The acceptance of indigenous leafy vegetables and their contribution to household food security in Limpopo and Mpumalanga provinces, South Africa

by

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DECLARATION

I, Sinethemba Zulu, declare that:

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

Supervisor'signature:..... Date: 12 January 2022

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Declaration 2: Publications

Author's contribution to publications which forms part of the dissertation

Publication 1- Chapter 4

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ACRONYMS AND ABBREVIATIONS

DAFF Department of Agriculture, Forestry and Fisheries

DALRRD Department of Agriculture, Land Reform and Rural Development

ESRM Endogenous Switching Regression Model

FAO Food and Agriculture Organization

HFIAS Household Food Insecurity Access Score

HIV Human Immunodeficiency Virus

ILVs Indigenous Leafy Vegetables.

KZN KwaZulu-Natal

SAVAC South African Vulnerability Assessment Committee

SURM Seemingly Unrelated Regression Model

ABSTRACT

The dietary shift from indigenous leafy vegetables to cash crops production and consumption increased the risk of micronutrients deficiency diseases, especially among rural-poor communities. The less consumption of ILVs promotes hunger and food insecurity among rural and urban households. An increase in consumption of these leafy vegetables helps minimize malnutrition, hunger, and food insecurity. Each ILV contain different levels of micronutrients, suggesting that diversifying ILVs in consumption has the potential to reduce health conditions associated with micronutrient deficiency. Therefore, understanding consumer acceptance of indigenous leafy vegetables (ILVs) is important in enhancing their consumption levels to increase micronutrient intake. However, the determinants of consumers' acceptance of ILVs, vis-à-vis its potential impact on household food security, is neglected by researchers, as a result, declining.

This study was set out to assess the determinants of acceptance of indigenous leafy vegetables by consumers in Limpopo and Mpumalanga provinces. The study used secondary data that was collected by the South African Vulnerability Assessment Committee in 2016. A total of 1520 respondents were selected from the two provinces using a multistage stratified sampling method. In analyzing the determinants of consumers' acceptance of ILVs, a seemingly unrelated regression (SUR) model was employed. The results of SUR showed that the gender of the household head, marital status, HIV status, wages/salary, and grants were statistically significant in influencing the acceptance of ILVs by consumers. The study further revealed that amaranth and cleome were the most accepted leafy vegetables while blackjack was the least accepted one. Education and marital status had a negative influence on the acceptance of all leafy vegetables being investigated in this study.

While estimating the impact of ILVs consumption on household food security, the household food insecurity access scale (HFIAS) was used to determine the household food security status of the respondents. In the same vein, the endogenous switching probit model (ESPM) was employed to estimate the impact of ILVs consumption on household food security status. The results from the household food insecurity access scale (HFIAS) showed that a large proportion of the population was food secure while a small portion of the population was food insecure. The correlation coefficients rho_1 and rho_ 0 in the ESRM were negative (-0.992) and positive (0.970), respectively. This indicates that self-selection occurred in the consumption of ILVs between both consumers and non-consumers of ILVs. The results from descriptive statistics

revealed that most consumers did not produce ILVs but consumed them. While a small number of farmers produced ILVs yet did not consume them. The household size and wealth index variables were positive and significant to the consumption of ILVs. On the other hand, age, gender, and education variables had a negative influence on the consumption of ILVs.

To increase the acceptance of ILVs, especially the least accepted ones. The study recommends that extension officers must educate farmers about the importance of these leafy vegetables. NGOs can provide agricultural input such as seedlings, fertilizers, farm machinery to encourage the production of underutilized ILVs among smallholder farmers, including blackjack. Strategies to enhance value addition and sensitization of consumers to traditional knowledge regarding leafy ILVs, and their nutritional importance to the human diet are required.

CHAPTER 1

BACKGROUND AND ITS SETTING

1.1 Introduction and background of the study

In recent years, food insecurity has been a prevalent issue facing developing countries around the globe (FAO, 2010). This is evident in that one billion people do not have access to sufficient food to meet their nutritional needs and their daily required energy needs for their diets (FAO, 2010). Despite technological advancement, the global food system is struggling to meet the basic needs of people equitably (Giller et al., 2021). This is apparent in that 820 million people are experiencing hunger and are living below the poverty line, underscoring the significant challenges of achieving zero hunger by 2030 (FAO.,2010). In addition to that, the displacement of indigenous leafy vegetables by exotic crops has partly contributed to the limited success of the global food systems in eradicating malnutrition and hidden hunger, especially, in developing countries (Matenge et al., 2012). However, due to increasing illnesses related to micronutrient deficiencies, the main focus has been on getting people to change their attitudes towards the consumption of indigenous leafy vegetables. Since ILVs have the potential to enhance household food security and alleviate hidden hunger emanating from micronutrients deficiency diseases.

In the past centuries, indigenous leafy vegetables have been the popular leafy vegetable that most rural communities consumed (Matenge et al., 2012). However, in recent years, the focus has shifted from indigenous leafy vegetables to exotic cash crops (Mavengama 2013). This has resulted in the displacement of indigenous leafy vegetables that once played a huge role in people's life. Thus, resulting in the widespread of micronutrient deficiency diseases as people's diet subsequently changed (Hoeven et al., 2013). These leafy vegetables are a vital source of vitamins, minerals, and other nutrients required by the body for its normal functioning. However, their consumption is decreasing due to factors such as perceptions and attitudes held by people. On top of that, the great value of indigenous leafy vegetables has been ignored by researchers since little research has been carried out on their acceptance and contribution towards household food security (Hoeven et al., 2013). Therefore, it is essential to improve their knowledge through scientific investigations and documentation to ensure that the future

generation is informed about the importance of these leafy vegetables and their nutritional benefits.

The consumption of these crops in South Africa has been highly dependent on the factors such as the degree of urbanization, poverty status, the season of the years, and distance to the market (Van Jaarveld et al., 2014). Aworh (2015), stated that an increase in the production of ILVs alongside post-harvest techniques and supply chains enhances smallholder farmers' income. As a result, eradicate poverty and food insecurity among consumers. These leafy vegetables have characteristics that help to fight food insecurity, including the fact that their leaves are resistant to adverse weather conditions such as drought (Aworh, 2015). These leafy vegetables are also perceived by rural people as tasty, nutritious, cheap, healthy, and uncultivated crops. However, despite the potential of ILVs to eradicate food insecurity and malnutrition, these crops are still undervalued, underrated, and unrecognized by people, especially urban consumers who rely on the market to access food (Babalola & Akinwande, 2014). Therefore, the study aims to investigate the acceptance of indigenous leafy vegetables and their contribution to household food security of Limpopo and Mpumalanga Provinces of South Africa.

1.2 Problem statement

The indigenous leafy vegetables have the potential to eradicate poverty, malnutrition, and food insecurity. However, their consumption pattern is determined by various factors such as the sensory characteristics of ILVs, including their appearance, smell, texture, and taste. These characteristics of ILVs play a significant role in determining people's decision to consume them. The other factors that influence the acceptance of ILVs include socioeconomic, institutional, and demographic factors. Faber et al. (2010) stated that as far as ILVs are concerned, different communities have different perceptions and attitudes about ILVs that grow in their spaces and this further affects the consumption and the utilization of these plants for various reasons.

Bvenura & Afolayan et al. (2015) stated that the decrease in the consumption of ILVs is because they are not part of the food system and formal market. This is evident in that only 21 food items from 12 species of indigenous crops are part of the food system. As a result, the consumption patterns of indigenous leafy vegetables have been decreasing over the years, especially in urban communities where consumers rely on the market to access food. Despite the great value of these leafy vegetables, little research has been carried out on their acceptance and contribution towards household food security (Mabhaudi et al., 2019). As a result, these

leafy vegetables have a minimal contribution to the household food security of people. Their less availability in the food system promotes hunger, food insecurity, and an unsustainable food system prone to climatic and economic shocks (Akinola et al., 2020).

1.3. Specific objectives of the study

It was hypothesized that the less consumption of ILVs has resulted in their minimal contribution to household food insecurity of consumers, especially urban consumers who highly depend on the market to access food. In this light, it is essential to get an insight into the extent to which the indigenous leafy vegetables contribute to food security. Therefore, the study aimed to understand the consumers' acceptance of indigenous leafy vegetables and their impact on household food security in Limpopo and Mpumalanga province of South Africa.

The specific objectives were to:

1. Analyse determinants of consumer acceptance of indigenous leafy vegetables; and
2. Evaluate the effect of consumer acceptance on household food security in the study area.

1.4. Sub-problems

1. What are the perception and attitudes of households to the consumption of indigenous leafy vegetables?

2. What are the determinants of consumer acceptance of indigenous leafy vegetables? and

3. What is the effect of consumer acceptance of ILVs on household food security in the study area?

1.5 Rationale/Significance of the study

This study will help to find out various factors that contribute to minimal consumption of Indigenous Leafy Vegetables. The finding of this research will provide insight to policymakers and researchers in the sense that they will recognize the significant role that ILVs can play in eradicating hunger, especially in rural areas since indigenous leafy vegetables are an affordable source of several micronutrients. The study will encourage agricultural programs to focus more on rural and smallholder farmers who produce these crops to produce more so that the food system will comprise diversified indigenous crops. Thus, increasing their acceptance among

rural and urban consumers. This will also improve their availability in the market, thereby, increasing their accessibility to urban people who often rely on the market to access food.

It will pass down the essential knowledge on ILVs as it has been revealed that the decline in the consumption of ILVs is exacerbated by the lack of passing down information from the older generation to the younger generation. Hence, little is known about people's acceptance of various dishes prepared using ILVs, especially young people. Therefore, a study on ILVs will help document and preserve imperative information concerning the preparation and cooking of these plants. It will also provide insight to the different organizations and actors (agricultural sector government and policymakers) advocating the consumption of ILVs to know how their agricultural programs can tackle food insecurity and hunger prevailing in societies.

The study also perceives that the acceptance of ILVs is minimized by people who have negative attitudes towards these leafy vegetables. As a result, the study will encourage extension workers to educate people about the benefits associated with producing and consuming these crops. Thereby, improving diet diversity, a sustainable food system, above all, enhances household food security. Therefore, the study will promote the importance of ILVs in minimizing hunger and enhancing the household food security of both smallholder farmers and consumers who are beneficiaries of the study.

1.6. Definition of terms

Attitudes- is how people feel and think of something (Vogel & Wanke, 2016). For this study, "attitude" will be understood in a way people feel and think about utilizing ILVs for consumption purposes.

Consumer- Refers to the person or thing that eats or uses something (Merriem-Websters Collegiate Dictionary, 1999). In this case, "consumer" refers to individuals or people consuming indigenous vegetables.

Household food security- Food security at a household level is defined as the ability of a household to secure sufficient nutritious food for meeting the dietary needs of all individual members of a household through their production or purchases (FAO,2010). In this case, household food security will be looked at, through the lens of household ability to cultivate indigenous leafy vegetables for consumption purposes.

Indigenous leafy vegetables- these are plants that grow in the wild or are cultivated, gathered, and harvested for food within a particular African system (Mavhengama, 2013). Sometimes referred to as plants that are indigenous in a particular area or have evolved through natural process or farmer selection and are socially accepted and consumed by communities (Kimiywe, 2007).

Perceptions- it is how individuals view or see something (Hoeven et al. 2013), in this case, the perception will be understood in the way that people view indigenous vegetables for consumption purposes.

1.7 Structure of the dissertation

In chapter 1, the study presented the research background, problem statement, subproblems, the aims and objectives of the study, and the significance of the study. In chapter 2, the literature gave an in-depth knowledge on the determinants of ILVs acceptance and the contribution of ILVs on household food security. It also provides a conceptual framework, empirical review and an analytical framework of ILVs acceptance and their impact on household food security. Chapter 3, presented the research findings of the study collected on 1520 smallholder farmers based in Limpopo and Mpumalanga provinces of South Africa. Chapter 4 gave an in-depth analysis of the determinants of ILVs and the food security of smallholder farmers. The conclusion and policy recommendations from the findings of the study were presented in the chapter.

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CHAPTER 2

LITERATURE REVIEW

2.0. Introduction

This section presents a literature review on the theory of household food security and the empirics related to the factors determining the consumption of ILVs and their impact on household food security. The concept of household food security, such as the pillars of food security (availability, accessibility, utilization, stability), and consumers' acceptance of ILVs are presented in this section. After that, theoretical and empirical evidence is provided to achieve the objectives of the study. This section looks at other factors influencing the acceptance of ILVs apart from ILVs consumption.

2.1. Brief overview on Indigenous Leafy Vegetables of South Africa

South African indigenous leafy vegetables are plants that have their origin in South Africa (Van Rensburg et al, 2007) These crops are sometimes introduced to the country through various natural processes that cause them to evolve. Indigenous vegetables have different names known by different authors including wild vegetables, traditional vegetables, and African leafy vegetables (Van Rensburg et al., 2007). In South Africa, they are called *imifino* in isiZulu and Xhosa, *Miroho* in Sesotho, and *Miroho* in Tshivenda. South Africa comprises of different types of 100 types of ILVS, however, only fewer groups of these plants are consumed (Faber et al., 2010) This includes vegetables such as Jute mallow, pigweed, bitter melon, cowpea, spider plant, and Chinese cabbage. Amaranth is also one of the indigenous vegetables widely available in South Africa reason being that it thrives in adverse weather conditions and also grows naturally without being cultivated (Faber et al., 2010).

These leafy vegetables are either cultivated or grow in the wild under different climatic conditions. Indigenous leafy vegetables such as Bambara groundnut, cowpea, cleome, jute mellow, amaranth typically grow in Mpumalanga, Northwest, Gauteng, KwaZulu Natal and Limpopo provinces in South Africa. ILVs are often eaten as boiled, dried, and roasted vegetables (Mabhaudi et al, 2017). Furthermore, most of these leafy vegetables are drought and heat-stress-tolerant and require minimal inputs for growth and adaptation in arid and semi-arid conditions (Mavhengama et al., 2013). These leafy vegetables are mainly grown by smallholder farmers in rural areas and are an essential source of food for rural poor households. However, despite their importance, people are not aware of the nutritional benefits associated

with consuming these leafy vegetables, particularly those residing in urban areas (Mavhengama et al., 2013). This is due to many factors that determine consumers' acceptance of indigenous leafy vegetables including attitudes, socio-demographic factors and perceptions.

2.2. Theory on household food security

The theory of household food security focuses more on people's access to resources and their ability to benefit from them. Ribot & Peluso (2003) argue that a person may have a right to access a particular resource but may not have the ability to use those resources because they lack knowledge, labour, market mechanisms, and market information. For instance, smallholder farmers may produce ILVs in tons. However, they may not have transport, market information needed to sell their local produce in the market. As a result, limit ILV's exposure to urban consumers who rely on the market to access food. Gaining access to resources and agricultural input can enable smallholder farmers to adopt sustainable land management approaches such as water-saving strategies and nutrient management. These are necessary to achieve a sustainable livelihood by increasing productivity and mitigating climate change (Liniger et al., 2011). Limited access to productive resources, on the other hand, makes smallholder farmers who produce ILVs to be susceptible to food insecurity, thereby, resulting in unsustainable livelihoods.

2.3 Concepts of household food security and consumer's acceptance of ILVs.

Food security is a broad term defined in different ways by different scholars and organizations. However, the most cited definition of food security is the one by the 2006 World Food Summit which stated that "food security exists when all people, at all the times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO,2008:9). on the other hand, the Department of Agriculture, Forestry and Fisheries (2009), described food security as the ability of people to access adequate food. Their ability to access sufficient food is measured using four pillars, known as food availability, food access, food utilization, and food stability (FAO,2008). This implies that a household is considered food secure when all the pillars of food security are met. If not, then the household is considered food insecure and that increases the chances of a household suffering from hunger and malnutrition. As a result, authors such as Mbhenyane (2017) & Mabhaudi et al. (2019) alluded that food-insecure households must increase their consumption of indigenous leafy vegetables since ILVs are easily accessible, nutritious, and

widely available in South Africa. In addition to that, they have the potential to eradicate hunger and malnutrition diseases, increase dietary diversity and the dietary quality of a household.

Food availability: it is the physical existence of food. In most cases, the availability of food focus is more on the production of food by farmers and the quantity of food available to be consumed by the household. On a national level, food availability comprises domestic food production, commercial food imports, domestic food stocks, and food aid. However, for the sake of this study, the focus is on household food security where food comes from households' production or bought in the local formal or informal markets (FAO, 2010).

Food access: food access is when the household has sufficient resources to obtain food whether in quality or quantity. This, in turn, helps the household members achieve dietary diversity and household food security. Additionally, accessibility of food depends on the prices of food and the number of the household's resources. Food access also focuses on the physical, social, and policy environment. Any change in these three dimensions may disrupt production strategies and threaten food access of affected households, for example, developing countries can be severely affected by droughts and floods more frequently. As a result, the harvest volume of food decreases, thus, increasing food prices, food access, and food availability (FAO,2010).

Utilization: in the utilization pillar, nutritious food is often assumed to be available and accessible. As a result, the focus is more on the kind of food a household decides to purchase, knowledge about its preparation, consumption. For instance, the utilization of ILVs is less in urban areas and young people because they are not knowledgeable about the preparation process of ILVs. The other focus of utilization is biological utilization. This refers to the ability of the human body to make use of the nutrients found in the food and convert them. This process is vital because the energy obtained from the food helps an individual perform day-to-day activities (Borisade &Bach, 2014).

Stability: stability refers to the temporal dimension of food and nutrition security. Food stability is the availability of food for the household over time. It is achieved when the supply of food in the household remains constant over a long period (a year). Food stability is improved by minimizing external risks (natural disasters, climate change, price volatility, and conflicts) that may temper household food security. This can be done by establishing measures such as insurance against drought, crop failure, and the unsustainable use of resources (Power, 2008).

Dietary Diversity: it refers to the number of food items consumed by the household over a given period of time (Ruel, 2003). It is measured by counting the number of food groups consumed by the household members than food items (Vakili et al., 2013). At a household level, dietary diversity measures access to food of the household, for instance, the household capacity to access costly food groups. At the individual level, dietary diversity focus on dietary quality, where food consumed consists of various micronutrients. For instance, ILVs are a vital source of micronutrients such as potassium, dietary fibre, vitamin A, vitamin C, iron, folate, and magnesium. Therefore, these leafy vegetables may help a household member meet their daily nutritional requirements especially, in rural and urban poor households (Nangula et al., 2010).

2.4. The perceptions and attitudes towards ILVs

The consumption of ILVs in South Africa has been immensely affected by the perceptions and attitudes held by many households. Hence, the consumption of these plants has been decreasing (Voster,2007). This is somehow in line with (Mayekiso, 2021) who stated that less consumption of ILVs stems from being overlooked in terms of their taste in contrast to conventional vegetables. Kimiywe (2007), alluded that the low intake of these plants is associated with poverty, ancient practices, and social backwardness, as a result, they receive less attention from people. However, Tavassoli &Baron Cohen (2009) stated that less consumption of ILVs is because the youngsters have active taste buds that get replaced every time they grow. Hence, they resent the bitter taste of these plants. However, adults, on the other hand, are fond of indigenous leafy vegetables as their taste buds do not get replaced every time they grow. Furthermore, youngsters show less interest in these plants as they are perceived as outdated and related to backwardness. Therefore, young people lack the critical information required to prepare, store, and cook these plants.

2.5. ILVs regarded as unhygienic foods

Cloate & Idsardi (2013) noted that indigenous leafy vegetables are collected from the wild rather than cultivated. These leafy vegetables, especially amaranth and blackjack are pioneer plants that emerge naturally from disturbed soil. Hence, people regard them as weeds. This notion has contributed to them being regarded as poor peoples' food-related to the concept of social backwardness. Since people in the past heavily relied on them to diversify their food intake in the household. Therefore, indigenous leafy vegetables' consumption is shaped and

governed by food sources references of the past. However, Cloate & Idsardi (2013) stated that territory contributes significantly in determining the kind of foods people consume. Mabhaudi et al. (2016) argued that the link between food and territory is eroded over time since there have been changes in food production, technologies, urbanization, and consumers' exposure to non-local experiences through travel and media. This implies that ILVs are consumed by everyone including those residing in urban areas. However, the connotations linked with socio-cultural backgrounds still exist; hence these leafy vegetables are still perceived as poor people's food that grows in rural areas.

2.6. Old fashioned food

These leafy vegetables are also regarded as old-fashioned because older people consume them more often (Taleni & Goduka, 2013). After all, they have the skills required to prepare and cook them. On the contrary (Maseko, 2018) stated that youth has more diverse food purchasing and consumption patterns selected based on preferences for novelty and convenience foods. Therefore, they prefer fast foods over ILVs which they deem as unhygienic due to little stone detected when eating them. Maseko (2018) further stated that the consumption of foods other than traditional foods such as amaranth encouraged by the massive urbanization of African consumers, leading to changes in the food preferences of the household. This has caused people to consume other foods than indigenous leafy vegetables, especially young people. On the contrary, Van Hoeven et al. (2013), indicated that the factors that led people to consume these plants in the past have triggered people to consume them in the 21st century for health and cultural purposes. For instance (Amabele (a final product of Sorghum) is a traditional food underutilized as people fell for western food. However, their consumption has increased as people go back to their roots because of medical advice (Akinola et al., 2020).

2.7. Determinants of consumers' acceptance of indigenous leafy vegetables

Indigenous leafy vegetables such as Bambara groundnut, cowpea, cleome, jute mellow, amaranth typically grow in Mpumalanga, Northwest, Gauteng, KwaZulu Natal, and Limpopo provinces in South Africa. ILVs are often eaten as boiled, dried, and roasted vegetables (Cloate & Dsardi, 2013). Furthermore, most of these leafy vegetables are drought and heat-stress-tolerant and require minimal inputs for growth and adaptation in arid and semi-arid conditions (Mabhaudi et al., 2016). These leafy vegetables are mainly grown by smallholder farmers in rural areas and are an essential source of food for rural-poor households. However, despite their

importance, people are not aware of the nutritional benefits associated with consuming these leafy vegetables, particularly those residing in urban areas (Mabhaudi et al., 2017). This is because there are factors determining consumers' acceptance of indigenous leafy vegetables including demographic factors, and institutional factors.

2.8 Demographic factors

It is revealed that the consumption of indigenous leafy vegetables is influenced by socio-economic factors such as age, gender, education, distance to the market, and income. As far as the income of consumers is concerned, Omotayo & Aremu (2020) stated that middle- and average-income earners consume these leafy vegetables because they fear risking their health. However, Mthombeni (2013), argued that the consumption of these plants is mostly determined by livelihood sources in the sense that unemployed people and casual labour people are consuming indigenous leafy vegetables more than their employed personnel counterparts. The study concluded that the livelihood sources determine the time spent preparing and cooking these plants. This is somehow in line with Mabhaudi et al. (2016), who stated that monthly income affected the extent to which people consume indigenous leafy vegetables. This indirectly implies that poor people consume these leafy vegetables more than rich people. Therefore, the consumption of ILVs is determined by the household level of income. However, the majority of the consumers of ILVs are low-income earners.

2.9 Institutional factors

The less availability of indigenous leafy vegetables in the market is caused by institutions and policy frameworks that pay less attention to indigenous leafy vegetables. Mabhaudi et al. (2019) further stated that these policies focus on cash crop production, which advocates eradicating any other plant that grows in the field as weeds. This implies that they support the eradication of indigenous leafy vegetables as they are regarded as weeds. These findings are somehow in line with that of Tudge (2014) who stated that the less consumption of these leafy vegetables emanates from the fact that the dominant food system policies focus on the production and marketing of exotic cash crops while leaving the indigenous leafy vegetables behind. This, therefore, proves that the policies are inclusive of exotic cash crops production and their marketing hence there has been a minimal availability of indigenous leafy vegetables in the market. On the contrary, Akinola et al. (2020) indicated that policies that are inclusive

of both cash crops and ILVs are to be developed since these leafy vegetables have gained their popularity back.

2.10. ILVs contribution to household food security

The diversification of leafy vegetables increases their chances of being a reliable, cheap source of food, especially for food-insecure rural households. These leafy vegetables such as amaranth, jute mellow, cassava, and cleome grow relatively well in arable land where conventional crops fail to thrive. They are also able to provide at least two foodstuffs during their life cycle (Ebert, 2014). Akinola et al. (2020), stated that ILVs have many desirable traits such as that they are richer in protein when compared to exotic cash crops. According to World Health Organization (2019), a healthy diet protects the body against malnutrition, hidden hunger, and micronutrient deficiency diseases such as stroke, cancer, and diabetes. However, to achieve this, an individual must consume at least 400g of vegetables per day. In this regard, indigenous leafy vegetables can provide full nutrient requirements since they comprise countless species of vegetables (Akinola et al., 2020). Other benefits of producing indigenous leafy vegetables include the fact that they are easily dried up, processed, and canned for consumption in other seasons where these leafy vegetables are less available (Akinola et al., 2020). This proves that ILVs can contribute to food security since they almost meet all pillars of food security as they are widely available, accessible, and promote food security, dietary diversity, and dietary quality among people. This then increases their acceptance among rural and urban consumers. However, Mavhengama et al. (2013) stated that regardless of the micronutrients these leafy vegetables possess, they are overshadowed by cash crops that people prefer over ILVs. Therefore, they somewhat have minimal contribution to household food security.

2.11. Factors increasing the acceptance of Indigenous Leafy Vegetables

Akinola et al. (2020) further stated that the acceptance of these leafy vegetables is highly dependent on their physical and sensory characteristics such as their appearance, odour, texture, and taste. These findings are similar to that of Maseko (2018) who stated that there was less acceptance of jute mellow because this leafy vegetable has a slippery texture that people resented. However, Shayanowako (2021), alluded that there is an increase in the acceptance of these leafy vegetables as people are realizing the various benefits of using them. This implies that the acceptance of ILVs is not only dependent on physical and sensory characteristics but also depend on their nutritional and medicinal benefits of them.

2.12. The availability and accessibility of ILVs among consumers

Bvenura & Afolayan (2015), stated that indigenous crops have minimal contribution to food security, especially in household food security of urban households. This is because the South African food database comprises 1472 food items, yet, only 21 food items from 12 species of indigenous crops are part of the food system. This implies that ILVs are less available in the market where they can be easily accessible by urban consumers who largely depend on the market to access food. Akinola et al (2020) stated that many ILVs like brassica are unfamiliar. As a result, they are classified as underutilized leafy vegetables. This implies that their contribution to household food security is minimal. However, Mayekiso (2021), stated that these leafy vegetables have a significant contribution to the household food security of the rural poor. This is because ILVs are readily available and easily accessible in rural communities and are largely used by rural consumers for medicinal and nutritional purposes. These findings are somehow in line with that of Mavhengama (2013) who stated that these leafy vegetables can be used to address household food security problems. Since they are easily available, accessible, and also comprise of a diverse set of leafy vegetables with high levels of nutrients.

2.13. Description of the analytical techniques of the study

The seemingly unrelated regression model

A single equation sometimes contains many linear equations. In such a model, it is often unrealistic to anticipate that the equation errors would be uncorrelated. A set of equations are a contemporaneous cross-equation error correlation. This is referred to as a seemingly unrelated regression (SUR) system. Quansah (2020) employed this model to understand pre- and post-harvest practices of leafy green vegetables in Accra, Ghana. In the study, 102 farmers from 12 farming areas were selected to identify and understand their pre- and post-farming practices of their leafy green vegetables. Semi-structured questionnaires were disseminated among farmers from different farming areas to obtain information on pre- and post-harvest practices of leafy green vegetables. The results from the model revealed that farmers who are uneducated, lack knowledge about food safety and have been planting leafy greens on their farmlands were likely to produce fecal coliform as opposed to other educated farmers. The results further showed that some of the uneducated farmers disagreed that irrigating their leafy green vegetables with polluted water can lead to sickness in consumers of these vegetables.

Ayanwale et al. (2016) also analysed household demand for underutilized indigenous leafy vegetables using SERM. The results from the model indicated that fluted pumpkin, English spinach, and garden egg were related to the age of the household head. Additionally, the results further revealed that garden egg increases as age increases while demand for the garden egg was lower. Wilde et al. (1999) employed a maximum likelihood estimator to integrate the seemingly unrelated regression model and one-way error component model on Food Guide Pyramid servings data that measured the impact income has on food intake. Participation in the food stamp program is related to a higher intake of meats, total fats, and added sugars while women, infants, and children are related to a lower intake of added sugars.

The endogenous switching regression model

Endogenous switching regression models are the natural extensions of classical experimental designs, that enable researchers to run tests of assumptions about the homogeneity of treatment effects from survey data. Endogenous switching regression applications are pervasive in the econometric literature and are widely used by sociologists in recent years (Power, 1993). A study by Krause et al. (2019) investigated the welfare and food security effect on the commercialization of indigenous leafy vegetables. The analysis was conducted on 706 rural and peri-urban small-scale farmers who produce these leafy vegetables. The results from the endogenous switching regression model revealed that education, access to the market, distance to the city, and irrigation water influenced farmers' decisions to commercialize ILVs produced in their farms.

Adewusi et al. (2010) employed this model to gain insight into the livelihoods of farmers residing in Nigeria- Canada, and the production of Indigenous leafy vegetables by farmers residing around these two countries. In the study, 222 vegetables farmers were chosen to participate in the survey. The results from the endogenous switching regression model revealed that the model accounted for the heterogeneity of the decision to participate or not, and for unobservable characteristics of farmers and their farms. The study also concluded that the livelihoods of farmers were negative. It further suggested that the project could have had a positive impact on the livelihoods of farmers. If household characteristics were taken into consideration during the implementation of the project.

Tanimonure et al. (2021) used this model to examine the impact of climate change adaptation strategies on underutilized indigenous leafy vegetables. The adopter and non-adopters farmers

of the adaptation strategies were chosen to get a comprehensive understanding of the adoption of the climate change adaptation strategies. 192 farmers of underutilized leafy vegetables were selected to participate in the survey. In this study, the endogenous switching regression model was used to estimate the effect of climate change adaptation strategies on farmers of these leafy vegetables. The results from the model revealed that farmers' perception of climate change showed high temperature and high variability in rainfall patterns.

Household food insecurity access scale

The household food insecurity access scale was developed to deal with complexities emanating from food insecurity issues (Coates, 2004; Coates, Swindale, & Bilinsky, 2007 Bilinsky & Swindale, 2010). This indicator consists of nine food security-related questions. These questions are grouped into three categories. The first category looks at the anxiety and uncertainty of food supply, while the second category of questions looks at the insufficient quality of food (food variety and preferred items). The last set of questions is about the impact of food deficiencies (insufficient food intake and its physical consequences).

HFIAS tool is a subjective rural appraisal tool that looks at respondents' perceptions of their household food security based on the food consumed in the four previous weeks(Headey & Ecker, 2013). A study by Mayekiso et al., (2017) employed the HFIAS indicator to get insight into the rural household food insecurity status of indigenous leafy vegetable producers. In the study, 238 respondents with a mean household age ranging from 45-56 years old. The results from the HFIAS revealed that the participants on HFIAS were 10.7 while non-participants were 13.6. This implies that ILVs participants were less food insecure than non-participants. This suggests that both groups experienced moderate food insecurity.

Ndobo et al. (2013) employed this indicator to determine the extent to which food insecurity prevails in households of South African townships. The results showed that 49% of the households were vulnerable to food insecurity and that females were significantly affected by food insecurity. Matebeni (2018) also employed HFIAS to measure food insecurity in the Nkonkobe local municipality of Eastern Cape, South Africa. The results from the HFIAS revealed that most of the respondents were food insecure. Since 31 households were food insecure, 14 of them were moderately food insecure, and 8 of the households interviewed were

food secure. The study concluded that food insecurity is prevalent in this area, and programs must be developed to help them fight hunger and food insecurity prevailing in the area.

2.14. Conceptual framework of the study

The concept employed in this study is developed on the consumption of ILVs and their impact on household food security. The framework further explains the impact of ILVs on household food security if they are accepted, produced, and consumed by both rural and urban people. In a nutshell, the concept explains the benefits and outcomes of the potential contribution of ILVs on its consumers and smallholder farmers. The concept further outlines other factors other than the consumption of ILVs that affect the production and consumption of these leafy vegetables. This includes the livelihoods assets that may affect the production and consumption of ILVs. In the conceptual framework, the improvement of the livelihoods assets results in sustainable livelihoods of smallholder farmers who produce these leafy vegetables. Figure 2.1 below shows a relationship between consumer acceptance, ILVs consumption, household food security, and its effect on the livelihoods of farmers.

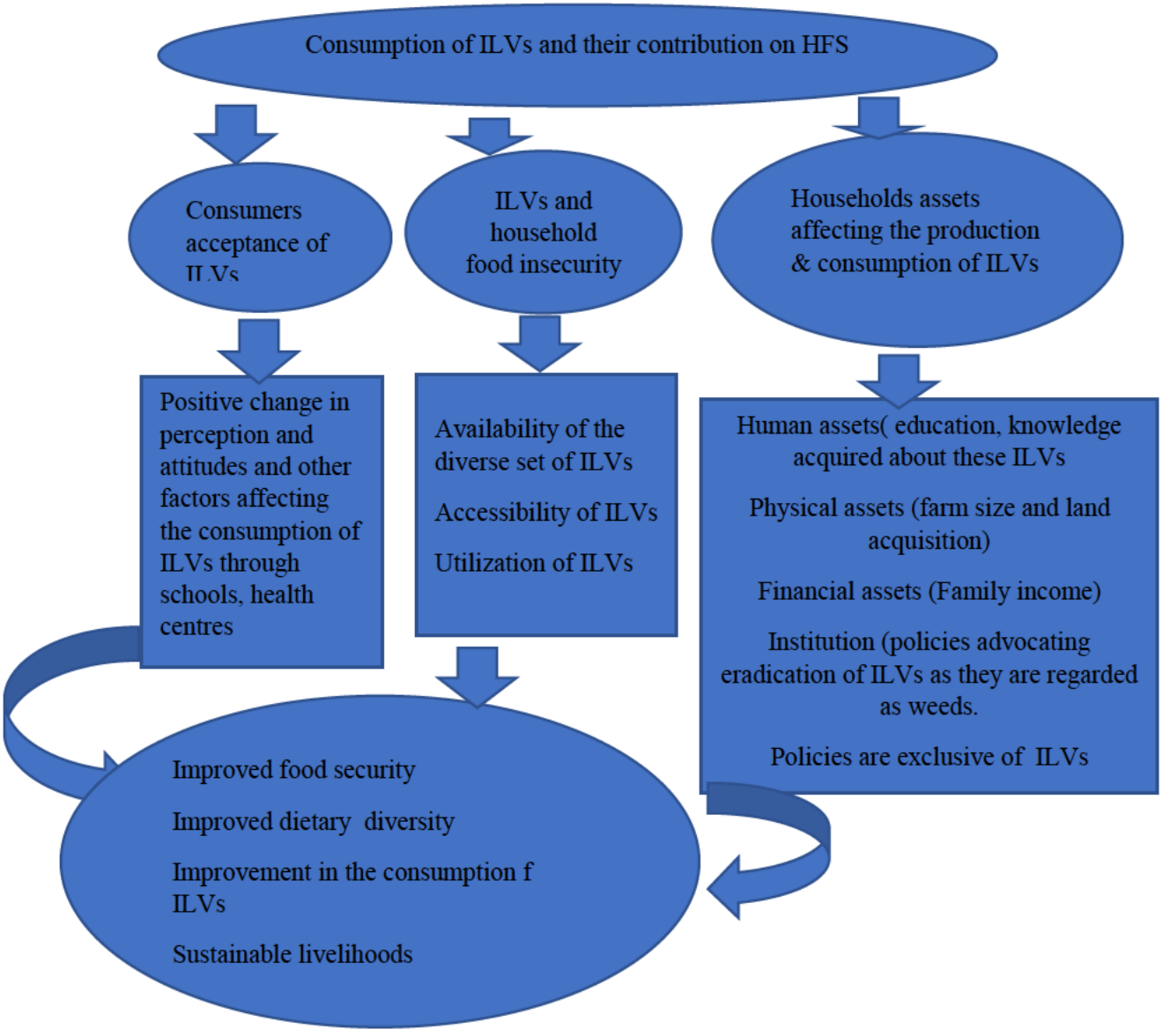

Figure 2.1: Conceptual framework for consumers' acceptance of Indigenous leafy vegetables and their contribution on household food security.

Source: Adapted from (Mavengahama et al., 2013)

To address the first objective, a seemingly unrelated regression model was used to analyze the determinants of consumers' acceptance of indigenous leafy vegetables. Seemingly unrelated regression models comprise of different individual relationships linked because their disturbances are correlated. This method is more efficient compared to other independent equation solution methods because it consists of contemporaneous correlation that prevents solution methods such as multiple regression models from simultaneous bias (Zellner, 1962). The advantage of using this model is that it enables a researcher to analyze multiple variables simultaneously.

To achieve the second objective, the endogenous switching regression model was used to analyze the acceptance of ILVs and their impact on household food security. In this instance, the model helped to identify food secure and food insecure individuals, producers, and nonproducers of ILVs. In this method there are two stages: The first one is about adoption behaviour with the limited-dependent variable method (Tanimonure et al., 2021). The second stage, on the other hand, estimates decision variables separately for each group e.g., producers/nonproducers of ILVs. As for the second objective, the household food insecurity access scale was used on top of the ESRM to determine household food security.

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CHAPTER 3

MATERIALS AND METHOD.

3.0 Introduction

This chapter focus on the study area, data collection and analysis methods employed in the study to turn raw data into something meaningful. At the beginning of this chapter, the study describes the study areas (Limpopo and Mpumalanga Provinces) where data was collected.

3.1 Description of the study area

The study was carried out in two out of nine provinces of South Africa, Limpopo, and Mpumalanga. These provinces were selected for the study because they consist of smallholder farmers who are heavily involved in the production of indigenous crops. These provinces consist of smallholder communal farmers who depend on agriculture and livestock farming as their livelihood source. Limpopo is located in the Northern part of South Africa, covering 125 754km2 of the area, which is 10, 2% of the total area of the country. Limpopo consists of several ethnic groups distinguished by race, language and culture: Sepedi (57%), Tsonga (23%), Venda (12%), Afrikaners (2.6%) and the English (1/2%). This province consists of 5, 8 million population situated in 5 districts known as Mopani, Vhembe, Capricorn, Waterberg, and Sekhukhune (Mamponga et al., 2021).

Mpumalanga province consists of different ethnic groups distinguished by culture and language: Siswati (27.67%), Zulu (24.14%), Xitsonga (10.42%), Isindebele (10.10%), Afrikaans (7.24%), Sesotho (3.47%) and English (3.12%) These are the districts where the data collection for the study was carried out as people in these areas are heavily reliant on agriculture. This is also evident in that 89% of the population in this province works within the agricultural sector. Mpumalanga is one of the provinces heavily reliant on agriculture as it produces a wide variety of fruits, vegetables, cereals, tea, and sugar. The production of these crops plays a significant role in the economic growth and development of Limpopo province (Hlatshwayo et al, 2021). It also comprises 167 existing irrigation schemes with small-scale farmers operating on these schemes. These small-scale irrigation schemes have about 10150 farmers with an average individual land holding of about 1.5 hectares per farmer.

Mpumalanga province is formerly known as Eastern Transvaal. This province is located in the northeastern part of South Africa. It is bounded by Limpopo province to the North and

Swaziland to the east of KwaZulu Natal. It covers about 6,5 % of the country's land area. It also consists of a 4, 04 million population where 72 % of the population is heavily involved in agriculture (Mamponga et al., 2021). The overall rainfall received by Mpumalanga is 1,000mm annually and also experiences warm weather conditions as it is 665 above sea level. It also produces indigenous crops such as amaranth, cowpea, African eggplant, okra, and pumpkin. The other foods farmers produce in Mpumalanga include corn, sugar, cotton, groundnuts, potatoes, other vegetables, and a wide variety of fruits, including oranges and mangoes in the subtropical Lowveld and peaches in higher elevations. Mpumalanga is also involved in the production of dairy cattle, beef, and wool production.

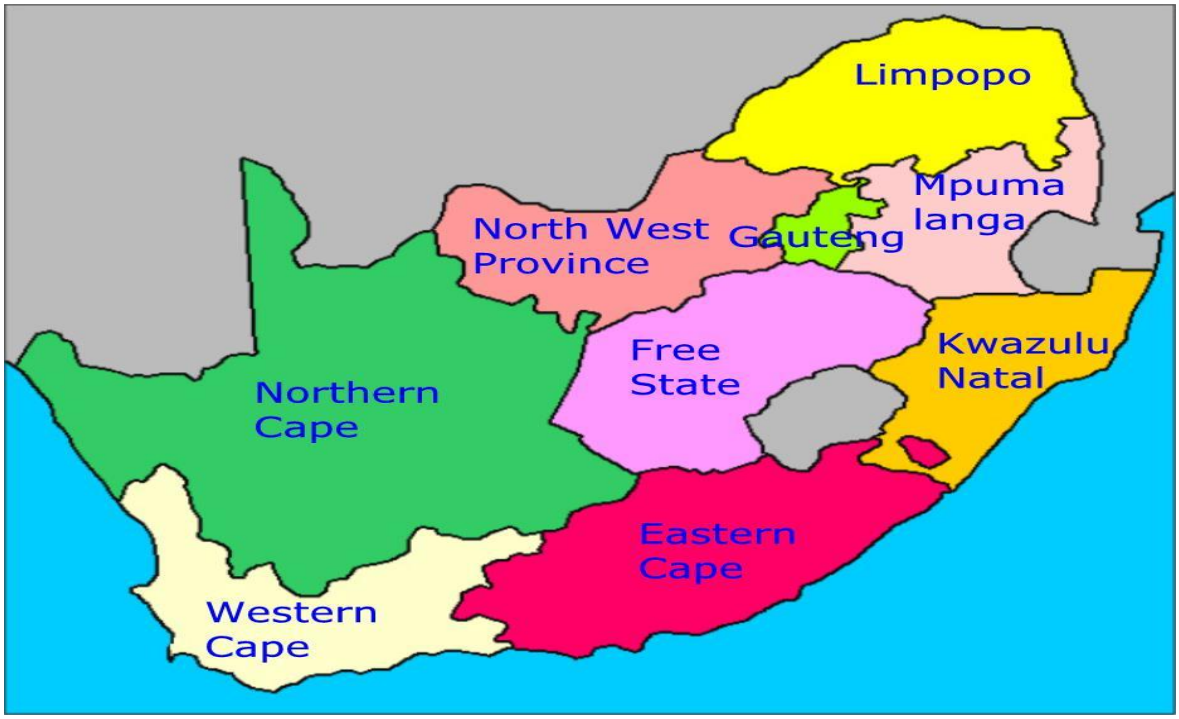

Figure 3.1: Map of South African provinces. Source: http://www.southafrica.to/provinces/provinces.php

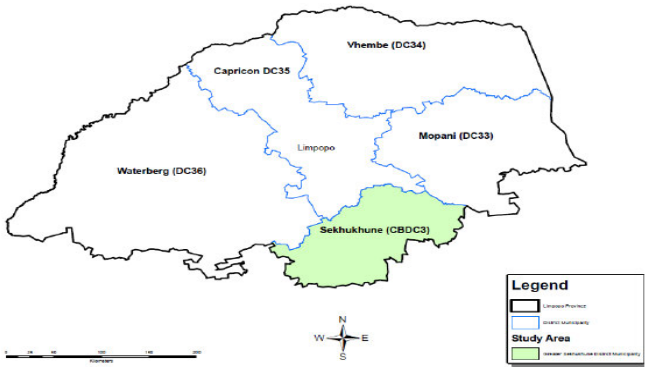

Figure 3.2: Map of Limpopo province. Source: http: www.vhembe.gov.za/district/location

Figure 3.3: Map of Mpumalanga province. Source: https://dermacation.org.za/Retrieved 13 /01/2020

3.2 Data collection method, source and technique

The study constitutes of quantitative method. In this regard, it will quantify behaviours, attitudes and other variables that will determine the extent to which ILVs contribute to household food security. This information is of paramount importance as it provides insight and understanding of the problem outlined in this proposal. The quantitative method is employed to, in this instance, collect data on key food and nutrition security indicators. A multistage stratified sampling technique was used to select the participants for the study. It also enables individuals in the population to have equal chances of being selected to participate in the study. This method increases the trustworthiness of match rate estimates, is inexpensive, and is quite easy to implement. It also allows a large sampling of the population, which helps researchers to draw an accurate conclusion about the study whereas small sampling produces less accurate results which then lead to the wrong conclusion being made about that particular population (Mertens, 2003). This technique also divides the population into homogenous, mutually exclusive strata. In this study, a multistage stratified sampling method was employed to divide farmers based on the similar characteristics they share such as socioeconomic factors, household size, institutional factors, and sales. The total number of respondents chosen during the research in Limpopo and Mpumalanga provinces was 1520, of which 392 were involved in producing ILV crops.

The study used secondary data that was collected by the South African Vulnerability Assessment Committee (SAVAC) in 2016 through the use of questionnaires (Appendix A). This secondary data comprised of demographics of the farmers such as crops (indigenous and cash crops) produced and consumed by rural households, their food security status and nutrition information. However, the purpose of the study was to analyse the determinants of ILVs acceptance and the impact they have on household food security. The list of indigenous leafy vegetables produced and consumed in the study areas was identified by the respondents (Table 3.1.). Although the study used secondary data collected 5 years ago, it is still relevant since there is no recent dataset that aggregates data on household food security. This implies that this dataset could still be used by policy-makers to influence food and nutrition policies to be more inclusive of indigenous leafy vegetables and smallholder farmers who produce them. The permission to use the dataset was granted by SAVAC (Appendix B) suggesting government willingness to see the data being used to help inform better agricultural programs based on evidence.

Table 3.1: showing ILVs produced and consumed in Limpopo and Mpumalanga provinces

Indigenous leafy vegetables	Scientific names
Amaranth, pigweed	*Amaranthus species*
Spider plant	*Cleome gynandra*
Gushe	*Spider plant*
Kale	*Brasica caritana*
Night shade	*Solanum refroflexum*
Traditional pumpkin	*Curcubuta spp*
Cow pea	*Vigna unguicalata*
Blackjack	*Bidens Pilosa*
Cleome	*Spider flower*

3.3 Data analysis

In this regard, the quantitative method used different analytical strategies to analyse data. Descriptive statistics such as mean and standard deviation were used to analyze the socio-demographic factors of the respondents (Kumar, 2018). The collected data validated the sub-objectives, confirm, and disconfirm proposed research questions as well as the hypothesis. As for sub-objectives 1 and 2, the descriptive analysis tool and a seemingly unrelated regression model was used to analyse the determinants of ILVs consumption. While sub-objective 3 was analysed using the descriptive statistics, household food insecurity access scale, and the endogenous switching regression model and where respondents were classified as food secure and food insecure to determine the food security status of a household. Thereafter, the researcher turned raw numbers into meaningful data through the application of rational and critical thinking (Cresswell, 2003). Data collected was ultimately analysed in a statistical manner using a software program known as Statistical Package for Social Science (SPSS).

3.4 References

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CHAPTER 4

DETERMINANTS OF CONSUMERS' ACCEPTANCE OF INDIGENOUS LEAFY VEGETABLES

4.1. Introduction

Agriculture in Southern Africa is one of the most critical sectors of economic development. In this region, agriculture is responsible for economic growth since it contributes to the GDP of most African countries. This is evident in that the agricultural sector in South Africa accounts for around 2.3% of the country's GDP, 40% of export earnings, and 4.6% of employment in the country (Baiphethi & Jacobs, 2009). In South Africa, Statistics South Africa reported that 13.8% of the households are heavily reliant on agriculture to improve their livelihoods, many of them situated in rural areas (Baiphethi & Jacobs, 2009). Yeboah and Jayne (2015) further pointed out that agriculture is the main source of livelihood for more than two-thirds of the population. Therefore, it is without a doubt that agriculture is the most powerful tool for eradicating hunger and unemployment, especially in rural areas.

However, the findings of the South African National Health Examination Survey reported that only 45,6% of South Africans are food secure. The findings of the study further reported that food insecurity is found to be more prevalent in rural areas (37%) than urban areas (32,4%) (Van Pittius et al., 2016). In addressing the issue of food insecurity. Mbhenyane (2017), stated that policies on food and nutrition security propose the promotion of indigenous leafy vegetable that contains more micronutrients such as amaranth and cleome than conventional vegetables (cabbage and lettuce). However, these policies are not proactive in ensuring that indigenous leafy vegetables contribute to household food and nutrition security and form part of a formal market. This is because their focus is on cash crops than indigenous leafy vegetables (Mahlangu, 2014). Therefore, the potential of ILVs to contribute to food and nutrition security is minimized and overlooked by food and nutrition policies.

These policies indirectly resulted in less consumption of these plants especially urban people who rarely produce ILVs. Therefore, it is crucial to promote the consumption of these plants as they serve as a good source of micronutrients such as vitamin A, C, iron, zinc, and magnesium (Cloate & Idsardi, 2013). They also contain significant levels of micronutrients that are essential for health such as Amaranth. However, these leafy vegetables are less available in the market. Their less availability in the market has proliferated micronutrient

deficiency diseases and disorders such as obesity, diabetes, and stunted growth in children (Mbhenyane, 2017).

The less availability of ILVs in the market also led to the questionable acceptance of these plants by people. As authors have reported that some people consider them as old-fashioned food, poor people's food, food for animals, unhygienic foods, regard them as weeds and as food-related to the concept of social backwardness (Van der Hoeven et al., 2013). These negative perceptions of people towards ILVs have limited the exposure of these plants which then minimize their contribution to household food security. On top of that, little research has been carried out especially on the factors determining the acceptance of indigenous leafy vegetables (Van der Hoeven et al., 2013).

This study sought to close the gap between the availability of indigenous leafy vegetables and exotic cash crops. It will do so by providing insight to policymakers that their policies are not in favour of indigenous leafy vegetables. Thereafter, they will review their existing policies on ILVs and raise awareness. This will not only increase their availability in the market but will also increase opportunities for the use of indigenous leafy vegetables. Furthermore, their availability in the market will help consumers to get rid of negative critics that people hold against these leafy vegetables such as old-fashioned food, poor people's food, food for animals, unhygienic foods since it grows in the wild (Gido et al., 2017). Therefore, it is against this backdrop that this study sought to analyse the determinants of consumers' acceptance of indigenous leafy vegetables in the study area.

4.2. Methods and materials

4.2.1. Study area, methods of data collection and sampling methods.

This information is covered in chapter 3.

4.3. Conceptual framework

The determinants of indigenous leafy vegetables were modelled using the Seemingly Unrelated Regression (SUR) model which assumes that the error terms between components are expected to be correlated. This model is an efficient estimator of coefficients compared with Ordinal Least Square (OLS) especially when the error terms between equations are correlated. SUR model estimates more than two equations simultaneously. The parameters of each equation take the information provided by the other equation into account (Maponya et al., 2021). This

model is employed in this study because when interdependence between dependent variables was assumed, the common underlying determinants were well estimated using simultaneous equations of SUR model.

Furthermore, this model was employed in the study because of its three main advantages, firstly, it was used to gain efficiency in estimation by combining information on different equations. Secondly, it imposes test restrictions that involve parameters in indifferent equations. Thirdly, it leads to improved tests of the hypothesis of regression coefficient and other parametric values (Maponya et al., 2021). This model has been used by scholars such as (Akinola et al 2020; Mabhaudi et al, 2017, Mavhengama et al, 2013; Cloate & Idsardi, 2013) to determine the production and utilization level of indigenous leafy vegetables.

With respect to the study, demographic factors and socio-economic factors were modelled to attain a comprehensive understanding of the extent to which different variables have affected the acceptance of these leafy vegetables. Furthermore, consumers' determinants of indigenous leafy vegetables are multidimensional, their acceptance relies on a combination of characteristics such as household size, gender of the household head, education level, main economic activity, wage/salary, HIV status, social grants and irrigation type. Therefore, SUR was seen as an ideal model to analyse the study.

This model was developed by Zellner in 1962 to estimate models with p > 1 dependent variable that allows for different regressor matrices in each equation (e.g. Xi≠Xj) and account for contemporaneous correlation, i.e. E(εitεjt) ≠0. The SUR model simplifies the notation by stacking all equations into one equation:

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_p \end{bmatrix} = \begin{bmatrix} X_1 & 0 & 0 & 0 \\ 0 & X_2 & 0 & 0 \\ 0 & 0 & \ddots & 0 \\ 0 & 0 & 0 & X_p \end{bmatrix} + \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_p \end{bmatrix} \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_p \end{bmatrix}$$

That can be written as $y = x\beta + \varepsilon$, where the $Y = (y_1^{'}, y_2^{'}, ..., y_p)'$ is a vector of all stacked dependent variables, X is a block diagonal design matrix with the i[th] design on ii[th] block, where $\beta = (\beta_1^{'} \beta_{2,}^{'} , \beta_p^{'})'$ is the vector of the stacked coefficient vectors of all equations, the total number of parameters estimated for all P sub models is $\Sigma_i^p =_1 K_i$ and $\varepsilon = (\varepsilon_1^{'} \varepsilon_2^{'}, ..., \varepsilon_p^{'})'$ is the vector of the stacked error vectors of all equations.

The same estimates by separate single-equation Ordinal Least Squares estimations can be obtained by an OLS estimation of the entire system of equations, i.e., $\beta^{OLS} = (X^{'}X)^{-1}X'y)$ .The SUR estimator that accounts for interrelations between the single sub models can be obtained by $\beta^{SUR} = [\overset{'}{X}\,\Omega^{-1}X]\,[\overset{'}{X}\,\Omega^{-1}Y]$ where Ω^{-1} is a weighting matrix based on the covariance matrix of the error terms Σ.This This covariance matrix $\Sigma = [\sigma_i j]$ has the elements $\sigma ij = E(\varepsilon_{in}\varepsilon_{jn})$ where

ε_{in} is the error term of the nth observation of the ith equation. Finally, the inverse of the weighting matrix can be calculated by $\Omega = \Sigma \otimes I_N$ where I_N is an N × N identity matrix and $\otimes$ denotes the Kronecker product. However, as the true error terms ε are unknown, they are often replaced by observed residuals, e.g. obtained from OLS estimates, i.e $y_i = x_1\beta_i^{OLS}$ so that the elements of the covariance matrix can be calculated by

$$\hat{\sigma} ij = \frac{\hat{\varepsilon}_i \hat{\varepsilon}_j}{N}$$

As a result, SUR model is an application of the generalized least squares (GLS) approach and the unknown residual covariance matrix is estimated from the data (Mdluli, 2013).

Table 4.1: Definitions and summary statistics of variables used in the SUR model

Variable name	Variable definition
Age	Age of the household member
Gender	Gender of the household head
Marriage	Marital status of the household head
Hh size	Number of the family members
Level of education	Level of education of the head
HIV status	HIV status of the household head
Grants	if the household receive social grants

4.4. Results and discussion

4.4.1. Descriptive statistics

4.4.1.1. Demographic and Socioeconomic Characteristics of Farm Household

The descriptive statistics results in Table 4.2 for the socioeconomic and demographic characteristics of Indigenous Leafy Vegetables (ILVs) reported that there were 392 crop producers and 1128 non-crop producers. These results show that indigenous leafy vegetable producers were low when compared to non-crop producers. This is because ILVs have been replaced by major cash crops that do not require much time to cook. Hence, the producers of ILVs were few when compared to that of non-crop producers.

Table 4.2: Results of crop and non-crop producers

Variables	%	Freq
Crop production of Indigenous leafy vegetables		
crop producers	25	392
Non- crop producers	75	1128
Overall	100	1520

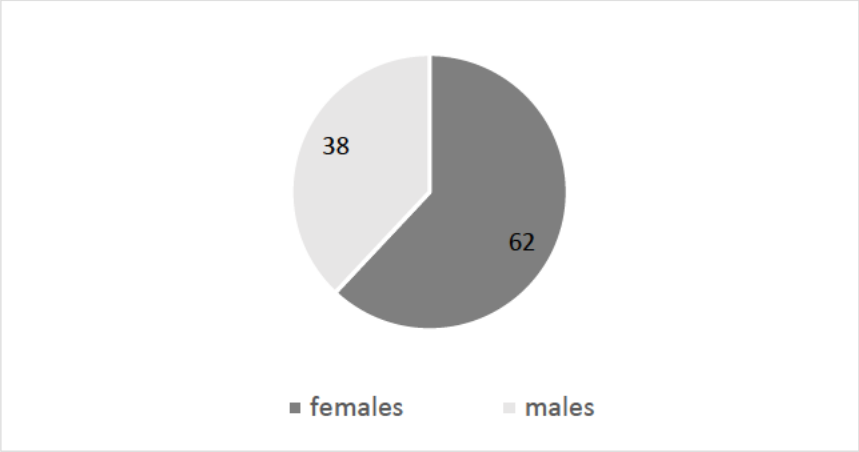

Figure 4.1: Pie chart showing the gender of ILVs consumers

Figure 4.1 reveals that 62% of these leafy vegetable consumers were females while 38% were males. The logical explanation for this could be that females are the ones with a wealth of knowledge about the preparation, cooking, and storage of indigenous leafy vegetables while males don't know much about them. Males prefer foods that require less time to cook.

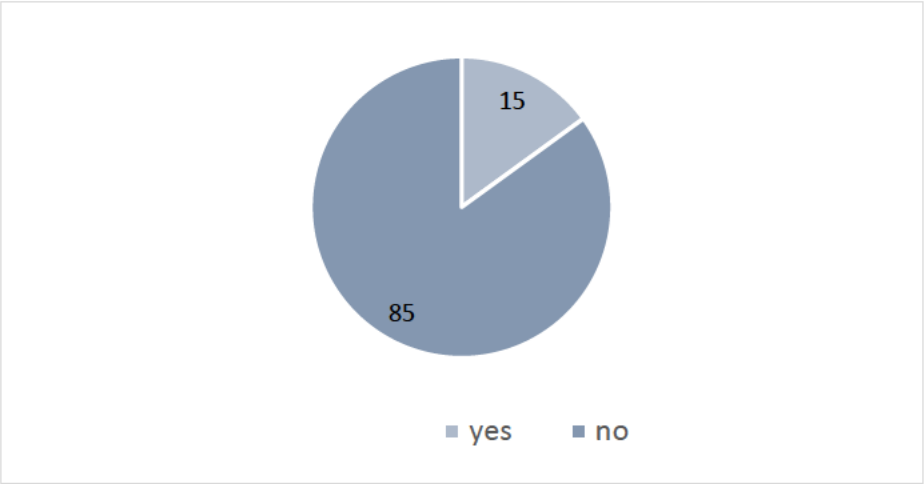

Figure 4.2: Pie chart showing access to the market of indigenous leafy vegetables

Source: Authors own analysis

Figure 4.2 shows that 15% of consumers of ILVs had access to the market information while 85% did not have access to market information. This implies that a large number of ILVs consumers don't have access to market information. Hence, they often produce ILVs for their own consumption. The other reason is that ILVs are often sold by vendors who form part of informal markets where there is no straightforward, succinct knowledge about market access information of ILVs consumers

Table 4.3: Socio demographic and socio-economic characteristics of ILVs consumers

Demographic characteristics of ILVs consumers in Limpopo and Mpumalanga provinces	Indigenous leafy vegetables consumption /production	Mean	F	Df	Sig.
Age of household head	Yes	1.24	1.009	129	0.317
	No	1.29		21.62	

Education of household head	Yes	35.36	0.000	102	0.989
	No	34.41		17.14	
Total output of crop (KG)	Yes	2242.60	25.622	818	
	No	717,17		134	0.000

Table 4.3 shows the demographic information of ILVs consumers in the Limpopo and Mpumalanga provinces. This Table shows that the mean age of ILVs consumers was 1.24 while for non-consumers of ILVs was 1.29. As for education, it was found to be statistically significant at 5%. The mean number of years spent by consumers at schools is 35.36 while spent by non-consumers of ILVs is 33.41. This simply means that ILVs consumers are more educated than non-consumers of these crops. The total output of crop production of these leafy vegetables was 2242,64kg while for non-consumers of ILVs was 717 kg. This means that the total output of ILVs was more than that of other crops. The possible explanation could be that they are easily available as they grow in the wild and uncultivated areas. Hence, their yield is high.

Table 4.4: Determinants of consumer acceptance of indigenous leafy vegetables: Seemingly unrelated regression model

	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z
Indigenous Vegetables		**Amaranth**			**Cleome**			**Blackjack**	
Household size	-0.007	0.005	0.130	0.004	0.002	0.055*	0.003	0.002	0.134
Gender of the HH member	0.129	0.064	0.044**	-0.091	0.029	0.002**	-0.063	0.031	0.042**
Age of the HH member	0.001	0.001	0.231	-0.001	0.000	0.153	0.000	0.000	0.734
If the HH resides in rural/urban	0.038	0.161	0.815	0.017	0.074	0.818	0.187	0.077	0.015**
Education of the HH member	-0.063	0.177	0.721	-0.073	0.082	0.369	-0.355	0.085	0.000**
Marital status of the HH member	0.075	0.147	0.613	0.607	0.068	0.000**	-0.071	0.071	0.314
Main economic activity	-0.046	0.074	0.532	-0.005	0.034	0.889	-0.091	0.035	0.010**
If member worked for a wage salary	0.254	0.131	0.053*	0.040	0.061	0.514	-0.005	0.063	0.931
If a member is informed about their HIV	-0.049	0.137	0.718	-0.008	0.063	0.899	-0.143	0.066	0.030**
If a member receives social grant	0.142	0.125	0.253	0.016	0.058	0.783	-0.121	0.060	0.043**
GRANTS	-0.167	0.070	0.017**	0.087	0.032	0.008**	0.234	0.034	0.000**
WEATHINDEX	0.078	0.054	0.149	-0.031	0.025	0.220	-0.005	0.026	0.843
Irrigation type	-0.052	0.111	0.636	0.031	0.051	0.544	0.236	0.053	0.000**
_cons	0.334	0.229	0.145	0.294	0.106	0.006**	0.900	0.110	0.000**
Equation	O bs	Parms	RMSE	R-sq	chi2	P-value			
Amaranth	1,427	13	0.48147	0.013	19.9	0.0977*			
Cleome	1,427	13	0.22256	0.786	5239.79	0.000**			
Blackjack	1,427	13	0.23164	0.768	4742.47	0.000**			

4.5. Discussion

Determinants of consumers' acceptance of indigenous leafy vegetables

As evident by the non-zero cross-correlation coefficients of the estimated equations' error terms, the use of Seemingly Unrelated Regression (SUR) is more suitable for estimating the three equations than estimating each of the equations independently. The results of the seemingly unrelated regression model revealed that different factors affected the acceptance of indigenous leafy vegetables. The hypothesized and tested independent variables were included in the model as shown in Table 4.4.

The three indigenous leafy vegetables (amaranth, cleome, and blackjack) variables had a mixture of negative and positive coefficients. However, blackjack had more negative coefficients in all the variables measured than other leafy vegetables (amaranth and cleome). This implies that the acceptance of blackjack is low when compared to that of other leafy vegetables in the study. Furthermore, this might have been proliferated by the fact that this crop has a bitter taste. Hence, consumers prefer other leafy vegetables other than blackjack. Mabhaudi et al. (2016) identified blackjack to be among the underutilized indigenous leafy vegetables in South Africa whose acceptance among the society needs to be promoted through research and policy interventions.

Education had a negative effect on the acceptance of indigenous leafy vegetables (amaranth, cleome, and blackjack) and was statistically significant at 5%. This implies that as the household members become more educated, their food preferences tend to change and, in most cases, they draw towards fast foods which they deem as appetizing. Similarly, Ayanwale et al. (2016) found education to have a negative effect on the acceptance of ILVs. The findings of the study concluded that people tend to change their food preferences as they become more educated, as a result, they consume less of ILVs as they are deemed as poor people's food. These findings are contrary to that of Sanlier & Karakus (2010), who found that educated people are adopting these leafy vegetables since they are aware of the benefits they have on their health.

Household size for amaranth had a negative effect on consumers' acceptance of this crop and was statistically significant. This is because as the household size increases, the household members may be reluctant to diversify the crops that they consume. They may decide to stick with major stable crops than indigenous leafy vegetables since people dislike them especially

young people. This is in line with Ayanwale, et al. (2016) who found that when household member purchases vegetables, they consider those that would meet the preference of most household members. Therefore, only a few members of the household are likely to accept ILVs for consumption. Gido et al. (2017) on the contrary stated that less consumption of these leafy vegetables is exacerbated by the fact that more time is required to pluck sufficient quantities of leaves from ILVs stalks in readiness for cooking, thereby reducing consumption intensity in large households due to the tedious process of vegetable preparation.

The gender of the household was positively correlated to the acceptance of indigenous leafy vegetables (amaranth) and was statistically significant at 5%. The increase in the acceptance of this crop was triggered by females who have a wealth of knowledge about the preparation, cooking, and storage of these crops. While, males, on the other hand, may decide whether ILVs are for their consumption or commercial purposes. This is in line with Gido et al. (2017) who found that urban males and rural young people resent indigenous leafy vegetables because they lack knowledge about the preparation and cooking techniques of these leafy vegetables. As pointed out by Voster et al. (2008) that females are more fond of these leafy vegetables than their male counterparts. Cleome, on the other hand, had a negative coefficient. The possible explanation is that cleome grows naturally in the wild, therefore, it is possible that most people regard it as a weed especially males who are particularly not fond of ILVs.

Although household age revealed that there was no statically significant for these leafy vegetables, there was a positive correlation between age and the acceptance of (amaranth and blackjack). This implies that as household members age increases, they tend to become fonder of these leafy vegetables especially because of the nutritional benefits attached to them. These findings are similar to that of Ayanwale, et al. (2016) which stated that rural elderly people were more likely to accept amaranth due to that there are familiar with cooking and preparation techniques and nutritional benefits attached to ILVs. Taleni & Goduka (2013) stated that young people resent ILVs just because their taste buds get replaced as they grow. Ayanwale et al. (2016) on the contrary, stated that a majority of ILVs consumers were relatively young people and indicated that factors that encouraged young people to consume ILVs must be investigated.

Results revealed that having a member in the household that is HIV positive had a negative effect on the acceptance of all leafy vegetables being analysed (amaranth, cleome, and blackjack) and were statistically significant at 5%. This means that HIV-positive consumers may not have enough time to prepare and cook ILVs. Therefore, they choose other crops that

take less time to cook as they may have other commitments such as exercising and having a doctor's appointment. These findings are in line with that of Ruel et al. (2005) who found that there is a perception that more time is required to prepare and cook indigenous leafy vegetables. However, Van der Lans, et al. (2012) findings begged to differ as they stated that low-income consumers who might be HIV positive and poor at the same time regard them as luxurious foods.

Wages/ salary was found to be positively correlated to the acceptance of indigenous leafy vegetables and were all statistically significant at 10%. This means that as the wage or salary increases also the acceptance of indigenous leafy vegetables increases. This is most likely to happen in urban areas where household members do not have sufficient space to practice subsistence farming, therefore, they often buy them from vendors. These findings were found to be contrary to that of Gido et al. (2017) who stated that as the urban consumers' salary increases, the consumption of ILVs decreases as consumers may prefer to buy conventional vegetables in the market such as lettuce, cucumber and spinach since they do not demand much time to prepare and cook.

4.6. Conclusion and Recommendations

The consumption of indigenous leafy vegetables can play a significant role in households' livelihoods through improving food and nutrition security. The acceptance of ILVs was affected by factors such as education of the household head, gender, main economic activity, ssHIV status, age, grants, and wages or salary. The HIV status and education variables were found to have a negative effect on all leafy vegetables being investigated in the study. The study further found that amaranth and cleome were the most accepted leafy vegetables while blackjack was the least accepted one. These findings show that research and policy intervention as well as extension workers need to educate people about the importance of ILVs and the nutritional benefits attached to them. There is a need to promote the consumption of ILVs through awareness and campaigns. This information must be imparted to young people who resent the bitter taste found in leafy vegetables especially blackjack. Policy makers need to consider the inclusion of ILVs into the school curriculum and national food and nutrition security policy. The HIV positive people should be encouraged to consume these leafy vegetables more so that their immune system can be strengthened

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CHAPTER 5

CONSUMER'S ACCEPTANCE OF ILVS AND THEIR CONTRIBUTION TO HOUSEHOLD FOOD SECURITY

5.1 Introduction

South Africa is one of the countries regarded as food secure at a national level, producing enough food to adequately feed its 53 million population (Crush &Frayne, 2011). However, a relatively large number of people at a household level are food insecure and are living below the poverty line (Gnegne, 2021). This is evident in that a vast number of people at a household level are suffering from malnutrition and hidden hunger. This has resulted in micronutrient deficiency diseases caused by hidden hunger (Faber et al., 2010). According to Uauy et al. (2008) 204 million people were suffering from micronutrient deficiency diseases. Another research conducted by the South African National Health and Nutrition Examination Survey (SANHANES) revealed that in 2013, 26% of the population was facing hidden hunger while 28% was already suffering from micronutrient deficiency diseases (Van der Waals & Laker, 2008). The result from the survey proves that there is a need to address and mitigate the adverse effect micronutrient deficiency diseases have had on people.

Some scholars believe that increase in micronutrient deficiency diseases is due to the drastic change in consumers' food preferences (Matenge et al. 2012; Mavhengama, 2013; and Mbhenyane, 2017). Households nowadays prefer fast foods such as fried chips other than healthy food that could eradicate diseases and enhance the functioning of their bodies (Kruger et al. 2015). Such attitude has exacerbated diseases such as obesity, diabetes, heart diseases, and stunted growth in children. In addressing this issue, scholars such as Mavhengama (2013) & Mbhenyane (2017), reported that African people need to go back to their roots and consume indigenous crops that once played a huge role in their diets in the olden days. World Health Organization (2019), stated that these crops have a high concentration of nutrients required by the body to eradicate micronutrient deficiency diseases, enhance the quality of diets and ultimately improve household food and nutrition security. However, their impact on people's diets is minimal since these crops are less available in the market and undermined by people who perceived them as poor people's food and unhygienic crops that grow in the wild.

Despite the negative critics these plants have received from people over the years. Indigenous Leafy Vegetables such as amaranth, nightshade, spider plants can address micronutrient

deficiency diseases because they have a high concentration of vitamin A, C, calcium, zinc, and iron required by the body for its normal functioning (Sharma et al., 2020). They also have characteristics that make them ideal for future research and investment to fight food insecurity, encourage climate-resilient agriculture, and develop a sustainable food system (Ngenoh et al., 2019). However, despite their perceived benefits, ILVs have been ignored by consumers who have replaced them with exotic crops such as cabbage and kale. On top of that, few of these plants are economically utilized, due to factors such as human perceptions, lack of consumers' awareness about their benefits, and cultural values (Sharma et al., 2020).

Mbhenyane (2017), further reported there is a great potential for the indigenous leafy vegetables to contribute to household food security if these leafy vegetables could be studied more extensively. However, their ability to contribute to household food security is hindered by the fact that they are not part of the food system, as a result, they are less available in the market. In addition, Mavhengama (2019), alluded that the inclusion of ILVs in the market as mainstream foods will increase their acceptance among urban and rural consumers. Many studies were conducted on the consumer acceptance of indigenous leafy vegetables. This includes studies such as van der Hoeven et al. (2013); Matenge et al. (2012); Gido et al. (2017). On the other hand, other scholars such as Shayanowako et al. 2021; Mwadzingeni et al. (2021), Hlatshwayo et al. (2021) & Raheem et al. (2021) have investigated the contribution of indigenous leafy vegetables to household food security. This implies that there is a knowledge gap in studies that links the two topics. Therefore, it is against this backdrop that the study seeks to assess the effect of the consumer's acceptance of indigenous leafy vegetables as well as their contribution to household food security.

5.2. Materials and Methods

5.2.1. study area, methods of data collection and sampling methods

This information has been covered in chapter 3

5.3. Conceptual framework

5.3.1. Endogenous switching probit model

The study used an endogenous switching regression model to model the impact of indigenous leafy vegetables on consumers. The contribution of ILVs on household food security is

determined by whether its consumers are food secure or food insecure. Following Lokshin and Sajaia (2004), the equations for the two regimes are presented as follows:

$I^* = aZ + V$ ……. (1)

$y_1 = \beta_1 X_1 + u_1$ if $I = 1$ ……... (2)

$y_0 = \beta_0 X_0 + u_0$ if $I = 0$ …… (3)

Where $y_{1 \text{ and }} y_0$ represents food security and food insecurity of ILVs consumers, I is the latent variable as defined in equation 1, and α, β_1 and β_0 are vectors of the parameters to be estimated. Although Z and X can overlap, at least one variable in Z is required not to be included in X to properly identify the outcome equations. v, u_1, u_0 are error terms assumed to be jointly normally distributed with zero mean vector and the following covariance matrix.

$$\text{cov}(v, u_1, u_0) = \begin{bmatrix} \sigma^2_{u_1} & \sigma u_1 u_0 & \sigma_{u_1} v \\ \sigma u_1 u_0 & \sigma^2_{u_0} & \sigma u_0 v \\ \sigma u_1 v & \sigma u_o v & \sigma^2_v \end{bmatrix} \text{ ……... (4)}$$

Where

$$\text{var } (v) = \sigma^2 v, \text{var}(u_0) = \sigma^2_{u_0}, \text{var}(u_1) = \sigma^2_{u_1}, \text{cov}(u_1 u_0) = \sigma u_1 u_0, \text{cov}(u_{1,} v) = \sigma u_1 v, \textit{and } \text{cov}(u_0 v) = \sigma u_0 v$$

The variance σ^2_v is assumed to be 1, as α can be estimated up to a scale factor (Maddala 1986). In addition, the covariance $\sigma u_1 u_0$ is equal to zero because $y_1 y_0$ are not observed together. (Maddala, 1986) further stated that the characteristics are related to selected bias, the structure of the error terms, *v*, of a selection equation 1is correlated with the error terms u_1 and u_2, of the generated equation 3 and 4 with the expected values of u_1 and u_2 ,being conditional on the sample selection being non-zero.

5.3.2. Household Food Insecurity Access Scale

The other tool used is the Household Food Insecurity Access Scale (HFIAS). This indicator is used to assess whether the households have experience problems with food access in the last 30 days (Becquey et al., 2010). This indicator consists of 9 occurrence questions and nine frequency questions. These questions ask about the changes in household food patterns that may arise because of insufficient access to food (Coates et al., 2006). As a result, HFIAS measures the level of food insecurity during the past 30 days as reported by the household. Then the results are then categorized into food secure, mild food secure, moderate food insecure and severe food insecure (Coates et al., 2006). The generic HFIAS questions help researchers to determine the degree of food insecurity in the household over the past 30 days. The respondent determines whether this never happened, rarely (once or twice), sometimes (3-10 times), or often (more than 10 times) in the past 30 days. Then, the HFIAS score variable is calculated for each household by adding the codes for each frequency of occurrence question. The maximum score for the household is 27 (if the household responds to all the nine occurrence questions was “often”), the minimum score is 0 (Becquey et al., 2010). The higher the score, the higher the food insecurity experienced by the household. The lower the score, the lower the food insecurity faced by the household.

Table 5.1: Definitions and summary statistics of variables used in the endogenous switching probit Model

Variable name	Variable definition
Age	Age of the household member
Gender	Gender of the household head
Marriage head	Marital status of the household
Hh size	Number of the family members
Level of education	Level of education of the head
HIV status	HIV status of the household head
Grants	If the household receive social grant

5.4 Results

5.4.1. Results on the impact of production and consumption of ILVs on household food security.

The descriptive statistics results from Table 5.2 showed that 66 farmers produced and consumed ILVs. The results further revealed that 350 farmers did not produce and consume ILVs. However, those who did not produce ILVs and but consumed them were 1059. The logical explanation for this is that farmers might rely on the market to access ILVs. This is in line with Senyolo et al. (2019) who alluded that ILVs are sold in the informal market. As a result, they are easily accessible to consumers and farmers. These urban farmers focus more on producing staple crops than ILVs. As a result, they might purchase ILVs in the market for consumption purposes than producing them on their farms. However, 45 farmers produced ILVs and did not consume them. This is because the household member may decide to produce ILVs for commercial purposes instead of producing them for consumption purposes. This is somehow in line with Mahlangu et al. (2020) who stated that in some parts of Limpopo, the

ILVs are produced for commercial purposes. After that, they are sold in the market with the price that arranges from R6.00 to R8.00.

Table 5.2: Production and consumption of Indigenous leafy vegetables

		Consumption of Indigenous leafy vegetables		
		Yes	No	Total
Production of Indigenous leafy vegetables	Yes	66	45	111
	No	1059	350	1409
Total		1125	395	1520

Table 5.3: Household Food Insecurity Access Scale survey among smallholder farmers in the 2016/2017 season in Mpumalanga and Limpopo province.

	Last 30 d0ays			
	Never	**Rarely (1 – 2 times)**	**Sometimes (3 – 10 times)**	**Often (more than 10 times)**
Worry about not having enough food	378	488	504	150
Do not eat your kinds of preferred food	216	511	548	182
Limit the diversity/quality of meals	260	517	240	283
Consume some foods that you really did not want to eat	263	513	535	208
Limit eaten food portions	401	516	467	136
Limit the number of meals	452	482	431	153
No food to eat of any kind in your household	866	331	254	69
Go to sleep at night hungry	1132	209	109	70
Go a whole day and night without eating anything	1227	147	94	52

The food security of rural households of Mpumalanga and Limpopo provinces was examined using an HFIAS score indicator. The results from this tool showed that the household response to occurrence questions was often “never” particularly the last two questions that focused on whether the household has gone a day or to bed without eating anything (Table 5.3). This implies that the households in these two provinces are somewhat food secure or experienced mild food insecurity. This is also evident in that a relatively small number of people responded with “often” to the nine occurrence questions of HFIAS. The logical explanation could be that the household members experienced less food insecurity. Some respondents stated that they “rarely” experienced food insecurity. While some respondents mentioned that they “sometimes” encountered food insecurity in their households. In summary, these results show that both provinces Mpumalanga and Limpopo were food secure and experienced a mild food

insecurity. These results are in contrary to that of Chinnakali et al. (2014) who stated that the study found that a total of 77.2% of household were food insecure. However, they are somehow in line with Oldewage-Theron & Egal (2021) who found that the majority of the respondents were food secure 67% and 4% of the respondents experienced a mild food insecurity.

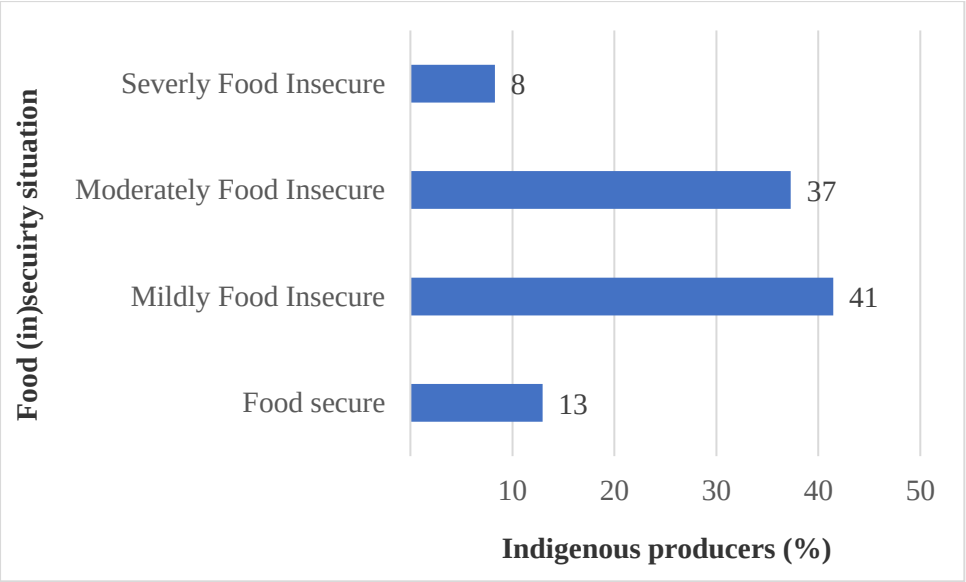

Figure 5.1: The food (in)security situation of the indigenous leafy vegetables' famers

Source: author's analysis

The Household Food Insecurity Access Scale, which is aimed at determining households' access to food, revealed that out of 392 indigenous leafy vegetable farmers, 87% of the households were food insecure and only 13% was food secure, indicating that the majority of the households were experiencing difficulties when it comes to food access while only a few percentages had no difficulties in accessing food. Figure 5.1 showed that when food (in) security is divided into four categories as determined by the HFIAS tool, the majority of the households was mild food insecure, with 41% of the households being found in this category. This was followed by moderately food insecure households, with 37% of the household being in this category. 8% of the households were found to be severely food insecure, indicating minimal access to food of farmers who take part in the survey.

Figure 5.4 impact of ILVs consumption on household food security

	CONSUMPTION OF INDIV			FOOD SECURE			FOOD INSECURE		
INDIVEG	**Coef.**	**Std. Err.**	**P-value**	**Coef.**	**Std. Err.**	**P-value**	**Coef.**	**Std. Err.**	**P-value**
Household member age	-0.003	0.003	0.366	0.001	0.003	0.772	-0.000	0.004	0.924
Household size	0.031	0.018	0.080*	0.052	0.020	0.010**	0.076	0.028	0.007***
Gender of the HH member	-0.146	0.217	0.501	-0.481	0.419	0.252	0.909	0.471	0.054*
If the HH resides in urban/rural	0.218	0.503	0.664	2.665	0.800	0.001***	0.446	2.609	0.864
Education of the HH member	-0.389	0.591	0.511	2.188	1.183	0.064*	1.704	5.804	0.769
Marital status of the household member	0.059	0.775	0.939	4.672	2.073	0.024**	1.770	4.874	0.717
If HH receive agriculture services	-0.361	0.187	0.054*	-1.098	0.334	0.001***	1.184	0.632	0.061*
If HH is involved in livestock production	-0.467	0.569	0.412	16.197	2.836	0.000***	1.609	2.890	0.578
If HH member work for a wage/salary	0.211	0.334	0.528	1.320	0.479	0.006***	1.052	3.335	0.752
WEATHINDEX	0.361	0.189	0.056*	-7.209	1.331	0.000***	-1.372	0.801	0.087*
HH receives government advice	-0.189	0.202	0.348	-0.887	0.360	0.014**	0.558	0.455	0.220
If a disability member receives social grant	1.457	0.820	0.075*	7.833	2.301	0.001***	2.689	10.377	0.796
If HH member know their HIV status	-0.225	0.429	0.601	-2.258	2.082	0.278	5.181	3.628	0.153
_cons	0.261	0.736	0.723	-14.765	2.776	0.000***	-4.632	3.022	0.125
/athrho1	-2.769								
/athrho0	2.088								
rho1	-0.992								
rho0	0.970								
Prob > chi2	0.000								
LR(rho1=rho0=0):chi2(2)	284.24								

Wald chi2(13)	815.51
Log likelihood	-992.651

, **, * represent 10%,5%, 1%*

5.5. Discussion

5. 5.1 The descriptive statistics of the impact of ILVs on household food security

This part of the research reports the description of both dependent and explanatory variables in the model estimations. The dependent variables are the factors that determined the contribution of Indigenous Leafy Vegetables on household food security. The description of explanatory variables and their means are presented in Table 5.4. The socioeconomic characteristics such as age, gender, household size, education level and livestock production were included in the endogenous switching regression model. These variables were hypothesized to determine their influence on the contribution of ILVs on household food security. The results of the endogenous switching regression model show that different variables influenced the consumption of ILVs and their contribution to household food security. In the study, the consumption of ILVs or lack of consumption thereof determined whether the household is food secure or food insecure.

5.5.2 Parameter estimates of the endogenous switching regression model (ESRM) of the determinants of the consumption of ILVs and their impact on household food security.

The results in Table 5.4 presents the endogenous switching regression model estimation of the determining factors that influence the consumption of ILVs and their contribution to household food security of Limpopo and Mpumalanga provinces, South Africa. In the study, the ESRM was used as an impact model as it was able to control all possible biases confound the results. In this instance, the correlation coefficients rho_1 and rho_ 0 in the ESRM were respectively negative and positive, and statistically significant for the correlation between the consumption of ILVs and their impact on household food security. Table 5.4 represents the results of the full information maximum likelihood estimates of the endogenous switching regression model. The estimates of the endogenous switching regression are discussed below and provide a comprehensive understanding of the variables that influence the consumption of ILVs and their impact on household food security.

The household size variable had a positive influence on the consumption of ILVs and was statistically significant. This implies that as the household size increases, the household member may grow various types of indigenous leafy vegetables in quantities for consumption and commercial purposes. These findings differ from that of Gido et al. (2017) who stated that the consumption intensity of ILVs in large households is likely to decrease as they prefer staple crops over ILVs. These findings concur with Ayanwale et al. (2016) who stated that a large household size indicates that more quantities ILVs are required to feed everyone in the household. The results further show that consumption of ILVs influenced the food security and food insecurity of the household. The logical explanation for the food-secure variable being significant is that as the household size increases, the demand for food increases which then causes the household member to produce more indigenous leafy vegetables. Food insecurity, in this instance, may occur as a result of as the household size increases, the household may be reluctant to diversify the ILVs they consume. The household quest can be on ensuring that everyone in the household is satiety without considering the importance of diversifying the ILVs they consume.

This is somehow in line with Mavhengama et al. (2013) who alluded that the diversification of these leafy vegetables is of paramount importance as it lowers the risk of diseases and food insecurity. This is contrary to Sekhampu (2013) who stated that larger household sizes are likely to suffer from food insecurity because they are often idle to diversify the foods they consume.

The gender of the household head had a negative influence on the consumption of ILVs and was not statistically significant. However, the food-secure variable had a positive impact on household food security and was statistically significant. This implies that males-headed households may prefer fast foods as they do not require a tedious process to prepare and cook. Thus, resulting in food insecurity among the household members. These results are similar to that of Sanlier & Karakus (2010) who alluded that male-headed households are likely to suffer from food insecurity as they rarely consume nutritious foods. These findings are somehow contrary to that of Lee et al. (2020) who indicated that females than their male counterparts are most likely to suffer from food insecurity because they often sacrifice their quality of nutrition to protect their children from hunger.

The education of the household head had a negative influence on the consumption of ILVs and was not statistically significant. However, it was positive and statistically significant on the food secure variable. This implies that as the household member gets more educated, they tend to consume more nutritious food from various food groups such as vegetables, fruits, grains, and protein foods. This is somehow in line with Akinola et al. (2020) who stated that as people become more educated, they often prioritize their well-being. Therefore, they consume healthy food from various food groups to improve their food security status. However, Mungofa (2016) found that as people get more educated, their eating patterns change as well. The study concluded that they consume unhealthy food perceived as luxurious food that matches their new status. Thus, resulting in food insecurity.

The marital status of the household head had a positive influence on the consumption of ILVs and was not statistically significant. Surprisingly, it was positive and statistically significant with the food secure variable. This implies that as the marital status of the household member changes the household food security is positively influenced by those changes. These findings are in line with that of Sekhampu (2013) who found that the marital status was positive and statistically significant. The study concluded that as the male household head marries, the food patterns of the household changes drastically. Thus, resulting in the positive change of the household food security status. However, Lee et al. (2020) stated that dissolution of marriage in couples (divorce) contributes considerably to food insecurity. This is because marriage dissolution leads to depression which ultimately leads to unhealthy eating patterns of fast foods.

Even though the household involvement in livestock production variable had a negative influence on the consumption of ILVs and was not significant, however, it had a positive impact on the food secure variable and was statistically significant. The logical explanation is that the household is likely to consume nutritious foods from livestock production such as milk, meat, beef, etc to improve their food security status. This is in line with Jodlowski et al. (2016) who stated that a household might decide to expand livestock production to improve

their household food security through direct consumption of home-produced animal products. The study concluded that the expanded livestock activities also contribute indirectly to increased dietary diversity which enhances the food security status of the household. However, Mayekiso et al. (2017) stated that smallholder farmers may produce livestock for commercial purposes than for consumption purposes. This results in food insecurity over time since the livestock production might be solely for commercial purposes and other animal services such as hauling and ploughing and not for the consumption purposes of the household.

The endogenous switching regression model revealed that wage/ salary had a negative on the consumption of ILVs and was not significant, however, it expectedly had a positive impact on food security and was statistically significant. This implies that the more the wage/salary increases, the more the household buys foods from various food groups in the market such as vegetables and fruits, and proteins. Thus, eradicating malnutrition and achieving food security within the members of the household. These findings concur with that of Sekhampu (2013) who stated that an increase in salary results result in food security as the household can afford to purchase more healthy food for their household members. However, Lee et al. (2020) alluded that some households may consume unhealthy foods as their salary increases

The 'if the household receives advice from government' negatively affected the consumption of ILVs and was not significant. The government advice was found to have an unexpected positive impact on household food security and was statistically significant. The logical explanation is that consumers may receive advice from the government extension services to improve the productivity of their cash crops, livestock farming, and non-farm activities. This is somehow in line with Adekunle (2013) who stated that the government extension services contribute significantly to the food security of smallholder farmers who produce staple crops and ILVs since it provides them with information, resources, and knowledge on increasing the production of staple crops and ILVs. However, Shackleton et al. (2009) alluded that government advice may indirectly lead to food insecurity since it focuses on cash crops. Thus, promote the eradication of any other nutritious crops (especially ILVS) that grow in the field along with staple crops.

5.6. Conclusion and policy recommendations

In conclusion, the study assessed the consumption of ILVs and their effect on household food security. The findings indicated that the consumption of indigenous leafy vegetables had a minimal impact on household food security. This is evident in that only a few variables of the consumption of ILVs were positive and significant (household size, wealth index, and if a disabled member receives a grant). Other variables were negative and had no statistical significance, however, most of the food security variables were positive and influenced the household food security status. This implied that the household relied on exotic cash crops and other nutritious foods other than ILVs to improve their food security. These results prove there is a need to promote and raise awareness on the consumption and production of ILVs. Since these leafy vegetables are more nutritious than staple crops that most households prefer.

The findings from this study revealed that age, gender, and education had a negative influence on the consumption of ILVs. These results highlight a need to promote awareness programs for ILVs where young people, males, and educated people (who were less fond of ILVs) will be informed about the importance and benefits of consuming of ILVs. This can be achieved through awareness programs that will pass knowledge regarding ILVs to consumers in languages that they understand to promote acceptance of ILVs among them. Agricultural Extension Services must equally promote the consumption of both exotic cash crops and ILVs. Since the study found that the profit-oriented policies promote the consumption of cash crops while alienating ILVs. This can be done by disseminating information on the benefits of ILVs in health facilities such as hospitals and clinics. Also, circulating brochures with all the necessary information on these leafy vegetables could encourage people to consume more of these vegetables. Finally, policies can contribute by increasing the diversity of ILVs leaves at retail outlets through diverse production.

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CHAPTER 6

SUMMARY, CONCLUSION, RECOMMENDATIONS AND LIMITATIONS

6.0 Introduction

The study aim was to determine factors that affect the consumption of ILVs and the impact these leafy vegetables have on household food security in the Limpopo and Mpumalanga Provinces. This chapter, in a nutshell, provides a summary of the study, conclusion, study limits, and directions for further studies and recommendations.

6.1. Summary

The purpose of the study was to understand the factors that determine the consumption of ILVs and their contribution to household food security in Limpopo and Mpumalanga provinces. The specific objectives were to analyze the determinants of ILVs acceptance and consumption and to evaluate their influence on household food security. The study showed that a large number of the participants were food secure while a small proportion of the participants was food insecure.

Descriptive statistics, a multivariate probit model, and an endogenous switching regression model were employed to achieve the objectives of the study. The results from the study revealed that food and nutrition policies accounted for the minimal consumption of ILVs since their focus is on exotic cash crops. The literature further revealed that smallholder farmers have limited access to the market. As a result, ILVs are less consumed by people especially urban consumers who are not primary consumers and producers of ILVs but rely on the market to access food. This implies that extension services must provide market information to smallholder farmers to increase their ability to sell their local produce to the market.

The hypothesis was that less consumption of ILVs will result in their minimal contribution to household food security. The hypothesis was proven to be true by the research study that found that the less consumption of ILVs limited their contribution to household food security. This implied that the household relies on exotic cash crops other than ILVs to improve their food security and dietary diversity.

6.2. Conclusions

Indigenous leafy vegetables can eradicate hunger and malnutrition. However, the study shows that ILVs are not fully accepted by people because they are not part of the formal market. On top of that, only a few of these leafy vegetables species are part of the global food system. As a result, they are not sold in the formal market where they will receive recognition from consumers, especially urban consumers who rely on the market to access food. Even the primary producers of these leafy vegetables are not sufficiently producing these leafy vegetables because they do not receive enough assistance from the government and NGOs to produce more of ILVs.

The government and NGOs, on the other hand, only provide support to commercial farmers who produce cash / exotic crops. Hence, smallholder farmers may decide to embark on commercial farming because these farmers usually receive support from the government. This has also accounted for the minimal consumption and production of ILVs by rural smallholder farmers who were once sole producers of these leafy vegetables. In this light, it is clear that consumers consume staple crops and other foods to eradicate hunger and malnutrition. However, to improve their household food security, the household must consume a diverse set of ILVs since the previous studies revealed that ILVs are way more nutritious, cheap, and easily accessible than staple crops.

The increase in the consumption of ILVs improves the production of less consumed/ neglected ILVs as some people regard them as poor people's food and also relate them with social backwardness. Also, the increase in the production of various ILVs will ensure that all the pillars of food security are met especially food access and food availability. This is because ILVs are easily available and accessible, and has many nutrients utilized by the body to improve its functioning. Therefore, it is safe to say ILVs acceptance can safeguard consumers against hunger and malnutrition while achieving food security and contributing towards achieving zero hunger by 2030.

6.3. Production and marketing of ILVs recommendations

6.3.1. Objective 1 recommendations: Analyse determinants of consumers' acceptance of ILVs

- The extension workers can help ILVs farmers gain access to market information as the findings of the study revealed that ILVs farmers have limited access to the market. This will even increase their consumption among urban people who rely on the market to access food.
- NGOs can provide smallholder farmers with advanced farming technologies, techniques, and seedlings to increase their agricultural output and productivity. This will enable smallholder farmers to diversify ILVs and other crops they can produce. As a result, increasing their ability to compete with commercial farmers who produce exotic cash crops.
- policymakers must revise food and nutrition security policies to ensure that they accommodate both ILVs and exotic cash crops.

- NGOs and agricultural programs can develop programs that encourage males to take part in agriculture as the findings of the study revealed that fewer males are involved in the production of ILVs.

6.3.2. Objective 2 recommendations: Evaluate the effect of consumers' acceptance of ILVs on household food security

- To increase the acceptance of ILVs and food security thereof, there must be an increase in the production and commercialization of ILVs since their availability in the market increases their accessibility to all consumers. This may require various stakeholders to come together to attend to all the problems that prohibit the acceptance of ILVs.

- Firstly, the agricultural programs can educate farmers about the nutritional and other various benefits associated with the consumption and production of ILVs. This may encourage smallholder farmers to produce more ILVs as the study revealed that as the household member becomes more educated their production and consumption dwindles.

- It is also compulsory that extension workers help smallholder farmers apply what they have taught them. Therefore, there must be thorough agricultural training sessions where farmers will be helped to practicalize what they have learned from the sessions. For instance, the training sessions may show them how to effectively produce and sell their local produce in the formal market. This in turn increases the agricultural yields of ILVs farmers and improves their food security overtime as the findings of the study revealed that a relatively large number of smallholder farmers are suffering from food insecurity.

6.4. Limitations of the study and directions for further studies

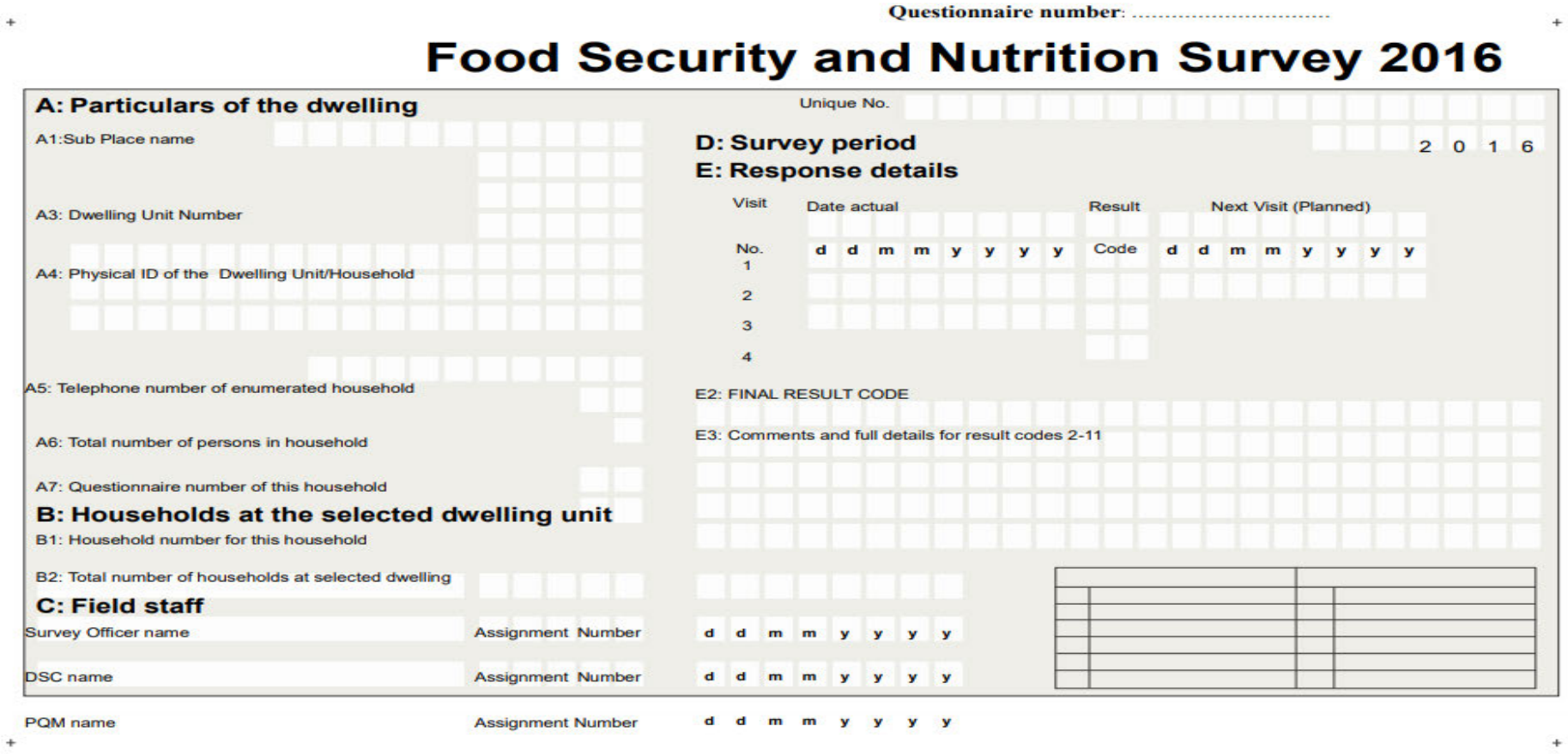
The study did not cover all parameters of food security but adopted HFIAS to assess the accessibility of ILVs to smallholder farmers. Therefore, future studies can focus on all pillars of food security.
The study also promoted the marketability of indigenous leafy vegetables. However, it implicitly discussed the marketability/commercialization of ILVs. Therefore, future studies can explicitly look at the ILVs with the potential to be marketable. This can be done by looking at the characteristics of marketable ILVs based on whether there is perishable or non-perishable.

The study revealed that ILVs are more nutritious than staple crops. However, it did not provide nutritional information to support those claims. Therefore, the study suggests that future studies must provide nutritional information on both ILVs and staple crops. This will serve as proof to educated farmers and consumers that indeed ILVs are nutritious than staple crops. Therefore, encouraging them to consume and produce them.

Due to the COVID 19 pandemic and restrictions, the study used secondary data collected in 2016 to get the picture of the consumption of ILVs and their contribution to household food security of Limpopo and Mpumalanga provinces. The consumption of these leafy vegetables may have evolved, especially after the aftermath of the COVID 19 pandemic that left many families suffering from hunger and food insecurity. Therefore, future studies may look at the consumption of these leafy vegetables and their contribution to household food security before and during the pandemic. This will be done to get the trend in the production and consumption of ILVs amid the pandemic.

APPENDICES

APPENDIX A: Food Security and Nutrition Survey 2016



Questionnaire number: .....

Food Security and Nutrition Survey 2016

A: Particulars of the dwelling

Unique No.

A1:Sub Place name

A3: Dwelling Unit Number

A4: Physical ID of the Dwelling Unit/Household

A5: Telephone number of enumerated household

A6: Total number of persons in household

A7: Questionnaire number of this household

B: Households at the selected dwelling unit

B1: Household number for this household

B2: Total number of households at selected dwelling

C: Field staff

Survey Officer name — Assignment Number — d d m m y y y y

DSC name — Assignment Number — d d m m y y y y

PQM name — Assignment Number — d d m m y y y y

D: Survey period

2 0 1 6

E: Response details

Visit No.	Date actual (d d m m y y y y)	Result Code	Next Visit (Planned) (d d m m y y y y)
1			
2			
3			
4			

E2: FINAL RESULT CODE

E3: Comments and full details for result codes 2-11

Questionnaire number: .....

Acknowledgement to University of Pretoria's Institute for Food, Nutrition and Well-being for providing the questionnairre

Questionnaire number: .....

The following information must be obtained for every person who is considered a member of the household. Only add persons who had stayed here for at least four nights on average per week for the last four weeks. ***Do not forget babies.***
If there are more than 10 persons in the household, use a second questionnaire.

INTERVIEW START TIME

		01	02	03	04	05	06	07	08	09	10
A	**First name and surname** ***First name:*** *Write down first name and surname of each member of the household, starting with the head or acting head. If more than one head take the oldest.*										
	Surname:										
B	Has ..... stayed here (in this household) for at least four nights on average per week during the last four weeks?										
	1 = Yes	1	1	1	1	1	1	1	1	1	1
	2 = No ***If "No", End of interview***	2	2	2	2	2	2	2	2	2	2
C	**Is ... a male or a female?**										
	1 = Male	1	1	1	1	1	1	1	1	1	1
	2 = Female	2	2	2	2	2	2	2	2	2	2
D	**What is ...?'s date of birth and age in completed years?**										
	Day of Birth: *Example of day 05*	d d	d d	d d	d d	d d	d d	d d	d d	d d	d d
	Month of birth: *Example of month 11*	m m	m m	m m	m m	m m	m m	m m	m m	m m	m m
	Year of birth: *Example of year 2007*	y y y y	y y y y	y y y y	y y y y	y y y y	y y y y	y y y y	y y y y	y y y y	y y y y
	Age in years *Less than one year = 0*										

Questionnaire number: .....

			01	02	03	04	05	06	07	08	09	10
F	Does the head reside in this household		Yes No									
G	If no to F, provide the following; Code:gender 1=M; 2=F Use code for education	name										
		Age in years										
		gender										
		education										

SECTION 1: HOUSEHOLD SPECIFIC CHARACTERISTICS

This section covers particulars of each person in the household

		01	02	03	04	05	06	07	08	09	10
1.2	**What is ……'s present marital status?** 1 = Legally married 2 = Living together like husband and wife 3 = Divorced 4 = Separated, but still legally married 5 = Widowed 6 = Single, but have been living together with someone as husband/wife before 7 = Single and have never been married/never lived together as husband/wife before										
1.4	**Is…… an orphan?** 1 = Yes 2 = No	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2
	Is…… A vulnerable child? 1 = Yes 2 = No	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2

Questionnaire number: .....

EDUCATION

Ask for all household members. Read out: Now I am going to ask you questions related to education for each member of the household

	Ask for all household members above 5 yrs	01	02	03	04	05	06	07	08	09	10
1.4	**What is the highest level of education that ..... has successfully completed?** *Diplomas or certificates must be of six months plus study duration full-time (or equivalent) to be included* 98 = No schooling 00 = Grade R/0 01 = Grade 1/ Sub A/Class 1 02 = Grade 2 / Sub B/Class 2 03 = Grade 3/Standard 1/ ABET 1(Kha Ri Gude, Sanli) 04 = Grade 4/ Standard 2 05 = Grade 5/ Standard 3/ ABET 2 06 = Grade 6/Standard 4 07 = Grade 7/Standard 5/ ABET 3 08 = Grade 8/Standard 6/Form 1 09 = Grade 9/Standard 7/Form 2/ ABET 4 10 = Grade 10/ Standard 8/ Form 3 11 = Grade 11/ Standard 9/ Form 4 12 = Grade 12/Standard 10/Form 5/Matric (No Exemption) 13 = Grade 12/Standard 10/Form 5/Matric (Exemption *) 14 = matric plus Diploma or degree										

	Ask for all household members aged 0-5	01	02	03	04	05	06	07	08	09	10
1.5	**Which of the following does the child currently attend?** 1 = Grade R 2 = Pre-school / nursery school/ Grade 00/Grade 000 3 = Creche / educare centre / ECDs 4 = Day-mother – out of home care 5 = None 6 = Do not know										

Questionnaire number: .....

Ask for all school going children

		01	02	03	04	05	06	07	08	09	10
1.6	**Does…. attend a school where food is given to the children?** 1 = Yes 2 = No ***xxxxxx*** 3 = Do not know ***Go to Q2.1***	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3

		01	02	03	04	05	06	07	08	09	10
1.7	**How many days in a week does …. eat the food provided at school?** *If yes, specify how regularly food is eaten.* 1 = number of times per week 2 = Do not know										

SECTION 2: ECONOMIC ACTIVITY STATUS

Ask for all household members. Read out: Now I am going to ask you questions related to occupation for each member of the household

		01	02	03	04	05	06	07	08	09	10
2.1	**What is your Economic activity Status?** 01=Subsistence farmers 02=Subsistence farmers 03=Commercial farmers 04=Parastatal employees 05=Formal sector private employees, 06=Formal sector public employees, 07=Self-employed outside agriculture, 08=Unpaid family worker 09=Workers not elsewhere classified, based on employment status 10=Unemployed, 11=Inactive, those whose main current activity was not										

Questionnaire number: .....

ECONOMIC ACTIVITIES

Ask for all household members 15 years and older

		01	02	03	04	05	06	07	08	09	10
2.2	**During the last 12 months did ….. work for a wage, salary, commission or any payment in kind (including paid domestic work), even if it was for only one hour?** *Examples: a regular job, contract, casual or piece work for pay, work in exchange for food or housing, paid domestic work.* 1 = Yes 2 = No 3 = Do not know	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
2.3	**During the last 12 months did … run or do any kind of business, big or small, for yourself or with one or more partners, even if it was for only one hour?** *Examples: Commercial farming, selling things, making things for sale, construction, repairs, guarding cars, brewing beer, collecting wood or water for sale, hairdressing, etc.* 1 = Yes 2 = No 3 = Do not know	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
2.4	**During the last 12 months did …… do any work for which they were paid in some way besides cash?** *Examples: Commercial farming, production of agricultural produce to sell, help to sell things, make things for sale or exchange, doing the accounts, cleaning up for the business, etc.* 1 = Yes, ate food on site 2 = Yes, was given a food ration to take home 3 = Yes, was given non-food items 4 = Do not know	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3

Questionnaire number: .....

		01	02	03	04	05	06	07	08	09	10
2.5	**What is ……'s total salary/pay at his/her main job?** *Including overtime, allowances and bonus, before any tax or deductions. Give amount in whole figures, without any text or decimals.* If "NONE", "REFUSE" **or** "DO NOT KNOW write 999 999 999										
2.6	**Ask only if an amount is given in Q2.5 Is this….** 1 = Per week 2 = Per month 3 = Annually	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3

SECTION 3: HEALTH AND GENERAL FUNCTIONING

Ask for all household members. Read out: Now I am going to ask you health-related questions for each member of the household

		01	02	03	04	05	06	07	08	09	10
3.1	**Has …..been unable to perform their usual duties (housework, employment) for 30 days or more during the past year due to illness?** *Read all the options* 01 = Yes 02 = No										

Questionnaire number: .....

		01		02		03		04		05		06		07		08		09		10	
3.2	**Has…been informed by a medical practitioner or nurse that he/she suffers from any if the following conditions?** *Read all the options*	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	1 =Asthma	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	2 = Diabetes	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	3 = Cancer	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	4 = HIV and AIDS	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	5 = Hypertension/high blood pressure	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	6 = Arthritis	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	7 = Stroke	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	8 = Heart attack / myocardial infection	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	9 = Tuberculosis	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	10 = Others (specify in the box)	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2

Read out: I am now going to ask about the general functioning of persons within the household

SECTION 4: SOCIAL GRANTS AND SOCIAL RELIEF

Ask for all household members

Read out: I am now going to ask about the use of social grants and social relief

		01	02	03	04	05	06	07	08	09	10
4.1	**Does anyone in this household receive a social grant, pension or social relief assistance from the Government?**										
	1 = Yes	1	1	1	1	1	1	1	1	1	1
	2 = No ***xxxxx***	2	2	2	2	2	2	2	2	2	2
	3 = Do not know ***xxxx***	3	3	3	3	3	3	3	3	3	3

Questionnaire number: .....

4.2	*If "Yes" in Q4.1a* **Does … receive a(n).....?** *Answer for each person who qualified for the grant and NOT for the person who applied on behalf of/physically receives the money. Someone who used to work for the Government and receive a pension do* ***not get*** *an old age grant* *Read all the options*	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	1 = Old-age grant	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	2 = Disability grant	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	3 = Child support grant	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	4 = Care dependency grant	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	5 = Foster child grant	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	6 = War veterans grant	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	7 = Grant-in-aid	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2

4.3 Does the household receive any social relief of distress ? Code: 1=Yes; 2=No _____

Questionnaire number: .....

SECTION 5: ANTHROPOMETRY: the following measurements should be recorded for all children under 5 years of age and the person who cares for them

		01	02	03	04	05	06	07	08	09	10
5.1	**Is any female in the household pregnant?** 1 = Yes 2 = No	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5.2	**Is the person older than 0 months and under 5 years of age (<60 months) at home?** 1 = Yes 2 = No	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2
	Measure weight of (household member name). Measure twice with a digital scale. Measurements are recorded in kilograms with two decimals.										
	Weight measurement 1										
	Weight measurement 2										
5.3	Measure height of children who are 0 – 5 years (household member name). Measure twice with stadiometer in centimeter (cm).										
	Height measurement 1										
5.4	Height measurement 2										
5.5	Mid-upper arm circumference (MUAC) for the children under 5: Measure twice with narrow tape in centimeters (cm). Measures (4-5) should only be done to children under the age of 5 (60 months).										
	MUAC Reading 1 (force entry)										
	MUAC Reading 2 (force entry)										
5.6	Last entry on the Road to Health booklet of children under 5 years of age										
	Date of entry										
	Age of the child in months										
	Weight of the child in kg, 2 decimal places										
5.7	How many meals did this child eat yesterday?										
5.8	Does this child breastfeed? 1=Yes 2=No	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2
5.9	Did this child breast feed yesterday? 1=Yes 2=No	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2
5.10	Is this child under exclusive breast feeding?	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2

Questionnaire number: .....

SECTION 6: GENERAL HOUSEHOLD INFORMATION AND SERVICE DELIVERY

Ask a responsible person in the household to answer on behalf of the household.

HOUSING ***Ask all households***

6.1 Indicate the type of main dwelling that the household occupies	**Main Dwelling**	**Other Dwelling**
01 = Dwelling/house or brick/concrete block structure on a separate stand or yard or on farm 02 = Traditional dwelling/hut/structure made of traditional materials 03 = Dwelling/house/flat/room in backyard 04 = Informal dwelling/shack in backyard 05 = Informal dwelling/shack not in backyard, e.g. in an informal/squatter settlement or on farm 06 = Room/flatlet on a property or a larger dwelling/ servants' quarters/granny flat 07 = Caravan/tent 08 = Other (specify)		

6.2 What is the main material used for the walls and the roof of the main dwelling?	**Walls**	**Roof**
01 = Bricks 02 = Cement block/concrete 03 = Corrugated iron/zinc 04 = Wood 05 = Plastic 06 = Cardboard 07 = Mud and cement mix 08 = Wattle and daub 09 = Tile 10 = Mud 11 = Thatching/grass 12 = Asbestos 13 = other (specify)		

Questionnaire number: .....

Ask all households +

6.4	**What is the household's main source of drinking water?** 01 = Piped (tap) water in dwelling/house 02 = Piped (tap) water in yard 03 = Borehole in yard 04 = Rain-water tank in yard 05 = Neighbour's tap 06 = Public/communal tap 07 = Water-carrier/tanker 08 = Borehole outside yard 09 = Flowing water/stream/river 10 = Stagnant water/dam/pool 11 = Well 12 = Spring 13 = Other (specify)	

		Yes	No
6.7	**Is the water from the main source of drinking water before any treatment .....** *Read all the options*		
	1 = S a f e to drink?	1	2
	2 = C l e a r (has no colour / free of mud)?	1	2
	3 = G o o d in taste?	1	2
	4 = F r e e from bad smells?	1	2

6.8	**Do household members treat the water used for drinking?** *This may include boiling, adding chlorine or other chemicals, filtering.* 1 = Yes, always 2 = Yes, sometimes 3 = No, never	1 2 3
6.9	**Does the household pay for water?** 1 = Yes 2 = No	1 2

SANITATION - ***Ask all households***

6.10	**What type of toilet facility does this household use?** 1 = Flush toilet connected to a public sewerage system 2 = Flush toilet connected to a septic tank 3 = Chemical toilet 4 = Pit latrine/toilet with ventilation pipe 5 = Pit latrine/toilet without ventilation pipe 6 = Bucket toilet 7 = None 8 = Other (specify)	
	11 = Well 12 = Spring	

ENERGY - ***Ask all households***

6.12	**Does thishousehold have access to/use electricity?** 1 = Yes 2 = No 3 = Do not know	1 2 3
	2 = 201 - 500 metres 3 = 501 metres - 1 kilometre	2 3

6.13	**What is the main source of energy/fuel for cooking in this household?** 01 = Electricity from mains 02 = Electricity from generator 03 = Gas 04 = Paraffin 05 = Wood 06 = Coal 07 = Candles 08 = Animal dung 09 = Solar energy 10 = Other, (specify) 11 = None	

6.11	**Is the toilet facility in the dwelling, in the yard or outside the yard?** 1 = In dwelling 2 = In yard 3 = Outside yard	1 2 3

Questionnaire number: .....

SECTION 7: HOUSEHOLD FOOD SECURITY

7.1	**In the past four weeks, did you worry that your household would not have enough food??** 1 = Never 2 = Rarely (1 – 2 times a month) 3 = Sometimes (3 – 10 times a month) 4 = Often (more than 10 times a month)	No:___
7.2	**In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?** 1 = Never 2 = Rarely (1 – 2 times a month) 3 = Sometimes (3 – 10 times a month) 4 = Often (more than 10 times a month)	
7.3	**In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?** 1 = Never 2 = Rarely (1 – 2 times a month) 3 = Sometimes (3 – 10 times a month) 4 = Often (more than 10 times a month)	
7.4	**In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?** 1 = Never 2 = Rarely (1 – 2 times a month) 3 = Sometimes (3 – 10 times a month) 4 = Often (more than 10 times a month)	

7.5	**In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?** 1 = Never 2 = Rarely (1 – 2 times a month) 3 = Sometimes (3 – 10 times a month) 4 = Often (more than 10 times a month)	No: ___
7.6	**In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?** 1 = Never 2 = Rarely (1 – 2 times a month) 3 = Sometimes (3 – 10 times a month) 4 = Often (more than 10 times a month)	No: ___
7.7	**In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?** 1 = Never 2 = Rarely (1 – 2 times a month) 3 = Sometimes (3 – 10 times a month) 4 = Often (more than 10 times a month)	No: ___
7.8	**In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?** 1 = Never 2 = Rarely (1 – 2 times a month) 3 = Sometimes (3 – 10 times a month) 4 = Often (more than 10 times a month)	No: ___

Questionnaire number: .....

7.9	**In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?** 1 = Never 2 = Rarely (1 – 2 times a month) 3 = Sometimes (3 – 10 times a month) 4 = Often (more than 10 times a month)	
7.11	How many times in a typical day do adults eat?	No____
7.12	How many times in a typical day do children under 5 years eat?	No____

Household Hunger Scale questions		
	7.14a In the past [4 weeks/30 days], was there ever no food to eat of any kind in your house because of lack of resources to get food? 1 = Yes 2=No (if No skip to 7.15a)	**7.14b How often did this happen in the past [4 weeks/30 days]?** 1= Rarely (1–2 times) 2= Sometimes (3–10 times) 3 = Often (more than 10 times)
7.13	**7.15a In the past [4 weeks/30 days], did you or any household member go to sleep at night hungry because there was not enough food?** 1 = Yes 2=No (if No skip to 7.16a)	**7.15b How often did this happen in the past [4 weeks/30 days]?** 1= Rarely (1–2 times) 2= Sometimes (3–10 times) 3 = Often (more than 10 times)
	16a In the past [4 weeks/30 days], did you or any household member go a whole day and night without eating anything at all because there was not enough food? 1 = Yes 2=No	**7.16b How often did this happen in the past [4 weeks/30 days]?** 1= Rarely (1–2 times) 2= Sometimes (3–10 times) 3 = Often (more than 10 times)

8.1	***Ask about the food consumption of household members***	**Did household members eat this food yesterday?**	**Did any child 6-23 months old eat this food yesterday?**	How often is this food group usually eaten in the household? Think of the past year, and then fill in the number of times: either per week OR per month OR per year.			Where was the food obtained from (source)?		
		Yes - tick	Yes - tick	Per week	Per month	Per year	Produced (e.g. from own garden)	In kind/donations/ event Gift/food bank/school feeding	Bought (name store)
	01 = Cereals: maize, rice, wheat, sorghum, millet, and any other foods made from cereals such as porridge, bread and noodles								
	02 = White roots and tubers - Potatoes, white sweet potato and cassava								
	03 = Orange-flesh vegetables: Pumpkin, carrot, butternut or sweet potato								
	04 –Dark green leafy vegetables, including wild/indigenous vegetables								
	05 – Other vegetables (tomato, onion, green beans, gem squash, eggplant, including wild/indigenous vegetables								
	06 - Orange-coloured fruit (e.g. ripe mango, apricot, spanspek, papaya, dried peach and 100% fruit juice made from these)?								
	07 - Other fruit (e.g. oranges, banana, apple, pear etc.), including wild/indigenous fruits?								
	08 - Organ meat (liver, kidney, heart or other organ meats or blood-based foods)								
	09 - Meat (e.g. beef, goat, sheep, poultry, pork, fish, insects 10 - Eggs from any animal								
	11 - Fish and seafood (fresh, tinned or dried and shellfish)								
	12 - Dried beans, peas, lentils, nuts, seeds or foods made from these (e.g. peanut butter)?								
	13 - Milk and milk products (e.g. yoghurt, maas cheese)								
	14 - Oils and fats(e.g. sunflower, rama, lard, butter added to food or used for cooking								
	15 - Sweets (e.g. sugar, honey, sweetened juices or fizzy drinks, sugary foods such as chocolate, cookies, cakes)								
	16 - Spices (e.g. pepper and salt), condiments (e.g. tomato sauce), coffee, tea, alcoholic beverages								

Questionnaire number: .....

Section 9: Months of Adequate Household Food Provisioning (MAHFP) for Measurement of Household Food Access

9.0	Months of hunger experiences		
9.1	In the past 12 months, were there months in which you did not have enough food to meet your family's needs? [1=Yes, 0=No]		
9.2	If yes, which were the months (in the past 12 months) in which you did not have enough food to meet your family's needs?		
A	January	A.....	
B	February	B.....	
C	March	C.....	
D	April	D.....	
E	May	E.....	
F	June	F.....	
G	July	G.....	
H	August	H.....	
I	September	I.....	
J	October	J.....	
K	November	K.....	
L	December	L.....	

9.3 How does the household cope with major income shocks (e.g. drought, death of a breadwinner, job loss, etc.) (Please tick where appropriate)			
Sell livestock	☐ Y ☐ N	Take on additional work	☐ Y ☐ N
Sell other assets	☐ Y ☐ N	Reduce spending	☐ Y ☐ N
Use own cash savings	☐ Y ☐ N	Reduce food consumption	☐ Y ☐ N
Borrow money from relatives	☐ Y ☐ N	Reduce or stop debt repayments	☐ Y ☐ N
Borrow money from stokvel	☐ Y ☐ N	Other: Please specify	☐ Y ☐ N
Receive help from friends or relatives	☐ Y ☐ N		

Questionnaire number: .....

SECTION 9B: CONSUMPTION COPING STRATEGIES INDEX

	Behaviours: In the past 7 days, if there have been times when you did not have enough food or money to buy food, how many days has your household had to: Yes or no	Number of days out of the past seven (use numbers 0 – 7 to answer number of days Use NA for not applicable
a. Rely on less preferred and less expensive foods?		
b. Borrow food, or rely on help from a friend or relative?		
c. Purchase food on credit?		
d. Gather wild food, hunt, or harvest immature crops?		
e. Consume seed stock held for next season?		
f. Send household members to eat elsewhere?		
g. Send household members to beg?		
h. Limit portion size at meal times?		
i. Restrict consumption by adults in order for small children to eat?		
j. Feed working members of HH at the expense of non-working members?		
k. Reduce number of meals eaten in a day?		
l. Skip entire days without eating?		

Questionnaire number: .....

SECTION 10: Food and Non Food Expenditure: I will know ask about household food and non-food expenditure for last 12 months

0. Where do you normally get this item? **Codes** *1…supermarket* *2…small shop/restaurant/takeaway* *3…Informal market / street vendors* *4…Own production* *5…Food aid* *6…Remittances*		1.Since March 2012 to this day, did the household spend money on the following food items?**Codes** *1…yes* *2…No* **go to next item**	2. If yes, how frequent were these purchased? Code *1…daily* *2…weekly* *3…monthly* *4…. quarterly* *5…annually* *6…other (specify)*	3. Number of purchases per period? number of times P= Number of Purchase M=Number of Months		4. How much money was normally spent per each purchase?	5. Quantity bought of this item Per purchase in Kgs
Item	*Code*			**P**	**M**	*Rand*	
01 Mealie meal, maize products							
02 Rice							
03 Millet							
04 Sorghum							
05 Wheat, wheat flour, etc							
06 Vegetables, Tomato,							xxxxx
07 Sugar, tea, coffee, etc							xxxxx
08 Salt, Spices, etc							xxxxx
09 Cooking oil, margarine, butter,							xxxxx
10 Cassava, sweet potatoes, Irish potatoes (root and tubers)							
11 Beans, peas (Pulses)							
12 Fish							
13 Meat							
14 Milk, milk products, etc							
15 Fruits							
16 Yam							
17 Bread							
18 Other (specify							

Questionnaire number: .....

SECTION 10B: Non- Food Expenditure

1. Did the household spend money on the following items in the past 12 months? **Code4** *1…yes* *2…No* **go to next item**		2. If yes, how frequent were these purchased *Codes 1…daily 2…weekly 3…monthly 4….quarterly 5…annually 6…other (specify)*	3. Number of purchases per period?	4. How much money is normally spent per each purchase?
01 Electricity (bills, light bulbs,				
02 Batteries				
03 Firewood				
04 Charcoal				
05 Petrol / diesel				
06 Kerosine				
07 Candles, matches, etc				
08 Security				
09 Telephone (calls, handsets,				
10 Transport				
11 General body hygiene				
12 Make up and hair dressing				
13 Shaving, nail cleaning, etc				
14 School fees				
15 Uniform				
16 Pocket money				

1. Did the household spend money on the following items in the past 12 months? **Code** *1…yes* *2…No* **go to next item**		2. If yes, how frequent were these purchased *Codes 1…daily 2…weekly 3…monthly 4….quarterly 5…annually 6…other (specify)*	3. Number of purchases per period? Put the number of times	4. How much money is normally spent per each purchase?
Item				
17 Writing materials				
18 Father's clothes				
19 Mother's clothes				
20 Children's clothes				
21 Clothes and shoes				
22 Pots				
23 Plates, spoons,				
24 Cups				
25 Baskets				
26 Loan repayment				
27 Remittances				
28 Gifts				
29 Religious Offerings				
30Wedding ceremony				
31 Funeral expenses				
32 Dowry (lobola etc)				
33 Entertainment				

Questionnaire number: .....

	Section 10: HOUSEHOLD LIVELIHOODS AGRICULTURAL ACTIVITIES ***Ask all households***	
10.1	**Has the household been involved in the production of any kind of food or agricultural products during the past twelve months? (e.g. livestock, crops, poultry, food gardening, forestry, fish, etc.)** 1 = Yes 2 = No	1 2
10.2	**What kind of food production/agricultural activities is the household involved in?** *Read all the options*	Yes No
	01 = Livestock production (cattle, goats, sheep, pigs, etc.)	1 2
	02 = Poultry production (chickens, ducks, geese, guinea fowl, etc.)	1 2
	03 = Grains and food crops (maize, wheat, beans, sorghum, millet, Groundnuts etc.)	1 2
	04 = Industrial crops (e.g. tea, coffee, cotton, sugar, tobacco)	1 2
	05 = Fruit and vegetable production	1 2
	06 = Fodder, grazing/pasture or grass for animals	1 2
	07 = Fish farming/aquaculture	1 2
	08 = Forestry	1 2
	09 = Game farming	1 2
	10 = Other	1 2
10.3	**Why do you grow farm produce or keep livestock for the household in the past year?** 1 = As a main source of food for the household 2 = As the main source of income/earning a living 3 = As an extra source of income 4 = As an extra source of food for the household 5 = As a leisure activity or hobby e.g. gardening	1 2 3 4 5
10.4	**Did your household sell any of its produce or livestock in the last year?** 1 = Yes 2 = No	1 2

10.5	Do you store any foods for later use? **1=yes 2=no**	If yes, what foods?
10.5b	If yes, how do you store your food? Tick appropriate	1=Refrigerate 2=Drying 3=Fermenting 4=Pickling 4=Dry salting 5=Smoking 6=Sealing 7=Cellaring 8=Other (specify)
10.6	Do you process any foods? **1=yes 2=no**	If yes, what foods?

Questionnaire number: .....

10.7	**If produce is sold, to whom does your household sell most of its produce?** *Read all the options* 1 = Local buyers from this district 2 = Buyers from neighboring cities and towns 3 = Formal markets in South Africa 4 = Export agencies in international buyers. 5 = Other	1 2 3 4 5
10.8	**Has your household received any of the following kinds of agricultural related assistance from the government during the past 12 months?** *Read all the options* 1 = Training 2 = Advice from government extension officers 3 = Grants (money that does not have to be paid back) 4 = Loans (money that has to be paid back) 5 = Inputs (seed, fertilizer, etc.) as part of a loan 6 = Inputs (seed, fertilizer, etc.) for free 7 = Dipping and vaccination services for livestock from State veterinarian or other Department 8 = Other (specify) **Go to Q10.9 if households answered yes to any of the categories above, else go to Q10.10**	Yes No 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2
10.9	**Did your household find this agriculture-related assistance:** 1 = Very useful 2 = Somewhat useful 3 = Not useful	1 2 3
10.10	**Did your household receive agriculture-related assistance from any other entity than government?** 1 = Yes 2 = No	1 2

10.11	**How many of the following does the household own?** *Please mark the most appropriate category with an x.* 1 = Cattle for food or investment 2 = Donkeys and mules 2 = Sheep 3 = Goats 4 = Pigs 5 = Poultry 6 = Other (specify)	**Number**

Continue if the household planted grains/vegetables/fruits/trees (forestry)/pastures/ industrial crops. Otherwise, go to Q10.14

10.12	**Where does the household practice its crop planting activities?** *Read all the options* 1 = Farm land (communal or private) 2 = Backyard garden (can include, vegetables, fruits, grains) 3 = School garden (can include, vegetables, fruits, grains) 4 = Communal garden (more than one household involved, can include vegetables, fruits, grains) 5 = On verges of roads and unused public/municipal land 6 = Other	Yes No 1 2 1 2 1 2 1 2 1 2 1 2

Questionnaire number: .....

10.14	**On what basis does this household have access to the land used for crop production? If more than one kind of tenure system applies for different pieces of land, give an answer for the biggest piece.** 1 = Owns the land 2 = Rents the land 3 = Sharecropping 4 = Tribal authority 5 = State land 6 = Other (specify) 7 = Do not know	

10.15	**If the household receives an income from remittances, please specify approximately how much they receive per month?** *If no income received from remittances write 0.*	
10.16	**If the household receives an income from pensions (do not include income from old age grants), please specify approximately how much they receive per month?** *If no income received from pensions, write 0.*	
10.17	**What was the total household expenditure in the last month?** *Include money spent on food, clothing, transport, rent and rates, alcohol and tobacco, school fees, entertainment and any other expenses.*	

10.13	**Approximately how big is the land that the household uses for production? Estimate total area if more than one piece.** 1 = Less than 500m² (approximately one soccer field) 2 = 500m² to 9 999m² (between one soccer field and one hectare) 3 = 1 but less than 2 hectares 4 = 2 but less than 5 hectares 5 = 5 but less than 10 hectares 6 = 10 but less than 20 hectares 7 = 20 or more hectares 8 = Do not know	

10.18	**How many of the following does the household own?**	Number
	01 = Bed with mattress	01 =
	02 = Sofa Set	02 =
	03 = Table (dining/desk)	03 =
	04 = Pay TV (M-Net / DSTV / Top TV) Subscription	04 =
	05 = Radio-working condition	05 =
	06 = Mobile Phone	06 =
	07 = Tape or CD/DVD	07 =
	08 = Television	08 =
	09 = Motor vehicle	09 =
	10 = Refrigerator	10 =
	11 = Washing machine	01 =
	12 = E lectric Stove / Gas Stove	11 =
		12=

Questionnaire number: .....

SECTION 12: CROPS PRODUCED in the 2013/14 season (X month 2013 to this month 2014)

12.1	Crops grown	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12

Crops planted and harvested	Total area planted	Total harvest	Price per unit	Did the household consume this crop?	Was any sold? Where?	Income	Was this processed in any way?	How much was stored for home consumption?	Was the crop irrigated?	If irrigated, what kind of irrigation? • buckets form a river, • treadle pump, • flood irrigation • irrigation scheme, • municipal water	If irrigated, what is the water source?	Did you use any inputs? Improved seeds? Fertilizer? Manure?	Is mechanized farming used? Tractor? Harvester?

Questionnaire number: .....

12.2			
	Do you apply crop rotation? Y/N	**1=Yes 2=No**	**Why?**
	Is there un-used land? Why?	**1=Yes 2=No**	**Why?**
	Is there follow land? Why?	**1=Yes 2=No**	**Why?**
	Do you have access to water?	**1=Yes 2=No**	**Why?**
	Do you use it for irrigation?	**1=Yes 2=No**	**Why?**
	Do you have enough water?	**1=Yes 2=No**	**Why?**
	What are you not growing and would like to?		
	Have you had poor success with a crop? Why?	**1=Yes 2=No**	**Why?**

Thank the respondent!

INTERVIEW END TIME

APPENDIX B: Letter of permission for use of SAVAC datasets

agriculture, land reform & rural development
Department:
Agriculture, Land Reform and Rural Development
REPUBLIC OF SOUTH AFRICA

OFFICE OF THE DIRECTOR: SUBSISTENCE FARMING
Private Bag X833, Pretoria, 0001; 503 Steve Biko Road, Pretoria, 0001
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Dr M Ngidi

Centre for Food Security
University of KwaZulu-Natal
Private Bag X01
PIETERMARITZBURG, 0028

Dear Dr Ngidi

RE: PERMISSION FOR USE OF SAVAC DATASETS

Thank you for your letter dated 29 January 2021, in which you request 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 in the Masters and PHD 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,

[redacted]
MR M MAMADI
DIRECTOR: SUBSISTENCE FARMING
DATE: 25 Feb 2021