.6. Conclusion

This study brings to light the critical role of home gardening in addressing food security challenges in rural communities, as shown by the key findings from this study conducted in Limpopo Province. The high prevalence of food insecurity among households highlights the urgent need for effective interventions. This study found that gender, household size, access to land and proximity to markets were significant influencers of household food security. Significantly, this study positively impacted food security among households that participated in home gardening. Targeted interventions are required to enhance food security further and promote sustainable livelihoods in rural communities. Agricultural training and skill-building programs can empower individuals to engage in home gardening effectively, thus increasing access to nutritious food and supplementary income. In addition, integrating agricultural curricula can foster a systematic and deeper understanding of food systems from a young age, providing a foundation for informed decisions about household food production and consumption. By policymakers and stakeholders identifying the significance of home gardening in rural communities, the challenge of food insecurity can be directly addressed.

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CHAPTER SIX

THE CONTRIBUTION OF HOME GARDENS TO NUTRITION SECURITY OF RURAL HOUSEHOLDS IN LIMPOPO PROVINCE, SOUTH AFRICA.

Abstract

South Africa has multifaceted challenges relating to nutrition deficiencies, resulting from socio-economic issues and policy implementation gaps. This study investigated the contribution of home gardens to the nutrition security of rural households in Limpopo province. Using a quantitative research approach, secondary data was analysed from 2043 respondents. The Household Dietary Diversity Score (HDDS) was used to measure nutrition security. The Endogenous Switching Poison regression model was used to analyse the contribution of home gardens to nutrition security. Most households (81%) were found to have high dietary diversity, while 15% and 4% were found to have medium and low dietary diversity, respectively. Most participants (70%) had no formal employment. There was a negative and significant association between vegetable consumption and participation in the home garden (-0.325, $p < 0.05$). There was a positive and significant correlation between household size and involvement in the home garden, with a coefficient value of 0.042 ($p = 0.060$). Access to land showed a negative and significant correlation with home garden participation (-3.164, $p <0.01$), while it exhibited a positive and significant relation with nutrition security (0.452, $p = 0.063$). A negative correlation was observed between agricultural-related assistance and home garden participation (-0.744, $p = 0.013$). There was a negative relationship between household members working for salary or wages and nutrition security, with a coefficient of -0.217 ($p = 0.098$). Factors such as education level (-3.273, $p = 0.026$), marital status (-1.424, $p = 0.019$) and working for salary or wage (-0.217, $p = 0.098$) had a negative and significant association with nutrition security. There was a positive and significant relationship between participation in the home garden and nutrition security, with a coefficient value of 0.452 ($p = 0.063$). The study concludes that households with more members are likely to participate in home garden activities, while land access contributes to nutrition security. Participation in the home garden is strongly associated with nutrition security. Factors such as vegetable consumption, working of salary or wages, access to land and agricultural-related assistance did not improve participation in home gardens. Similarly, working for pay or salary, education level and marital status did not influence the nutrition security of the farming households. There is a need for

government, nutritionists and extension workers to conduct training regarding the types of crops that households can grow to improve their nutrition security.

6.1. Introduction

The global consensus is that ending hunger and malnutrition is crucial for every country's development and socioeconomic well-being (Muller & Krawinkel, 2005; United Nations, 2015). In 2020, 2.4 billion people were food insecure, lacking regular and sufficient food access (United Nations, 2021). The General Household Survey in South Africa (Stats SA, 2021) revealed that 17.9 million households had inadequate food access. Food security is a situation whereby all people, at all times, have both physical and economic accessibility to sufficient, safe and nutritious food that can meet their dietary needs and food preferences for an active and healthy life (FAO, 2006). On the other hand, nutrition security is "when a person has a nutritionally adequate and the food consumed is biologically utilised such that adequate performance is maintained in growth, resisting or recovering from disease, pregnancy, lactation and physical work." (Frankenberger et al., 1997, p.1). Therefore, unlike food security, which mainly focuses on food availability and sufficient quantity, nutrition security emphasises food quality – including its nutritional value, safety, and ability to support an active life (Sobal *et al*., 1998).

Food and nutrition security remains elusive for many developing countries, especially in sub-Saharan Africa, partly due to varying definitions and measurements of food and nutrition security. The current state of food and nutrition security in South Africa is characterised by several challenges exacerbated by economic and environmental factors. Approximately 28% of children under the age of five are stunted, and 3.4% of children under the age of five suffer from wasting in South Africa (Simelane *et al.*, 2024). With regards to wasting, statistics revealed that the overall prevalence of wasting for children below the age of 5 was 5.3%, while the prevalence of underweight children below the age of 5 was 27% (Simelane *et al*., 2024). South Africa also faces increased challenges with micronutrient deficiencies, particularly iron deficiency anaemia, which affects about 30.5% of women of reproductive age (Global Nutrition Report, 2020). These conditions are significant indicators of the broader problem of malnutrition that plagues under-resourced communities.

A study by Govender *et al.,* (2017) focused on nutrition insecurity in selected rural communities in KwaZulu-Natal. This study highlights severe issues rural household dwellers face, including stunting and vitamin A deficiency among the population. Another study confirmed a relationship between diet quality and anaemia in school-aged children in South Africa, emphasising the importance of nutrient-rich foods in preventing diet-related illnesses (Visser et al., 2021). Studies further advocate for the effectiveness of policy implementation in addressing the multiple forms of malnutrition, undernutrition and micronutrient deficiencies in the South African landscape (Thow et al., 2018). These recent studies provide insights into the ongoing challenges related to food and nutrition deficiencies South Africans face. The National Policy on Food and Nutrition Security and the Integrated Food Security Strategy (IFSS) guide efforts to improve food security (DAFF, 2014; Ramaila et al., 2011), although persistent challenges remain, especially within the rural landscape. In light of this backdrop, this study focuses on Limpopo province, as few empirical findings have been documented about home garden activities and their influence on household nutrition security.

Home gardens have emerged as a promising strategy to enhance household food and nutrition security. These gardens supplement household food needs, improve health, and offer environmental benefits (Galhena et al., 2013; Odebode, 2006). Studies from Nepal, Ghana, and Zimbabwe show that poorer communities often rely more on home gardens (Bennet-Lartey et al., 2002; Krishna, 2006; Maroyi, 2009; Wiersum, 2006). Home gardens increase dietary intake and nutrient absorption, which is crucial for under-resourced households (Talukder et al., 2000). In South Africa, food insecurity and undernutrition severely affect rural areas, particularly pregnant women and children (Development Initiatives, 2017). A study in KwaZulu-Natal highlighted high stunting rates in children and overweight and obesity in women, suggesting a need for further research on women's nutrition (Govender et al., 2021). The study advocated for agriculture to improve food availability and access. While home gardens have been an integral part of the recent food-based interventions aimed at stimulating changes in dietary patterns and improving nutrition, evidence of their specific effects on nutrition is still limited. Against this backdrop, this study aims to analyse the association between home gardens and nutrition as measured by the Household Dietary Diversity Score.

6.2. Methodology

6.2.1. Description of Study Areas

The description of the study area is outlined in detail in Chapter Three, along with associated geographical maps, to avoid repetition in the following chapter.

6.3. Data collection

The study used secondary data from 2043 participating respondents, all from rural households. A quantitative research method was employed, using multi-stage stratified random sampling to select households from various municipalities in Limpopo. Data was collected through a structured questionnaire that included demographic information, home garden participation, the consumption of vegetables, household size, distance from the market,

6.4. Data analysis

Descriptive statistics were analysed using STATA version 13 and SPSS (Statistical Software for Social Sciences) version 24. The nutrition security assessment employed the widely used 12-scale dietary diversity score at the household level, the Household Dietary Diversity Score (HDDS), developed by the Food and Nutrition Technical Assistance of International Development (USAID) (Swindale & Bilinsky, 2006).

The Household Dietary Diversity Score (HDDS) is widely used in research, policy, and program implementation to assess and monitor food security as well as nutrition, as it provides insights into nutrition and dietary understanding within households using a 24-hour food consumption recall (Swindale & Bilinsky, 2006). Only food consumed within the household is included in the score because it needs to capture a typical food intake within the household accurately and not outside. According to Swindale & Bilinsky (2006), food categories used in the HDDS include cereals, vegetables, roots and tubers, fruits, seafood, fish, pulses/legumes/nuts, seeds, milk, and milk products, oil/fats, sugar/honey, eggs, spices, condiments, and beverages. The HDDS is an adequate proxy for a household's economic access to food and food security (Headey & Ecker, 2012). The HDDS in this study was used to see whether home food gardens in rural Limpopo contribute to households' nutrition security.

6.4.1. Endogenous switching Poisson regression model

The current study used the Endogenous Switching Poisson Regression Model to assess the contribution of home gardens to household nutrition security. The model was designed I t h by Terza (1998) and Miranda (2004), who stated that given the I t h household from a random sample cap, I equal household from a random sample cap I $I = \{1 \ldots . n\}$conditional on a vector of explanatory variables X_i, an endogenous dummy C_i, and a random term ε_i , the dependent variable Y_i , which is a count, is supposed to a follow a standard Poisson distribution as follows:

$$F(Y_i/\varepsilon_i) = \frac{\exp\{-(x_i'\beta+\gamma C_i\varepsilon_i)\}\{\exp(x_i'\beta+\gamma C_i\varepsilon_i)\}^{yl}}{Y_i} \quad (1)$$

Where β nd γ are coefficients to be estimated. The error term ε_i measures omitted and unobserved variables as well as any measurement error. Given a vector of explanatory variables Z_i (which may contain some or all elements of) X_i, C_i is characterised by the indexing process.

$$C_i = \begin{cases} 1 \; if \; Z_i\alpha + V_i > 0 \\ 0 \; otherwise \end{cases} \quad (2)$$

Where a vector of coefficients is to be estimated. Suppose that W_i represents all endogenous variables and ε_i and V_i are jointly normal with mean zero and covariance matrix $\sum = \begin{pmatrix} \sigma^2 & \sigma\rho \\ \sigma\rho & 1 \end{pmatrix}$, is given that ε_i , C_i and Y_i are independent. Hence, the joint conditional probability density function of Y_i and C_i, given W_i, can be written as

$$F = (Y_i/C_i/W_i) \; = \; \int_{-\infty}^{\infty}\{C_i f(C_i/Y_i = 1, W_i, \varepsilon_i)Pr(C_i = 0/W_i, \varepsilon_i)\} f(\varepsilon_i)C_i\varepsilon_i \quad (3)$$

where $f(\varepsilon_i)$ denotes the probability density function for the random term ε_i.

6.5. Results and discussion

6.5.1. Descriptive results

A total of 2043 households in rural areas participated in the study. Table 6.1 displays the demographic characteristics of households. , where 54% of the participants were female and 46% of the participants were males. According to the findings, older participants showed more interest in home gardening than younger participants. The average household is comprised of

five family members. Regarding education, the study showed that 42% of the participants had grade 8 to grade 12 levels, while 18% did not attend school. With higher learning degree attainment, 0,2% had obtained a doctoral degree. These findings show that most participants did not further post-school studies (42%), while a smaller proportion had no education and were somewhat illiterate. Hamad and Olson (2016) documented that having lower educational levels within rural households contributes towards increased food insecurity and malnutrition experiences among members. A report by (Olsom et al. (1996) additionally noted a correlation between low education levels and food insecurity.

The results revealed that (70.7%) of home garden farmers had no formal employment, which suggests a reliance on home gardens for nutritious food accessibility after harvesting. Kongolo (2009) notes that Limpopo's high unemployment rate hugely impacts women-headed households. Limpopo is known for its extremely high unemployment rate (49.9%) (Statistics South Africa, 2022), which calls for a more integrated means of accessing nutritious foods for households to secure food and nutrition. Table 1 shows the demographic characteristics of the sample used in the study.

Table 6.1: Demographic characteristics of Limpopo households

Characteristics	**%**
Gender	
Male	46.2
Female	53.8
Participant household distribution by study site	
Capricorn	18.7
Greater Sekhukhune	21.5
Mopani	21.2
Vhembe	20.8
Waterberg	17.8
Educational Level	
Primary School Education	27.3
Secondary School Education	42.2
NTC 1/N1 - NTC III/N3	1.7
NTC4/ N4 - NTC 6/ occupational certificate	0.8

Diploma with less than Matric	0.4
Higher/ national/advanced certificate with Matric	0.6
Diploma with Matric / occupational certificate	2.1
Higher Diploma/ occupational certificate (b-tech diploma)	1.2
Post Higher Diploma (Masters Diploma/ Degree)-	0.2
Bachelor's Degree/ occupational certificate	1.5
Honours degree/ postgraduate diploma/ occupational certificate	0.4
Doctoral degrees (doctoral diploma and Ph.D.)	0.2
No schooling	18.2
Employment Status	
Employed full-time	15.4
Employed part-time	7.0
Self-employed	5.8
Not employed	70.7
Studying full-time	1.1
Relationship status	
Living in common-law marriage	38.0
Cohabiting	10.8
Divorced	1.8
Legally separated	0.6
Spouseless	20.9
Single	27.9
Salaries and wages	**23.2**
Household income	
No income	1.5
Less R1500	21.7
1501-3000	38.9
3001-4500	18.6
4501-600	6.5
Greater than 6000	12.9
Access to land	**36.0**
Own land	88.9
Rent land	1.1

Tribal authority	3.5
State-owned land	0.6
Other	6.0
Land used for the production of food and other agricultural products	**82.5**

6.5.2. Household dietary diversity

Figure 5 illustrates findings from the Household Dietary Diversity Score (HDDS). The results revealed that 81% of households had high dietary diversity, where six or more food groups were consumed, while 15% had medium dietary diversity, where households consumed 4 to 5 food groups. Interestingly, only 4% of the households showed low dietary diversity, only consuming three or fewer food groups. The study noted that the HDDS findings are used as a guide to show consumption patterns in terms of dietary diversity and are not an accurate measure of household nutrition. In addition, having a high nutritional diversity does not always translate to consuming healthy or high-quality food groups such as vegetables, fruits and nuts.

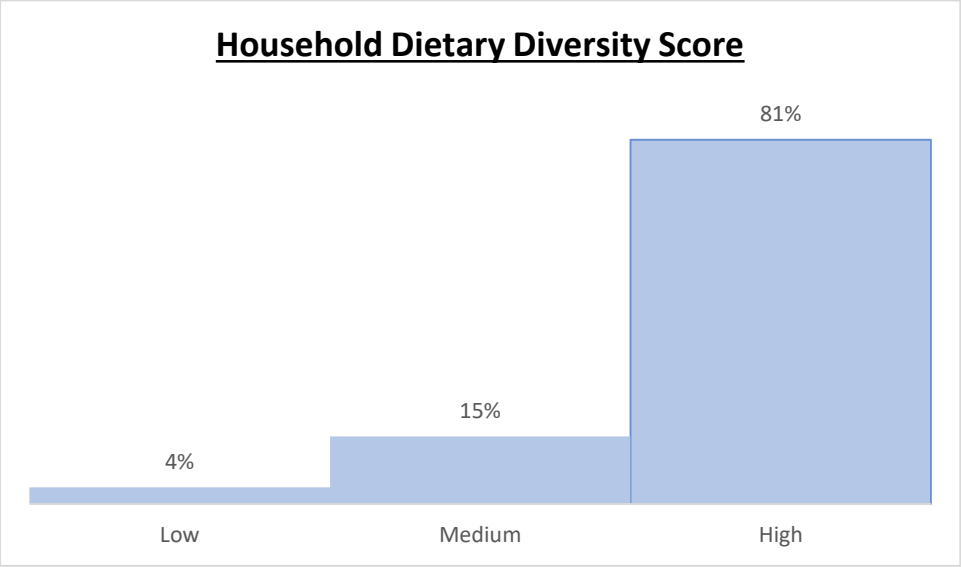

Figure 5: Limpopo household dietary diversity score

6.5.3. The Contribution of Home Gardens to Nutrition Security of Rural Households - Endogenous switching Poisson regression model.

The results showed a negative but significant association between participation in home gardens and fruit and vegetable consumption **(**-0.325**,** $p < 0.05$), suggesting that households producing vegetables do not always lead to direct produce consumption. Households

sometimes produce food to sell and buy other important household items they cannot make. Household size showed a positive and significant correlation to participation in home gardens (0.042, p = 0.060). This means that the more household members you have, the more labour you have for home garden activities. These findings align with the study of Onomu *et al*., (2022) on drivers of home gardening, which found that larger household sizes often participate more in home gardens. Access to land negatively and significantly influenced participation in home gardening (-3.164, p < 0.01), while it showed a positive and significant relationship with household nutrition security (0.452, p = 063). This suggests land access is not always a determinant of participation in home gardens, and this is because households have innovative ways to grow food, including the use of vehicle tyres and house roofs. However, land accessibility remains crucial for participation in home gardens and cultivating diverse foods. Nzama & Ntini (2022) stated that women involved mainly in home gardens face challenges accessing land for agricultural activities, including home gardening. Doing work for a wage or salary was negatively and significantly associated with participation in home gardens (-0.085, p = 0.057). This is because working household members often spend their time at work and do not have time to participate in home food gardening activities. These findings align with the results of Bongiwa & Obi (2015), who found that employed household members have reduced participation in the home gardens.

There was a negative and significant association between agricultural-related assistance and participation in the home garden (-0.744, p = 0.013). These findings are unexpected because their involvement in home gardens is expected to improve as they receive agricultural assistance. However, these results could mean that these households are shifting their focus from home gardening to other agrarian production or that the resources provided reduce the need for home gardens. Supporting research highlights similar findings. For instance, a study in Limpopo Province, South Africa, found that while agricultural assistance positively impacted food security, it negatively influenced home garden participation. This implies that households with access to agrarian aid might prefer larger-scale farming or market-based agricultural activities over maintaining home gardens, which they might perceive as less productive or economically beneficial in comparison (Gwacela et al., 2024; Wang et al., 2021).

Table 6.2: Determinants of home garden participation and its impact on household nutrition security.

	Participation in home gardens			Household nutrition security		
Status	Coefficient	Std.err	P>z	Coefficient	Std.err	P>z
Vegetables consumed	-0.325	0.123	0.012**	-0.011	0.018	0.528
Gender HH	0.054	0.117	0.644	-0.035	0.291	0.904
Age of HH	-0.002	0.004	0.628	0.133	0.110	0.225
Employment Status of HH	0.038	0.068	0.573	0.022	0.196	0.909
Household Size	0.042	0.022	0.060*	-0.003	0.008	0.661
Did work for wage/salary	-0.085	0.148	0.0567*	-0.217	0.131	0.098*
Received any social relief or funds	0.142	0.133	0.287	0.019	0.045	0.679
Access to land	-3.164	0.243	0.000***	0.452	0.243	0.063*
Agricultural related assistance	-0.744	0.310	0.013**	0.128	0.217	0.556
Education of HH	0.000	0.002	0.862	-3.273	1.464	0.026**
Marital status of HH	0.004	0.025	0.874	-1.424	0.609	0.019**
Market distance	0.001	0.007	0.826	0.004	0.003	0.245
_cons	4.493	0.789	0.000***	0.015	0.041	0.704
Log-likelihood	-344.27499			-0.008	0.014	0.543
LR chi2(12)	738.02			16.927	3.680	0.000***
Prob > chi2	0.0000					
Pseudo R2	0.5173					

* Indicates significance at 10% level,** Indicates significance at 5%, level*** Indicates significance at 1% level.

There was a negative and significant relationship between household members who did work for salary or wages and nutrition security, with a coefficient of -0.217 (p = 0.098), suggesting that having a salary did not translate into consuming diversified foods. The findings of this

study are against the studies of Babatunde (2010) and Talukder *et al*., (2014) which found that income and home garden production can improve nutrition security. The lack of investment towards the diversification of food by these households may be attributed to using the money for other pressing household needs like paying for school children and prioritising non-food household needs.

Study findings showed that access to land had a positive and significant relationship with household nutrition security, suggesting that access to land is likely to improve nutrition. Land accessibility increases food production as households can grow various crops, thus aiding in a more diversified diet, often richer in essential nutrients, thus aiding nutrition security. Furthermore, households with increased access to land can produce surplus foods that can be sold, providing additional income for household needs. Similarly, Baiphethi and Jacobs (2009) found that access to land is likely to contribute towards improved food and nutrition security. The findings also align with Tesfamarian *et al*., (2018) who found that facilitation of (adequate) land contributes positively to nutrition security.

Education of household heads showed a negative and significant correlation to nutrition security (-3.273, $p = 0.026$), which suggests that higher education levels of household heads may inadvertently lead to reduced focus on food production, which may impact nutrition security. These results are surprising because it would be expected that better-educated households are more likely to adopt improved nutrition practices, including being able to grow and buy diversified foods. The study's findings differ from those of Yila and Sylla (2019) and Hlatshwayo *et al*. (2023), who reported that education levels contribute towards improving households' food and nutrition security. However, the study's findings emulated the study of Ngema et al. (2018), which found a negative correlation between higher educational levels of household heads when correlated with food and nutrition security due to increased reliance on purchased rather than homegrown produce. There was a negative and significant association between marital status and nutrition security (-1.424, $p = 0.019$), suggesting that marital status did not influence the nutrition security of household heads. This could be attributed to the added financial responsibilities that married household heads may have compared to unmarried household heads. The results are against the study of Sekhampu (2017), who reported that the marital status of the household head was associated with food and nutrition insecurity.

6.5.4. Treatment Effects of Home Garden Participation on Household Nutrition Security

The research aimed to assess how participation in home gardens affected households' nutrition security. A significant difference in nutrition security between non-home garden participants and participants can be biased and fails to account for potential heterogeneity in the two groups' characteristics. Therefore, a Probit-2SLS analysis was conducted to check the robustness of the estimated results. The Average Treatment Effect (ATE), Average Treatment Effect of the Treated (ATET) and Average Treatment Effect on Non-Treated (ATENT) were used to compare the potential outcomes as shown in Table 6.3. The findings showed that all three treatment estimates (ATE, ATET and ATENT) had a positive and significant ($p < 0.001$) effect on household nutrition security. This means that the average rural household participating in home garden production had improved nutrition security.

Table 6.3: Distribution of ATE, ATET and ATENT on household nutrition security

	Coefficient	**Std. err.**	**P>z**
ATE	5.825	1.625	0.002***
ATET	5.179	1.745	0.003***
ATENT	5.184	1.758	0.003***

*** Indicates significance at 1% level.

6.6. Conclusion and Recommendation

This study brings to light the critical role of home gardening in addressing diet and nutrition challenges in rural communities, as shown by the key findings from this study. The global consensus is that ending hunger and malnutrition is crucial for every country's development and socioeconomic well-being. Nutrition deficiencies resulting from socio-economic issues and policy implementation gaps remain challenging for South Africa and the province of Limpopo. Home gardens have been an integral part of the recent food-based interventions aimed at stimulating changes in dietary patterns and improving nutrition. This study was set to assess the contribution of home gardens on household nutrition security. This study identified access to land as an important factor contributing to the household's nutrition security. In contrast, household size was associated with a likelihood to participate in home garden activities. Doing work for a salary or wage did not influence participation in home gardens, nor did it improve the nutrition security of the household. Land accessibility is critical

for home garden participation and cultivating diverse foods. Participation in the home garden is likely to improve nutrition security. There is a need for an effective policy implementation plan to address challenges related to the nutrition of rural households by including specific measures that target nutrition-sensitive interventions like food production. There is a need to make land available for households wanting to engage in food production.

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CHAPTER SEVEN

INVESTIGATING THE EFFECT OF HOME GARDEN PARTICIPATION ON HOUSEHOLD MULTIDIMENSIONAL POVERTY INDEX WITHIN RURAL HOUSEHOLDS IN LIMPOPO PROVINCE, SOUTH AFRICA.

Abstract

In South Africa, poverty is a multidimensional challenge. Households and individuals lack access to adequate food, deprivation in quality education and healthcare services, and various economic opportunities that hinder the well-being of households. Hunger, malnutrition, and other related factors contribute to the poverty challenge that the country faces. Home gardens could play a role in mitigating these challenges through improving food and nutrition security and providing economic opportunities. This study investigated the effect of home garden participation on the household Multidimensional Poverty Index (MPI) within rural households in Limpopo. Data were collected from 2043 participants using structured questionnaires and analysed using STATA version 13 and SPSS Software version 24. The MPI was utilised to understand the poverty situation amongst households. The results demonstrate significant gender and age differences among the households participating in home gardens, with higher involvement by females and older individuals. The results show that older household heads (Age HH) are associated with a 0.6% decrease in poverty levels for each additional year, as indicated by a coefficient of -0.006 (significant at 1%, p = 0.004**). Larger household sizes also correlate with lower poverty levels, reducing poverty by 3.2% for each additional member (-0.081, p = 0.000***). Educational deprivation was high, with 78% of households having no members who completed at least six years of schooling and 68% having at least one school-age child not attending school. High deprivation rates were also observed for undernourishment (89%) and child mortality (77%), emphasising the potential of home gardens to mitigate these issues by providing fresh foods and promoting nutrition awareness. The study identified substantial concerns in living standards within rural households and demonstrated that home garden participation significantly reduces MPI. Older household heads and larger household sizes were associated with lower poverty levels. Access to land emerged as a critical factor in reducing poverty, with a substantial coefficient of -3.096, corresponding to a 1.23% reduction in poverty (p = 0.000**). Similarly, receiving agricultural-related assistance reduces poverty significantly, with a coefficient of -0.60 (significant at 5% significance level (p = 0.014*). Overall, the findings underscore the importance of home gardens in reducing poverty and improving the living standards of rural households in Limpopo, as results showed that home

gardens yielded the highest negative impact (-5.519, p = 0.000**), further underscoring the importance of participation in agricultural activities, particularly home gardens, in alleviating household poverty. The government needs to intensify its programmes aimed towards educating communities, reforming land, and providing extension and advisory services to reach the broader population of the province. There is also a need to conduct nutrition-related workshops to empower households on the importance of diversification of crops grown in their households and beyond.

7.1. Introduction

Home gardens have long been recognised as potential vehicles for enhancing food security, income generation, and overall livelihood improvement, particularly in rural areas with limited access to resources and economic opportunities (Keatinge et al.,2012). The impact of home gardens on alleviating poverty in South Africa, particularly in rural areas, is significant and complex (Mokone, 2016). Home gardens are often called backyard or small-scale gardens cultivated by households. Home gardens provide a means for households to diversify their food sources, improve nutrition through access to fresh produce, generate supplemental income through the sale of surplus crops, and enhance overall household resilience in the face of economic shocks or environmental stressors (Dissanayake et al., 2020). Stats SA (2019) states that more than 2.2 million households have recently constructed food gardens to avert food insecurity. Despite the diverse agricultural activities offered by home gardens, many rural households experience multidimensional poverty, encompassing factors such as income deprivation, limited access to education and healthcare, inadequate housing, and insufficient nutrition.

More than 736 million people were living below the poverty threshold in 2022, which equates to one in ten people globally (World Bank, 2022). Poverty is easily identified as individuals or households lacking resources to meet their basic needs, including food, clothing, and shelter. According to the World Bank, people in poverty live on less than $2.15 daily. There are two ends to poverty classification: absolute poverty and relative poverty. The inability to meet basic needs refers to absolute poverty, while relative poverty is based on societal contexts (Deaton, 1997; Hasa, 2020; Strydom & Tlhojane, 2014). The traditional way of measuring poverty involved income-based measurements; however, one of the significant shortcomings was that they lacked community-specific norms and values (Deaton, 1997; Posel & Rogan, 2014).

As poverty was recognised for its multifaceted and multidimensional nature, a few more inclusive measuring methods were thus included. The Multidimensional Poverty Index (MPI) is one which Alikire and Foster developed through the United Nations and Oxford Poverty and Human Development Initiative. The MPI acknowledges the multifaceted nature of poverty through its dimensions: education, health and living standards (Alkire & Foster, 2011). This comprehensive tool has been applied in many countries, including South Africa.

Despite economic progress over recent years, Sub-Saharan Africa remains burdened by high levels of poverty, possibly due to poor governance (Kouadio & Gakpa, 2022; Said*i et al.*, 2023). South Africa is renowned for its state of inequality, which remains one of the highest globally. The Gini coefficient of 0.67, which South Africa has, is characteristic of how the rich remain rich while the poor remain troubled with varying degrees of poverty (World Bank, 2023). Rural areas, in particular, are at the worse end of poverty, as they reflect a higher poverty headcount ratio when compared to urban areas of South Africa (Stats SA, 2020).

Home gardens represent a valuable and sustainable strategy for poverty alleviation in South Africa's rural areas. Their promotion and support can contribute to improving livelihoods, enhancing food security, and building resilient communities, thereby advancing broader socio-economic development goals in the country. Understanding the nexus between home garden participation and multidimensional poverty is crucial for informing targeted interventions and policies to improve rural livelihoods in Limpopo provinces. There are several studies (Rammohan *et al*., 2019; Saediman *et al.*, 2021; Issahahn, 2023) that have been conducted on the impact of home gardens on food and nutrition security, while others were conducted on multidimensional poverty index (Dika *et al.*, 2021; Ali et al., 2022; Tighsazzadeha et al., 2023), however these studies did not investigate the impact of the home garden on poverty. There is a need to close the knowledge gap on the relationship between home gardens and poverty. Therefore, this study aims to estimate the MPI while also analysing the impact of home garden participation on MPI among rural households in Limpopo Province of South Africa. This study contributes to the literature and provides evidence-based findings that can inform sustainable development strategies tailor-made to the unique context of rural Limpopo.

7.2. Methodology

7.2.1. Description of Study Areas

An in-depth description of the study areas has been outlined in Chapter Three in order to avoid repetition.

7.3. Data Collection

An in-depth description of the data collection has been outlined in Chapter Three in order to avoid repetition.

7.4. Data Analysis

In order to meet the study objectives, quantitative data was analysed using the STATA software (version 13) and Statistical Software for Social Sciences (SPSS) version 24. Descriptive analysis was performed to analyse socio-economic factors arising from the questionnaire responses. Data about poverty was analysed using the three domains of the Multi-Dimensional Poverty Index. A control function fractional response model with a quasi-maximum likelihood estimate was employed to analyse the impact of home garden participation on MPI.

7.4.1. Multidimensional Poverty Index

The Alikire-Foster Multidimensional Poverty Index was used in this study to assess poverty across various dimensions of deprivation within rural households in Limpopo. This method of multidimensional poverty measurement was developed by the Oxford Poverty and Human Development Initiative by Sabina Alikire and James Foster. The multidimensional poverty index (MPI) is comprised of two measures: poverty incidence (average deprivation experience) and poverty intensity (the population percentage that is classified as multidimensionally poor). A total of 10 indicators are included in the MPI, which are further condensed into three primary dimensions: health, education and standard of living (Alkire et al., 2015).

The health dimension focuses on the undernourished (assessing whether anyone in the household is undernourished) and child mortality (whether there has been child mortality in the family). The education dimension refers to the level of education achieved within the household. Firstly, this is done by measuring whether any members have completed six years of schooling and whether any school-aged children are not attending school. The standard of living dimension measures different aspects of the household's living condition, including the

type of house flooring, electricity accessibility and sanitation, the type of fuel used for cooking, as well as possessions of certain assets by the household (Alkire & Foster, 2011).

Increasingly, policymakers and governmental structures use the multidimensional poverty measurement to improve or deepen their understanding of poverty, effectively allocate resources, and improve poverty reduction plans (Tighsazzadeha & MalekpourAsl, 2023).

7.4.2. Multi-dimensional poverty index calculation

The study used Alkire *et al.*'s *(2015*) and Alkire and Foster's (2011) methods to calculate the multidimensional poverty index. To achieve this, the poverty incidence, which is the multidimensional headcount ratio, i.e. the ratio of individuals, identified multidimensional poverty among individuals. Thereafter, the average share of weighted indicators in which people experiencing poverty are deprived is calculated. The deprivation score can thus be calculated by dividing the total number of poor people by the deprivation score. This calculation computes the intensity of multidimensional poverty. A household is determined poor if one-third (33%) of indicators are deprived. Multidimensional poverty is projected as the product of incidence and intensity: A x H. The total number of people who are multi-dimensional poor is represented by q. The formula is indicated below:

$$H = \frac{1}{n}\sum_{i=1}^{n} p_i \tag{1}$$

$$A = \frac{1}{q}\sum_{i=1}^{q} p_i \tag{2}$$

$$M = HA \tag{3}$$

The multidimensional poverty index can be decomposed by indicator where M_j represents the contribution of the dimensional relative poverty index, and q_j represents the total number of multidimensional relatively poor individuals deprived in the dimension. The rate of contribution for each indicator to the MPI is indicated as follows:

$$I_j = \frac{{}^{q_j}/_{N^{w_j}}}{M} \quad (4)$$

7.5. Results and Discussion

The study aimed to examine the impact of home garden participation on household multidimensional poverty index in rural households in Limpopo. This section will outline the results obtained from the study.

7.5.1. Results and Discussion

Table 7.1 illustrates the demographic characteristics of the study participants. A total of 2043 rural households were involved in this study, of which 54% were female and 46% were male. Females participated in home gardening more than men. Women's increased participation confirms their significant role in home food gardening as a means to address poverty in the household. This may imply that males had other responsibilities deviating from home gardening, such as employment, or they had less interest in home gardening due to traditional perceptions or socially constructed gender roles of men and women. Oguttu *et al*., (2021) and Bhandari *et al.*, (2021) found rural women's involvement in home gardening significantly higher than that of males, concurrent with the current study findings.

Older people were likelier to be involved in home gardening than younger people. This could be due to limited income and resources, which forced older people to participate more in home gardening to supplement their diets by growing their food and selling surplus produce for income. Many study participants were unemployed (71%), while 15% were employed part-time. Amidst financial constraints, home food gardening may contribute to the overall well-being and quality of life of older people in rural areas. With regards to access to land, 89% of participants own land.

Table 7.1: Demographic characteristics of Limpopo Households.

Characteristics	**%**
Gender	
Male	46.2

Female	53.8
Participant household distribution by study site	
Capricorn	18.7
Greater Sekhukhune	21.5
Mopani	21.2
Vhembe	20.8
Waterberg	17.8
Educational Level	
Primary School Education	27.3
Secondary School Education	42.2
National Training Certificate (NTC) Level 1 – 3	1.7
National Training Certificate level 4 - 6	0.8
Diploma with less than Matric	0.4
Higher/ national/advanced certificate with Matric	0.6
Diploma with Matric / occupational certificate	2.1
Higher Diploma/ occupational certificate (b-tech diploma)	1.2
Post Higher Diploma (Masters Diploma/ Degree)-	0.2
Bachelor's Degree/ occupational certificate	1.5
Honours degree/ postgraduate diploma/ occupational certificate	0.4
Doctoral degrees (doctoral diploma and Ph.D.)	0.2
No schooling	18.2
Employment Status	
Employed full-time	15.4
Employed part-time	7.0
Self-employed	5.8
Not employed	70.7
Studying full-time	1.1
Relationship status	
Living in common-law marriage	38.0
Cohabiting	10.8
Divorced	1.8
Legally separated	0.6
Spouseless	20.9

Single	27.9
Salaries and wages	**23.2**
Household income (Rands)	
No income	1.5
Less 1500	21.7
1501-3000	38.9
3001-4500	18.6
4501-6000	6.5
Greater than 6000	12.9
Access to land	**36.0**
Own land	88.9
Rent land	1.1
Tribal authority	3.5
State-owned land	0.6
Other	6.0
Land used for the production of food and other agricultural products	**82.5**

Table 7.*2* illustrates the severity of poverty within Limpopo households, assessed by considering various deprivations experienced across three dimensions: education, health and standard of living.

Table 7.2: Deprivation percentages of rural households

Dimension	Indicator	Type	Weight	Deprived
Education	Six years of schooling	Binary	0.17	77.53%
	School-aged child not attending	Binary	0.17	68.43%
Health	Undernourished	Binary	0.17	89.18%
	Child mortality	Binary	0.17	76.55%
Standard of living	House flooring	Binary	0.06	76.75%

Electricity	Binary	0.06	78.71%
Sanitation	Binary	0.06	83.26%
Cooking fuel	Binary	0.06	85.85%
Drinking water	Binary	0.06	81.35%
Asset	Binary	0.06	79.39%

The table shows the percentages of deprivation that indicate where the households face difficulties. Each indicator in the table is binary; participants responded with a yes/no. The weight column assigns relative importance to each indicator within the overall index. From the education indicators, the study found that 78% of households had no members who have completed at least six years of schooling, and 68% reported having at least one child of school-going age who is not currently attending school. A person who is less educated is poorer than one who is highly educated, and a poor person has a lesser chance to be educated – this further ensures a continuous vicious cycle of remaining in poverty. Education is an important dimension of what is known to be 'non-monetary' poverty - an important cause and effect of poverty. Households with less educated members have a higher chance of being poor, and the chances are higher for non-poor households to have a post-school degree. A study found that rich people have more chances to have secondary diploma qualifications than poor people (Bici & Çela, 2017). A study by Bici & Çela (2017) highlighted education as a risk factor for poverty, further confirming education as an important determinant of poverty. Education and low education levels play a critical role as they have long-term effects on household members' ability to earn income and develop human capital, a significant household asset. Water and sanitation challenges are also linked to non-monetary poverty, including low or no education – this is identified in most rural areas with a lack of access to essential services (Bici & Çela, 2017). Education influences whether one can find a good and well-paying job; however, the lack of education further decreases the prospects of finding suitable or sustainable employment for a better life, thus resulting in access to health care and a better standard of living. These study findings are synonymous with other studies conducted in rural areas.

The high deprivation percentages for undernourishment and child mortality have significant implications for rural households in the context of home gardening, particularly for rural households. Undernourishment showed that 89.18% of rural households had at least one member who was undernourished. Home gardens play an important role in improving the nutritional status of households by providing a wide range of nutrients derived from the

consumption of different legumes, vegetables and fruits from the home garden. The enhancement of home garden productivity can directly and positively impact the reduction of undernourishment because of the increased availability and accessibility provided by home gardens, thus promoting a food-secure household. Furthermore, the potential of home gardens in supplying immediate and sustainable food sources can assist households in being more resilient when external shocks such as food price hikes and disruptions in food supplies happen, which have direct adverse effects on the nourishment of household members.

Childhood malnutrition has been identified to be widespread in lower and middle-income countries (LMICs) (Kirolos et al., 2021). The study found that within 76.55% of households in the study, a child had died. Numerous studies have confirmed that mildly and moderately malnourished children face increased risks of death resulting from poor nutritional status (Kirolos *et al*., 2021; Pelletier et al., 1995; Rachana *et al*., 2020). In addition, malnutrition contributes towards more than half of child deaths globally. Nutritional status is closely associated with child mortality because undernourishment can contribute towards a compromised immune system – making the body more susceptible to diseases that ultimately contribute towards increased child deaths in rural or lesser-developed areas (Rachana et al., 2020). The source of fresh foods provided by home gardens can mitigate this reality for many households. Family members ' involvement in home gardens has a positive impact. It may raise awareness about nutrition and healthy eating practices, which is beneficial for child care, growth and development (Faber & Laurie, 2010; Galhena *et al*., 2013). This can further contribute to reducing child mortality rates in rural areas.

The standard of living indicators revealed severe inadequacies for households' living conditions that significantly contribute towards multidimensional poverty. Although home gardening may not directly affect the standard of living indicators, it may influence multidimensional poverty in several ways. Below are the deprivation rates of rural households' Standard of Living indicators in Limpopo.

Household flooring showed 77% deprived. Potentially, the additional income derived from selling produce from home gardening could be used to make home improvements, such as household flooring. Rural households showed a deprivation percentage of 79%. Access to electricity is important as it may grant the household extended food preservation, heating, and access to electric appliances necessary for food preparation. Income from home food gardens

may increase the household's accessibility to off-grid electricity solutions so they can live normally. Good sanitation is essential for health. The study revealed that 83% of households were deprived of sanitation. Home food gardens can indirectly contribute towards better sanitation by promoting the use of natural resources, and they may also assist with reducing environmental contamination. The study showed that 86% of households were deprived of cooking fuel. Cooking fuel is essential in rural areas, especially for households that do not have electricity or the means to cook with electricity. Home food gardens can contribute towards cultivating biomass necessary for cooking, which may further reduce dependency on harmful and expensive cooking fuels that may create a financial burden on limited resources. Drinking water is necessary for maintaining life, while the study results showed 81% deprivation; this emphasises the severity of the lack of drinking water for rural households. Therefore, households that participate in home gardening must not over-utilize drinking water to ensure water availability at all times. The study showed that 79.39% of rural households were deprived in terms of assets, as measured in the Standard of Living dimension. Home gardens can indirectly affect the acquisition of assets by providing a means to increase household wealth – either by selling surplus produce or by saving money that would have been spent on food purchases.

A holistic approach towards reducing multidimensional poverty and improving rural households' living standards can be achieved through home gardens. Economic empowerment, improved nutrition and health, and an integrated approach to alleviating poverty can be achieved through home food garden participation. The multidimensional poverty findings emphasise the need for comprehensive rural development strategies and policy implementation that will consider home gardening and infrastructural improvements that will aid in tackling the multifaceted nature of poverty in rural households.

Table 7.3 shows the impact that determinants of home garden participation have on household multidimensional poverty. The results indicate that nearly all variables hurt MPI, suggesting that these factors contribute to reducing poverty. Specifically, household participation in home gardens, the variable of highest interest, had a significant negative coefficient of -5.519 ($p = 0.000^*$) on MPI, with a marginal effect of -2.186. The result demonstrates that households engaged in home gardening experienced a substantial and statistically significant reduction in poverty levels. The findings were supported by many studies that reported that participation in home gardens led to poverty alleviation (Keatinge *et al*.,2012; Mokone, 2016; Rammohan

et al., 2019; Dissanayake *et al*., 2020; Saediman et al., 2021; Issahahn, 2023). These studies outlined that home gardens are an essential source of food and nutrition. They further stated that home gardens have established a traditional way of providing food and offer great potential for improving household livelihoods and alleviating poverty.

Table 7.3: Impact of home gardens participation on household multidimensional poverty index-a control function-fractional response model.

	Home garden participation			**Multidimensional Poverty Index**		
MPI	**Coef.**	**Std. err.**	**P>z**	**dy/dx**	**Std. err.**	**P>z**
Age HH	-0.006	0.002	0.004***	-0.002	0.001	0.004***
Employment Status of HH	-0.047	0.033	0.156	-0.019	0.013	0.156
Household size	-0.081	0.012	0.000***	-0.032	0.005	0.000***
Did work for a wage /salary	0.091	0.076	0.231	0.036	0.030	0.231
Receive any social relief	-0.138	0.068	0.042***	-0.055	0.027	0.042**
Access to land	-3.096	0.368	0.000***	-1.227	0.145	0.000***
Agricultural related assistance	-0.602	0.245	0.014**	-0.238	0.097	0.014**
Education HH	-0.007	0.001	0.000***	-0.003	0.000	0.000***
Marital status HH	-0.142	0.013	0.000***	-0.056	0.005	0.000***
Market distance	-0.008	0.006	0.162	-0.003	0.002	0.162
Involved in agricultural production	-0.005	0.104	0.960	-0.002	0.041	0.960
Fruit vegetable produced	-0.545	0.105	0.000***	-0.216	0.042	0.000***
Predicted residual home gardens	-5.519	0.650	0.000***	-2.186	0.257	0.000***

** Indicates significance at 5%, level*** Indicates significance at 1% level.

The results show that older household heads are associated with lower multidimensional poverty levels. This may be related to several reasons, such as stability of income and assets or better access to resources and social networks that assist the household in mitigating poverty – in comparison to younger household heads that might not have access to social networks or stable income and assets. Research conducted by Dika *et al*., (2021) and Pinilla-Roncancio *et al*., (2020) further illustrates the association between older household heads and lower levels of multidimensional poverty.

Household size represents the number of people living in a single household, which is essential as the number of people impacts resource allocation, particularly income or financial resource

allocation (Girsang et al., 2024). The current study found that as the household size increases, poverty decreases. This may be surprising, seeing as larger households may have strained resources due to the number of people that need to be catered for, compared to smaller households. Batame's (2024) study highlights how larger households influence low dietary diversity in Ghana's rural areas, contributing to food insecurity. The reception of any social relief indicated a decrease in poverty, thus confirming the correlation between social relief and poverty reduction in rural areas. Setloboko (2022) further highlights how social relief funding positively impacted rural households, which contributed towards ensuring food accessibility in times of vulnerability or shocks.

Results from the study highlight the significance of land access to rural households. Land access is one of the critical factors in the reduction of household poverty in rural areas. Studies have confirmed how land enables agricultural activities and food production, a key source of food security and income generation for rural households (Borga & D'Ambrosio, 2021; Li et al., 2021). The accessibility of land for rural households means better investments in farming practices; it provides an opportunity for diversified crop production and increased productivity levels, contributing to the overall reduction of poverty through improved livelihoods and well-being.

The study showed a substantial decrease in MPI associated with receiving agricultural-related assistance (-0.602, p = 0.014**) and the size of the household (-0.081, p= 0.000***). In addition, the study revealed a significant relationship between households that produce fruits and vegetables (-0.545, p= 0.000***), implying that an increase in participation is associated with a substantial decrease in multidimensional poverty. This finding indicates that interventions such as agricultural training, subsidies and other resources related to agriculture are effective in reducing MPI among rural households. With additional assistance given to home garden farmers, there is an increase in productivity and income generation from sold produce, which also positively impacts household food security. Therefore, expanding or enhancing agricultural support programs is encouraged for rural households. These findings also align with previous studies that show a positive relationship between receiving agricultural assistance and decreasing poverty. Haile *et al.,* (2021) discovered the decrease in multidimensional poverty when farmers received assistance with crop production. Farmers saw increased income from agricultural production and various non-farm activities in rural households. An Ethiopian study further showed how productivity increased when households

were assisted with climate-smart farming practices, reduced multidimensional poverty, and improved food security among rural households in Ethiopia.

In under-developed and developing countries, it is known that education is good, and families instinctively know that educating their children grants them opportunities they did not have. Study findings showed that multidimensional poverty decreases when household heads are educated. However, multidimensional poverty increases with the absence of education for household heads. Education influences better economic opportunities, better health and utilisation of resources (Mihai et al., 2015) – such as the effective management and establishment of home gardens and other critical life skills obtained through the education system. This result underscores education's significance in alleviating poverty in rural households. The International Monetary Fund (IMF, 2000) also confirmed that the education of households leads to higher income that benefits those vulnerable to poverty in rural areas.

7.6. Conclusion and Recommendations

Home gardens are one of the sustainable strategies for poverty alleviation in South Africa's rural areas. However, rural households face several challenges that hinder their participation in home gardens, which worsens the poverty index. The results indicate that nearly all variables had a negative impact on the MPI, suggesting that these factors are associated with reductions in poverty. Specifically, household participation in home gardens had a significant negative coefficient of -5.519 ($p = 0.000^*$). This finding is important as it emphasises that households engaging in home gardening experienced a statistically significant decrease in poverty levels. Other significant variables that negatively affected MPI included household size (-0.081, $p = 0.000^{***}$), access to land (-3.096, $p = 0.000^*$), and agricultural assistance (-0.602, $p = 0.014$). On the other hand, receiving any social relief (-0.138, $p = 0.042^{**}$) and producing fruits and vegetables (-0.545, $p = 0.000^{***}$) also showed significant reductions in MPI. The findings confirm that household participation in home gardening significantly and negatively affects the Multidimensional Poverty Index of rural households, indicating its substantial role in reducing poverty. Access to land, agricultural assistance, and household size are other critical factors that contribute to poverty alleviation.

Based on these findings, the study recommends promoting home gardening programs by policymakers and organisations to improve food security and reduce poverty among rural

households. Secondly, strategies should be geared towards enhancing rural households' access to land for agricultural purposes, as this could amplify the poverty-reduction effects observed in the study. Agricultural assistance can be expanded to provide support such as resources, education, and even financial aid for agricultural activity to alleviate poverty further. Lastly, the study findings recommend that social relief or support programs, such as providing social assistance, should be maintained and expanded, as they significantly reduce poverty levels.

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CHAPTER EIGHT

CONCLUSIONS AND RECOMMENDATIONS

8.1. Summary

Households that participate in home garden food production have the potential to improve their food and nutrition security status. Home gardens offer a reliable source of fresh produce that is easily accessible. The diverse variety of cultivated crops in home gardens contributes significantly to a more balanced diet and improves overall health due to the consumption of micronutrients and vitamins. Ultimately, the reduction of various elements of poverty can be seen with home garden participants due to the income generated from surplus produce sold within the communities and local markets. Furthermore, the empowerment of women and marginalised groups involved in home gardening can be seen through various productive activities and decision-making processes related to local food production. Home gardens have numerous benefits for households in rural areas, which are already limited in financial assets and other vital resources. The specific objectives assigned to the study were to assess the factors that influence home garden participation, analyse whether home food gardens improve food security for rural households, evaluate the contribution of home gardens to nutrition security for rural families, and determine the impact of home gardens on multidimensional poverty.

A stratified random sampling technique selected 2043 participants from the Province of Limpopo. The study objectives were investigated by employing various econometric models and indices to analyse the contributions and limitations of home gardening among rural households. The methods utilised in the study were the probit model, endogenous switching Poisson regression model, the multidimensional poverty index, and the endogenous switching probit model. The Household Food Insecurity Access Scale (HFIAS) was used to measure food security, while the Household Dietary Diversity Score (HDDS) was used as a proxy measure of nutrition security. Generally, access to social services improved food security and nutrition. While some socio-economic factors were found not to influence participation in a home garden, socio-economic factors typically contributed to the household head's decision to participate in the home garden. Similarly, these socioeconomic factors also contributed to food

and nutrition security. More importantly, home garden participation contributed to food and nutrition security.

8.2. Conclusion

Home gardening is crucial for enhancing food and nutrition security, reducing multidimensional poverty, and empowering marginalised groups within rural households. Home gardens significantly contribute to balanced diets, improved health outcomes, and increased household income by selling surplus produce and offering a consistent and diverse supply of fresh produce. Socio-economic factors, though varied, play a significant role in influencing participation in home gardening, which subsequently impacts food availability, nutrition, and poverty alleviation. These findings emphasise the importance of promoting home gardening initiatives, particularly in resource-constrained regions such as Limpopo Province, as a sustainable strategy to address food insecurity, foster community empowerment, and build economic resilience.

Home gardening enhances food and nutrition security by diversifying household food sources, mainly cultivating nutrition-rich crops to improve dietary quality. It also has the potential to reduce poverty by serving as an alternative source of income and increasing food access. While challenges such as employment commitments may hinder participation, these obstacles can be mitigated through hiring labour or utilising non-wage-earning household members for gardening activities. Larger households, in particular, benefit from an increased labour force to support home gardening efforts.

To maximise the benefits of home gardening, there is a pressing need for enhanced agricultural education, training, and support. Educational programs and awareness campaigns can underscore the importance of home gardens in poverty alleviation and household welfare. Additionally, transforming land into an income-generating resource through cultivating, consuming, and marketing diverse crops can significantly enhance food and nutrition security. This study highlights the need for targeted agricultural policies and programs that encourage land access, youth education, and agricultural awareness to optimise the potential of home gardening for rural households in Limpopo Province.

8.3. General recommendations of the study

Based on the findings of this study, the following recommendations were made:

- Rural households need to be encouraged to participate in home garden food production through workshops that focus on the benefits of home gardens and the consumption of home-grown fresh produce.
- To improve home garden participation, demonstration gardens or field schools for practical training on sustainable home garden practices should be facilitated for community members of different age groups.
- Continued community-based assistance through extension advisory services to foster sustainable and prosperous home gardens in rural areas must be implemented to aid food and nutrition security.
- The education system could integrate the agricultural curriculum in schools to foster a deeper understanding of food systems and form a better foundation for improved food production and consumption patterns within households
- Government departments focusing on agriculture should expand their assistance programs to target poverty reduction in rural areas.

8.4. Recommendations for policy implementation

To maximise the benefits of home gardening, the study recommends a multifaceted approach that includes community-based assistance, agricultural training, and educational programs. Workshops and field schools should be established to demonstrate the benefits of home gardening and provide practical training to ensure the viability and sustainability of garden production. Extension workers should include home garden owners in all advisory services offered to smallholder farmers to enhance support and integration.

Targeted interventions, such as agricultural training and skill-building programs, can empower individuals to effectively engage in home gardening, increasing access to nutritious food and supplementary income. Integrating agricultural education into school curricula can foster a deeper understanding of food systems from a young age, promoting informed decisions about household food production and consumption. This approach can address the lower educational levels observed among study participants, significantly contributing to food insecurity.

Ensuring land accessibility is crucial for reducing poverty and enhancing food security. Cultivated land can become an income-generating asset, allowing households to improve their economic status and nutritional intake by cultivating, consuming, and marketing various crops. Additionally, providing social relief funding when needed can help safeguard household well-being and prevent long-term adverse effects. By identifying and addressing the significance of home gardening in rural communities, policymakers and stakeholders can effectively tackle the challenge of food insecurity. Investing in the skills and resources necessary for home gardening can lead to more resilient and self-sufficient communities, ultimately improving the quality of life for rural households in Limpopo.

8.5. Limitations of the study and suggestions for further research

The data collection for this study was conducted during the global COVID-19 pandemic, which imposed significant national restrictions on movement and interactions with communities and individuals. Consequently, the study relied on secondary data sources. Future research is encouraged to utilise primary data collection methods, which can be compared with the secondary data in this study to provide richer comparative analyses and insights.

Primary data collection allows for direct interaction with respondents, fostering richer dialogue and a deeper understanding of the underlying reasons behind specific dataset characteristics. Employing follow-up questions and tools such as focus group discussions can enhance the depth and quality of the data, leading to a more comprehensive analysis of the study findings.

Additionally, this study was confined to the Limpopo province. Further research could extend to other regions across South Africa, facilitating comparative studies between provinces and rural and urban home gardens. Such broader investigations would provide a more comprehensive understanding of the home garden landscape throughout the country. This expanded scope can significantly inform policy and program implementation to improve household well-being and food security.

APPENDIX A

agriculture, land reform & rural development

Department:
Agriculture, Land Reform and Rural Development
REPUBLIC OF SOUTH AFRICA

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Dr M Ngidi

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Dear Dr Ngidi

RE: PERMISSION FOR USE OF SAVAC DATASETS

Thank you for your letter dated 29 January 2021, requesting the Department of Agriculture, Land Reform and Rural Development (DALRRD) to **use the SAVAC datasets for PhDs, Masters and publication of papers.** Permission is granted expressly for use as listed in your letter. The data remains the property of the South African Vulnerability Assessment Committee (SAVAC) as the originator. Users are expected to respect the intellectual property rights of the SAVAC. It is, therefore, expected that the analysis and insights emanating from the use of this data will be shared with the SAVAC Chairperson.

Yours Faithfully,

(

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MR M MAMADI
DIRECTOR: SUBSISTENCE FARMING DATE: 25 Feb 2021