DIVERSITY AND POTENTIAL OF FINGER MILLET (*Eleusine coracana*) UTILIZATION FOR SUSTAINABLE LIVELIHOOD IN RUMPHI DISTRICT

MSc IN TRANSFORMATIVE COMMUNITY DEVELOPMENT THESIS

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MZUZU UNIVERSITY

JANUARY, 2025

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BSc TRANSFORMATIVE COMMUNITY DEVELOPMENT (MZUZU UNIVERSITY)

THESIS SUBMITTED TO THE FACULTY OF ENVIRONMENTAL SCIENCES, DEPARTMENT OF AGRI-SCIENCES IN FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE MASTER OF SCIENCE DEGREE IN TRANSFORMATIVE COMMUNITY DEVELOPMENT

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DECLARATION

I hereby declare that this thesis, titled "Diversity and potential of finger millet utilization for sustainable development", has been written by me and is a record of my research work. All citations, references, and borrowed ideas have been duly acknowledged. It is being submitted in fulfilment of the requirements for the award of the degree of MSc in Transformative Community Development of Mzuzu University. None of the present work has been submitted previously for any degree or examination in any other University.

Bakhita Malombe 10/12/2025

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CERTIFICATE OF APPROVAL

This thesis, Diversity and Potential of Finger Millet utilization for sustainable development by Bakhita Malombe, is submitted with our approval as university supervisors for the MSc in Transformative Community Development

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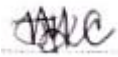
Sign  Date 10/12/2025

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Co-supervisor

DEDICATION

I dedicate this work to my mother, Maria Mwadzangati, for her prayers, love, support, and belief in me throughout my studies.

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ACRONYM

AEDC	: Agriculture Extension Development Coordinator
ADD	: Agriculture Development Diversion
ANOVA	: Analysis of variance
DOL	: Diffusion of Innovation Theory
EPA	: Extension planning area
FGD	: Focus Group Discussion
KII	: Key Informant Interview
MZUNIREC	: Mzuzu University research ethics committee
SPSS	: Statistical Package for Social Sciences
TPB	: Theory of Planned Behaviour

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ABSTRACT

Finger millet (*Eleusine coracana*), an underutilised orphan crop, has significant potential to enhance sustainable food and nutrition security in Malawi due to its resilience to harsh climates and high nutritional value. However, its cultivation and consumption remain limited. This study assessed the diversity and potential of finger millet utilisation for sustainable livelihoods. Specifically, the study aimed to (i) analyse farmers' knowledge and perceptions of finger millet and millet products, (ii) investigate farmers' adoption of agricultural innovations in finger millet cultivation, and (iii) assess the level of finger millet consumption among vulnerable groups. The study was conducted in Nchenachena and Bolero EPAs using a mixed-methods approach. Quantitative data were collected from 354 respondents and analysed using SPSS to generate descriptive and inferential statistics, including regression analysis and one-way ANOVA. In contrast, qualitative data from four Focus Group Discussions (FGDs) and four Key Informant Interviews (KIIs) were analysed using NVivo. Results revealed a diversity of knowledge, with only 2.8% of farmers felt very knowledgeable about finger millet, although knowledge increased significantly with farming experience ($p = 0.005$). Farmers expressed positive perceptions and a strong willingness to promote its cultivation (mean = 4.03). Despite 63% being aware of agricultural innovations, adoption remained low (7.1%), influenced mainly by farm size ($p = 0.016$) and access to information ($p = 0.001$). Innovations, such as ridge cultivation and improved varieties, have the potential to increase yields ($\beta = .198$, $p = .027$). Consumption among vulnerable groups was minimal (1.4%), with most households consuming finger millet weekly (41.4%), mainly as beverages like Thobwa (34.6%). Key constraints included the high cost of finger millet (30%) and limited market availability. The study concludes that despite its recognized potential, finger millet adoption and consumption are hindered by significant knowledge gaps, low adoption of key innovations, and economic barriers. Therefore, to directly address these constraints, the study recommends targeted interventions, including practical farmer training, improved access to seed systems, and the development of affordable, value-added products to enhance the crop's contribution to sustainable livelihoods and nutrition security in Malawi**.**

Keywords: *vulnerable groups, finger millet, agriculture innovation, adoption, knowledge, perception, consumption*

CHAPTER ONE: INTRODUCTION

Chapter introduction

This Chapter introduces the study by providing a general overview of the role of finger millet in contributing to sustainable development within the context of underutilised crops in Malawi. It presents the background of the study, highlighting key issues related to agricultural diversification, food and nutrition security and the limited utilization of finger millet in the study area. The chapter defines the research problem and outlines the main and specific objectives of the study and introduces the key research questions that guided the investigation. Lastly, it justifies the study's relevance.

1.1 Background

Agricultural diversification is crucial for achieving sustainable food security and economic resilience, especially in regions facing climate variability and resource limitations. Globally, farming systems are under increasing pressure to meet the food needs of a growing population, which is expected to reach nearly 10.5 billion by 2050. To ensure sustainable food and nutrition security, global agricultural production must increase significantly within that same timeframe, from 60% to 100%. (Tilman et al. 2011). This challenge requires a shift toward crops that can be grown with minimal environmental impact, focusing more on ‘orphan’ or 'underutilized' crops like finger millet..

Sub-Saharan Africa faces increased vulnerability due to climate variability, food insecurity, and a historical emphasis on a limited range of staple crops, which has reduced agricultural diversification and raised systemic risks (Padulosi, Thompson & Rudebjer 2013).

In Malawi, maize is the dominant staple crop, with nearly 85% of smallholder farmers relying on it for food and income (World Bank 2022). Overreliance on maize has increased vulnerability to drought and soil degradation, underscoring the need to explore more resilient, underutilized crops.

Finger millet (Eleusine coracana) is one such crop with significant potential for sustainable agriculture. The cereal offers a viable alternative due to its adaptability to harsh environmental conditions, low input requirements, and high nutritional value. Recognized for its superior agronomic traits, finger millet is highly resilient. It adapts well to various growing conditions, including low rainfall and nutrient-deficient soils, where crops such as maize and soybeans often struggle. Plate 1 shows the finger millet plant, while Plate 2 displays the finger millet straw.

Plate 1: Eleusine coracana plant in a farmer's field in Nchenachena EPA.

Plate 2: A harvested finger millet straw showing the panicle's finger-like spikes in Bolero

The neglect of underused crops, including finger millet, mainly arises from historical biases in agricultural policies, research, and market structures that favor major staples like maize, wheat, and rice. This neglect has led to low yields and small cultivation areas for these crops, including millet. For example, finger millet consistently yields poorly, mainly due to unproductive seed varieties, pest problems, and weak market connections, which further discourage widespread cultivation. Tackling these challenges requires increased investment in research and the adoption of innovative farming methods to improve productivity and unlock the crop's full potential.

Beyond its agronomic benefits, finger millet is ideal for this role because of its drought tolerance, low input requirements, high mineral and micronutrient content, long shelf life, and suitability for vulnerable groups such as pregnant women, lactating mothers, and children (Kerr 2014; Parthasarathy Rao et al. 2006; Gupta & Mishra, 2018). The crop's high fiber content and low glycemic index also make it beneficial for managing diabetes and other metabolic disorders.

Despite the many benefits of finger millet farming, many farmers are still hesitant to adopt it, mainly because of their attitudes and perceptions toward the practice. Farmers' knowledge about finger millet tends to decline as their levels of education increase, and they often lack community engagement with experienced farmers, training, and extension services. Participation in formal social networks, such as farmer groups, can promote learning and the adoption of improved cropping systems. However, the use and adoption of finger millet are also affected by broader factors, including government policies, market demand, and cultural preferences. Cultural preferences.

Despite generally positive views of millet farming, productivity remains low, mainly due to a significant adoption gap. This gap is not just about missing technology; it is deeply rooted in a critical lack of farmer knowledge. As Rogers (2003) highlights, knowledge is the essential first step in the adoption process. For farmers to adopt new practices, they need a range of information, including technical skills for applying new methods, economic understanding of costs and profits, and local knowledge to choose suitable technologies for their environment (Glover et al. 2019). Without access to this broad knowledge base, farmers tend to remain risk-averse, sticking to familiar traditional methods rather than adopting improved varieties and techniques (Kansiime et al. 2021). Therefore, closing the adoption gap and boosting productivity and income depend on directly meeting these knowledge needs through targeted and easy-to-access information efforts.

The primary goal of boosting production is to enhance nutrition and food security. It involves assessing the consumption side of the value chain, especially among those who stand to benefit the most. Finger millet is rich in essential micronutrients, including iron, zinc, calcium, and folic acid, making it a powerful dietary tool for combating micronutrient deficiencies among vulnerable groups such as pregnant women, lactating mothers, and children (Parthasarathy Rao et al. 2006). However, in Malawi,

awareness of these benefits is limited, and dietary habits remain focused on maize, which restricts its integration into local diets (Okwadi 2005).

1.2 Problem statement

Finger millet has the potential to improve Malawi's food security and nutrition due to its adaptability to harsh environments, low production costs, and high nutritional value. However, its cultivation and use remain significantly underdeveloped (FAO 2020). Malawi's agricultural policies, while focusing on food security and diversification (MoAIWD 2016), remain heavily biased toward maize and a few key crops, with little attention paid to orphan crops such as finger millet. This policy gap has led to low research investment, insufficient extension support, and underdeveloped finger millet value chains. Additionally, non-governmental organizations (NGOs), which are important partners in providing agricultural extension and promoting nutrition in Malawi, have largely reflected this policy bias. Their programs mainly focus on maize and legumes, resulting in a significant gap in promoting underused crops like finger millet at the community level. Despite its notable agronomic and nutritional benefits, the cultivation and utilization of finger millet in Malawi remain largely underdeveloped, primarily due to a critical policy and research gap that favors major staple crops.

The limited awareness and understanding of finger millet are further worsened by low participation in community-based farmer groups, inadequate training, and insufficient extension services. These challenges hinder the adoption of finger millet cultivation, thereby restricting its potential to improve food security, economic opportunities, and nutritional outcomes. Hence, understanding farmers' perspectives toward finger millet and its products is essential for identifying barriers to adoption and designing targeted interventions to promote its cultivation and utilization.

The absence of agricultural innovations, such as improved seed varieties, improved farming practices, and mechanized processing, has caused low productivity and restricted market opportunities for the crop. Additionally, the lack of clear policies supporting finger millet has resulted in limited awareness, inadequate extension services, and underdeveloped value chains. Consequently, the crop remains underutilized, preventing it from reaching its full potential in enhancing food security and economic livelihoods.

Besides low production, finger millet consumption in Malawi remains minimal despite its high nutritional value. Research in India and Tanzania has shown that finger millet contains essential micronutrients, including calcium and iron, which benefit vulnerable groups such as pregnant women, breastfeeding mothers, and malnourished children. In Malawi, however, awareness of these benefits is limited, and dietary habits are mainly centered around maize-based foods, further restricting the integration of finger millet into local diets. Addressing the low adoption of finger millet requires understanding farmers' perspectives, knowledge, and the challenges they face in its production and use.

Therefore, this study aims to examine the diversity and potential of finger millet utilization for sustainable livelihoods in Malawi. Specifically, it seeks to evaluate the adoption of agricultural innovations that can boost finger millet productivity, explore farmers' knowledge and perceptions of the crop, and assess its consumption among vulnerable groups. By identifying the barriers and opportunities for adopting finger millet, this research will offer evidence-based recommendations to promote its cultivation, improve food security, and support sustainable agricultural development in Malawi.

1.3 Study objectives

1.3.1 Main objective

The main objective of this study is to assess the diversity and potential of finger millet utilisation for sustainable livelihood

1.3.2 Specific objectives

1. To analyse the knowledge and perception of farmers on finger millet and millet products
2. To investigate farmers' adoption of agriculture innovations on the productivity of finger millet cultivation
3. To assess the level of finger millet consumption among vulnerable groups

1.3.3 Research questions

1. What are the knowledge levels and perceptions of farmers regarding finger millet and its products?
2. How does the adoption of agriculture innovations influence the productivity of finger millet among farmers?
3. What is the consumption level of finger millet among vulnerable groups?

1.4 Justification

Understanding farmers' knowledge and perceptions is essential; without this foundational understanding, extension efforts might be misdirected and ineffective. This study will identify specific knowledge gaps and cultural perceptions, allowing the Ministry of Agriculture and NGOs to develop targeted training and awareness campaigns that align with farmers' realities. If this research is not carried out, extension services will continue to rely on assumptions about farmers' knowledge, attitudes, and cropping practices regarding finger millet, which could result in wasted resources. Consequently, farmers would likely experience ongoing low productivity due to a lack of properly tailored information and support.

Furthermore, adopting innovations is essential to turn awareness into concrete action and higher yields. By identifying which practices are most widely used and impactful and by understanding the specific barriers farmers encounter, this study provides guidance for policymakers, extension services, and

development partners to focus on interventions that boost finger millet adoption and productivity. It gives the Ministry of Agriculture and organizations like ICRISAT the evidence needed to prioritize and subsidize high-impact technologies, while NGOs and development partners can use these findings to improve community-based programs. Although NGOs currently play a key role in promoting agricultural diversification and nutrition in Malawi, their efforts remain primarily focused on maize and legumes. Highlighting this implementation gap underscores the importance of integrating finger millet into nutrition and livelihood projects and of developing strategies to overcome obstacles, such as cost and labor. Failing to conduct this research would lead to a persistent disconnect between agricultural research and on-farm realities. Investment in R&D might be diverted toward less adoptable innovations, leaving farmers stuck in a cycle of low productivity and economic vulnerability, unable to benefit from climate-resilient farming practices.

Finally, assessing consumption among vulnerable groups is essential to ensure that increased production leads to better nutritional security. The study will provide development partners with concrete data needed to incorporate finger millet into national nutrition programs, such as supplementary feeding for pregnant women and school meals for children. Without focusing on the end beneficiaries, the nutritional potential of finger millet will largely remain untapped. The most vulnerable groups—children under five, pregnant women, and lactating mothers—would continue to suffer from preventable micronutrient deficiencies, with lasting impacts on their health, cognitive development, and future potential. This effort will be key in reducing malnutrition and enhancing food security, directly supporting Sustainable Development Goals (SDGs) 2 (Zero Hunger) and 3 (Good Health and Well-being). Research shows that finger millet's high mineral content can significantly improve dietary quality and health outcomes.

This study supports Malawi's agricultural policy goals of improving food security and nutrition by implementing effective strategies, plans, and programs that deliver quality nutrition services and address nutrition-related problems. Diversification into other crops (MoAIWD 2016) is crucial for this effort. By focusing on adopting innovations in finger millet farming, the research aims to promote sustainable agricultural development, enhance livelihoods, and meet both national and international nutritional goals. Overall, the results contribute to the existing body of knowledge by helping researchers, policymakers, and development practitioners understand how traditional crops like finger millet can increase productivity, improve nutrition, and strengthen food security at the local level.

1.5 Chapter conclusion

Chapter 1 emphasizes the significance of finger millet in promoting sustainable development, food security, and agricultural diversification in Malawi. It outlined the research problem, objectives, and questions, and justified the necessity of the study. The chapter also lays the groundwork for examining farmers' knowledge, adoption of innovations, and consumption patterns among vulnerable groups. The next chapter will review relevant literature to support the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Chapter Introduction

The literature review provides a comprehensive examination of existing studies relevant to the adoption of agricultural innovations in finger millet cultivation, farmers' knowledge and perceptions and the consumption of finger millet among vulnerable groups. By reviewing these studies, this chapter identifies research gaps and provides a foundation for the study's methodological approach.

2.2 Theoretical Framework

This study is supported by three complementary theoretical frameworks that together offer a comprehensive understanding of the factors influencing finger millet use from production to consumption.

Theory of Planned Behaviour (TPB) (Ajzen 1991)

The Theory of Planned Behaviour indicates that individual behavior is shaped by their intention to perform that behavior. These intentions are influenced by three factors: attitudes (the person's positive or negative view of performing the behavior), subjective norms (the perceived social pressure from important others such as family and community to perform or not perform the behavior), and perceived behavioral control (the perceived ease or difficulty of performing the behavior, based on past experience and expected obstacles). TPB is helpful in explaining farmers' knowledge and perceptions of finger millet. Farmers' attitudes toward finger millet (which can be assessed by examining their beliefs about its profitability, nutritional value, and tastesuch as whether they see it as a "poor man's crop" or a nutritious, marketable crop) influence their willingness to grow or consume it. Subjective norms will be examined by exploring how community leaders, fellow farmers, and family influence decisions about growing or consuming finger millet. Cultural beliefs, community practices, and peer influence shape both cultivation and consumption patterns. Perceived behavioral control will be assessed by looking at

farmers' perceptions of the labor, cost, and skills needed for finger millet cultivation. This reflects farmers' confidence in their ability to grow or process finger millet, which is affected by access to inputs, extension services, and processing technologies. Therefore, TPB helps clarify how knowledge, perceptions, and social influences drive decisions related to finger millet cultivation and use.

Diffusion of Innovation Theory (Everett Rogers, 1931)

This theory outlines the decision-making process for adopting agricultural innovations, consisting of five key stages. The Diffusion of Innovation Theory describes how new technologies and practices spread through communities, highlighting stages such as knowledge, persuasion, decision, implementation, and confirmation. It emphasizes factors like relative advantage, compatibility, complexity, trialability, and observability. This model is directly relevant to assessing how agricultural innovations, such as improved finger millet varieties, are adopted. The knowledge stage occurs when a person first encounters an innovation and understands its functions and benefits. During the persuasion stage, the decision-making unit (farmers) form attitudes toward the innovation, which can be positive or facilitative. The decision stage involves actively accepting or rejecting the innovation. Implementation happens after a decision to adopt, where the innovation is used unless uncertainties arise. Finally, the confirmation stage reinforces the adoption decision but may lead to reversal if new conflicting information appears. Using this theory helps the study identify barriers and motivators influencing the adoption of innovations in rural farming communities (Rogers, 2003).

Food and Nutrition Security Framework (FAO 2008)

The Food and Nutrition Security Framework is built on four main pillars: availability (sufficient quantities of food), which refers to when finger millet is produced in high quantities and is within reach of the household. Access (economic and physical access to food) means that finger millet is easily

accessible to the household. Utilisation (use of food for proper nutrition) concerns when vulnerable groups can consume finger millet, and stability (consistent access and availability over time). This framework is relevant to the third objective of the study, which assesses finger millet consumption among vulnerable groups, including pregnant women, lactating mothers, and children under five. Increased adoption of finger millet increases household access. Utilization depends on awareness of nutritional benefits and preparation methods, while stability is determined by seasonal availability and resilience to shocks (e.g., drought or price fluctuations). By applying this framework, the study will explore how finger millet contributes to household food security and nutrition among vulnerable groups in Malawi, by examining if it is readily available in households or markets, affordable, culturally acceptable, and used in ways that meet dietary needs. It also helps evaluate whether consumption patterns remain stable across seasons or are disrupted by external shocks, such as drought or changes in market prices (FAO 2008).

2.3 Farmers' knowledge and perceptions of finger millet and finger millet products

Research on farmer decision-making, viewed through the lens of the Theory of Planned Behaviour, shows that knowledge and perceptions (attitudes) are fundamental to the intention to grow a crop. Finger millet is widely recognized for its resilience to harsh climatic conditions and its rich nutritional profile, which includes high levels of calcium, iron, and dietary fiber (Kumar et al. 2021). However, its cultivation remains limited, often due to limited awareness of its agronomic and nutritional value (Anitha et al. 2019). This knowledge gap negatively affects farmers' attitudes and perceived behavioral control.

Studies show that experience leads to a greater appreciation of its health benefits and affordability, especially among low-income farmers who see it as nutritious and accessible (Kerr et al. 2016). These

positive attitudes are sometimes reinforced by subjective norms, such as cultural importance (Kane-Potaka et al. 2021), as finger millet holds cultural significance in several communities and is often used in traditional ceremonies and local rituals. This cultural connection positively influences farmers' perceptions of finger millet cultivation over time.

On the other hand, a study in Nigeria found that a lack of technical knowledge and institutional support weakens perceived behavioral control, which limits the adoption of better practices. The study also observed that the absence of support from extension services and NGOs contributed to poor knowledge transfer and low adoption of improved practices.

This lack of control worsens because finger millet is viewed as a "low-income" and labor-intensive crop, especially during weeding and threshing, which discourages its expansion. Compared to maize or rice, this perception damages its acceptance, motivation, and cultivation. However, processing finger millet into value-added products, such as flour, can change this perception by increasing its market value, improving its relative advantage, and making farmers feel more in control of its profitability. Although these studies provide valuable insights, most were conducted in India and Nigeria, leaving a significant gap for Malawi, where culture, economics, and agro-ecology differ. This study will use the TPB framework to examine how attitudes, norms, and perceived control influence Malawian farmers' decisions.

These findings align with a study by Yadav (2024), which found that many farmers view finger millet as labor-intensive, especially for weeding and threshing. This perception discourages farmers from expanding their cultivation because they consider it less profitable.

Although existing research on finger millet's health and cultural perceptions is primarily from other regions, such as India and Kenya, significant differences in culture, economics, and agro-ecology make these findings not directly applicable to Malawi, revealing a critical geographic gap in understanding

local farmer perspectives. Furthermore, the few studies conducted in similar regions often rely on small-scale qualitative designs or quantitative surveys with limited sample sizes. These methodological constraints restrict the ability to generate statistically robust, generalizable data on farmer perceptions and adoption rates. Therefore, this study seeks to address this gap by employing a mixed-methods approach with a larger, more robust sample size in the finger millet hubs of Rumphi District, aiming to provide findings that are both contextually deep and quantitatively representative.

2.4 Farmers' Adoption of Agriculture Innovation on the Productivity of Finger Millet Cultivation

The Diffusion of Innovations theory provides a structured framework for understanding the factors influencing the adoption of new practices. This is essential for improving finger millet productivity. Adoption of agricultural innovations plays a key role in boosting crop yields, food security, and income among smallholder farmers in sub-Saharan Africa. Despite its potential, the adoption of agricultural innovations in finger millet cultivation remains relatively low due to various socioeconomic and information barriers (Wamalwa et al. 2021). Embracing agricultural innovations can significantly increase crop productivity, raise household incomes, and strengthen food security, especially for underutilized cereals like finger millet (Eleusine coracana). Finger millet has been recognized as an important crop for sustaining livelihoods, improving ecosystem resilience, and helping communities, particularly vulnerable populations, adapt to climate change. (Pradhan, Panda & Bhavani 2019)

Despite these benefits, productivity remains low in many areas, mainly due to limited adoption of modern agricultural techniques. Innovations that could boost finger millet productivity include new seed varieties, mechanized planting and harvesting equipment, integrated pest and nutrient management strategies, and water conservation practices. Research revealed an 82% increase in the use of improved seed varieties, indicating a high relative advantage. Likewise, conservation tillage was found to increase

finger millet productivity among smallholder farmers significantly. This approach considerably boosted finger millet productivity among smallholder farmers.

The innovation-decision process heavily relies on communication channels and a farmer's capacity. Gitu, Onyango, and Obara (2014) highlighted that access to information from peers, extension services, and media plays a crucial role in farmers' choices regarding new technologies. Key factors include awareness, perceived benefits, and practical understanding of innovations. They also identified that factors such as plot size, on- and off-farm income, household credit access, and the frequency of extension interactions positively influence both the decision to adopt and the level of adoption.

Socio-economic and cultural barriers also slow down the adoption process. It has been noted that gendered power dynamics within rural households often affect access to innovations, with women facing more obstacles. Rebecca et al. (2018) emphasized the importance of literacy in gaining access to agricultural knowledge and closing the information gap. Additionally, age and gender influence adoption decisions, as older farmers and women may face additional barriers Srinivas Sukanya & Rao (2024),

The impact of adopting innovation on productivity has been well-documented. Koech et al. (2022) reported that adopters of improved finger millet varieties and conservation tillage experienced significant yield increases and better technical efficiency, with a mean efficiency score of 67% in Elgeyo-Marakwet County. These findings support the argument that adopting innovation directly contributes to improved farm performance and income growth,(Gitu, Onyango and Obara 2014).

To improve adoption rates, policymakers and development actors should focus on strengthening extension services, ensuring access to quality inputs, and upgrading market infrastructure. Bett et al. (2019) emphasize the importance of gender-sensitive interventions to promote inclusive participation,

while value addition and product diversification can help boost the economic attractiveness of finger millet.

While these studies offer valuable insights, most focus on East African countries such as Kenya and India. There is limited empirical data on the adoption of finger millet innovations in Malawi. Additionally, many existing studies use solely quantitative methods, whereas this study employs a mixed methods approach to capture both statistical trends and contextual perceptions. This creates a methodological and geographical gap that this research aims to address by examining how Malawian farmers adopt and perceive agricultural innovations in finger millet production. This study will utilize the DOI framework to identify which innovation attributes are the most significant barriers and at which stage of the decision-making process Malawian farmers encounter stalls.

2.5 Consumption of finger millet among vulnerable groups

The consumption of nutritious foods by vulnerable groups is not automatic; it is influenced by the four pillars of food and nutrition security. Finger millet (Eleusine coracana) is widely recognized for its nutritional richness. It is essential for people, especially vulnerable groups such as children under five, pregnant women, and lactating mothers, as it is high in dietary fiber, calcium, iron, and antioxidants, all of which are crucial for physical development and overall health. However, its availability and access within households do not guarantee its utilization by those who need it most.

Research has found that finger millet improves bone health, strengthens immunity, and aids digestion due to its high fiber content. Similarly, studies have highlighted the presence of sulfur-containing amino acids, which are comparable to those found in milk, making it suitable for individuals with milk allergies and lactating mothers.

Despite its nutritional benefits, finger millet consumption among vulnerable groups varies widely. Sharma et al. (2020) reported that in some rural areas, children and the elderly often eat finger millet because of its digestibility and health benefits. However, Maharajan, Ceasar and Ajeesh Krishna, (2022) found that only 12% of respondents reported feeding finger millet to children daily, and pregnant or lactating women often did not eat it themselves, even though it was prepared for the household. This contrast highlights a gap in how food is shared within families and points to a need for better nutrition education, revealing a significant gap in intra-household utilization.

Cultural and economic factors further limit access. In some communities, it is regarded as a lower-status food compared to maize or rice (Jain & Jain 2017). A subjective norm can discourage consumption, especially in urban households. This view may reduce intake, particularly among wealthier or city-based families who prefer commercially processed grains. Sharma et al. (2020) also observed that in certain areas, social norms affect how and by whom finger millet is eaten, often excluding pregnant and lactating women from the target group despite their increased nutritional needs.

Accessibility and awareness are also important factors influencing consumption. In a study on consumption patterns conducted in the Koraput district of Odisha, India, a 13% increase in average intake was reported after implementing improved production practices and nutrition awareness campaigns. However, a significant portion of the population still lacks exposure to various preparation methods, relying mainly on porridge. This dependence limits dietary diversity and discourages broader adoption among younger groups, who favor modern foods. Furthermore, the absence of finger millet in some urban markets and its higher cost compared to subsidized maize can restrict access for low-income households.

Innovations in product development may increase consumption. Verma & Patel,(2013), emphasized that incorporating finger millet into bakery products, such as biscuits, enhances their fiber and

micronutrient content. A lack of awareness and preparation methods also hinders utilization. (Maharajan, Ceasar & Ajeesh Krishna 2022) Noted a reliance on porridge, which limits dietary variety. Innovations in product development, such as incorporating finger millet into bakery products, can improve accessibility and utilization by making it more appealing.

While multiple studies highlight the nutritional value and potential of finger millet (Rashim, 2015; Ajeesh Krishna et al. 2022; Maharajan et al. 2022), most research has been conducted in India and other Asian countries. Very few studies have focused on finger millet consumption specifically among vulnerable groups in Malawi, where cultural and economic contexts may differ. Furthermore, most studies use quantitative surveys but rarely explore qualitative insights into household decision-making and food choices. This study aims to fill a geographical, methodological, and contextual gap by focusing on Malawian communities using a mixed-methods approach. It will apply the Food and Nutrition Security Framework to examine how constraints on availability, access, utilization, and stability limit consumption among the most vulnerable in Malawi.

2.6 Conceptual framework

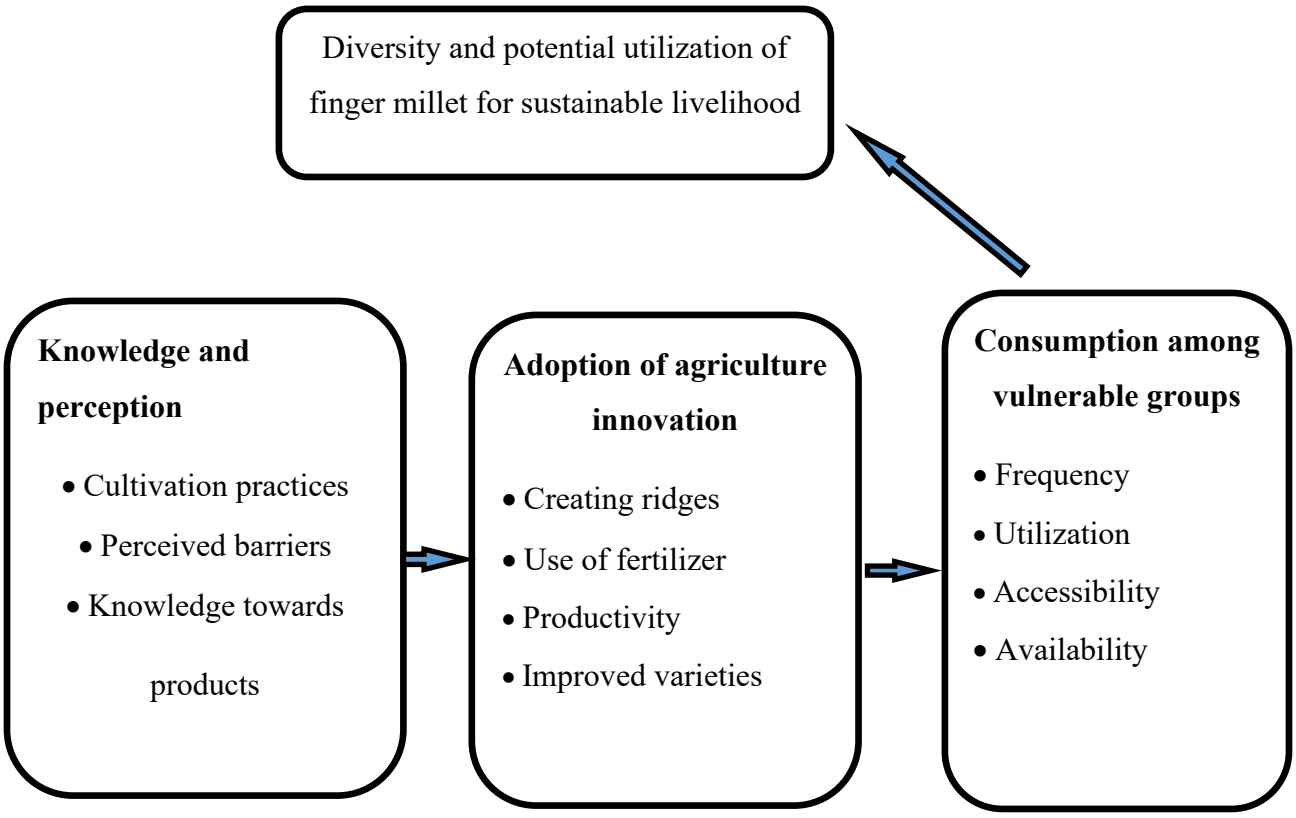

Figure 1: Conceptual Framework on the Diversity and Potential of Finger Millet Utilization for Sustainable Livelihood

The conceptual framework (Figure 1) shows how finger millet cultivation and use contribute to sustainable livelihoods. The process starts with farmers' knowledge and perceptions of the crop, which form the basis for their decision to adopt agricultural innovations. Adopting these improved practices directly increases productivity and yields. This higher production improves availability and supports consumption, especially among vulnerable groups like children, pregnant women, and breastfeeding mothers. Because of the crop's high nutritional value, this consumption improves nutrition, health, and household income—key components of a sustainable livelihood. The whole process is influenced by external factors, including barriers (e.g., unpredictable weather, high costs) and enablers (e.g., extension services, supportive policies), which can either hinder or help progress at each stage.

2.7 Summary of the Chapter

Chapter Two examined theories and research related to finger millet knowledge, innovation adoption, and consumption among vulnerable populations. It noted that although finger millet is nutritious and climate-resilient, its use remains low due to limited farmer awareness, negative perceptions, and low adoption of improved practices. Vulnerable groups also face challenges in consumption due to cultural beliefs, accessibility issues, and a lack of targeted nutrition education. Most existing studies are from outside Malawi and often employ narrow methods, resulting in gaps in context and methodology. This study aims to fill these gaps by focusing on Malawi and employing a mixed-methods approach to produce more relevant insights for policy and practice. In Chapter 3, I will describe the methodological approaches used to assess the diversity and potential of finger millet utilization for sustainable development.

CHAPTER THREE: METHODOLOGY

3.1 Chapter Introduction

This chapter presents the research methodology used in this study, explaining the approach taken to evaluate the diversity and potential of finger millet for sustainable livelihoods in Malawi. It covers the study area, research design, sampling methods, data collection techniques, and data analysis processes. A mixed-methods approach combining quantitative and qualitative methods was employed to gain a thorough understanding of the adoption of agricultural innovations, farmers' knowledge and perceptions, and finger millet consumption among vulnerable groups.

3.2 Study Area

This study was conducted in two Extension Planning Areas (EPAs), Nchenachena and Bolero, located in Rumphi District under the Mzuzu Agricultural Development Division (ADD). The region receives about 180.96 millimeters of rainfall across 161.84 rainy days, accounting for 44.34% of the year. Finger millet is a major crop grown in these areas (Chinsinga 2009). According to the Malawi Government (2020), finger millet production in the region increased from 715 kg/ha in 2012 to 759 kg/ha in 2017. These EPAs were specifically chosen because of their high levels of finger millet cultivation.

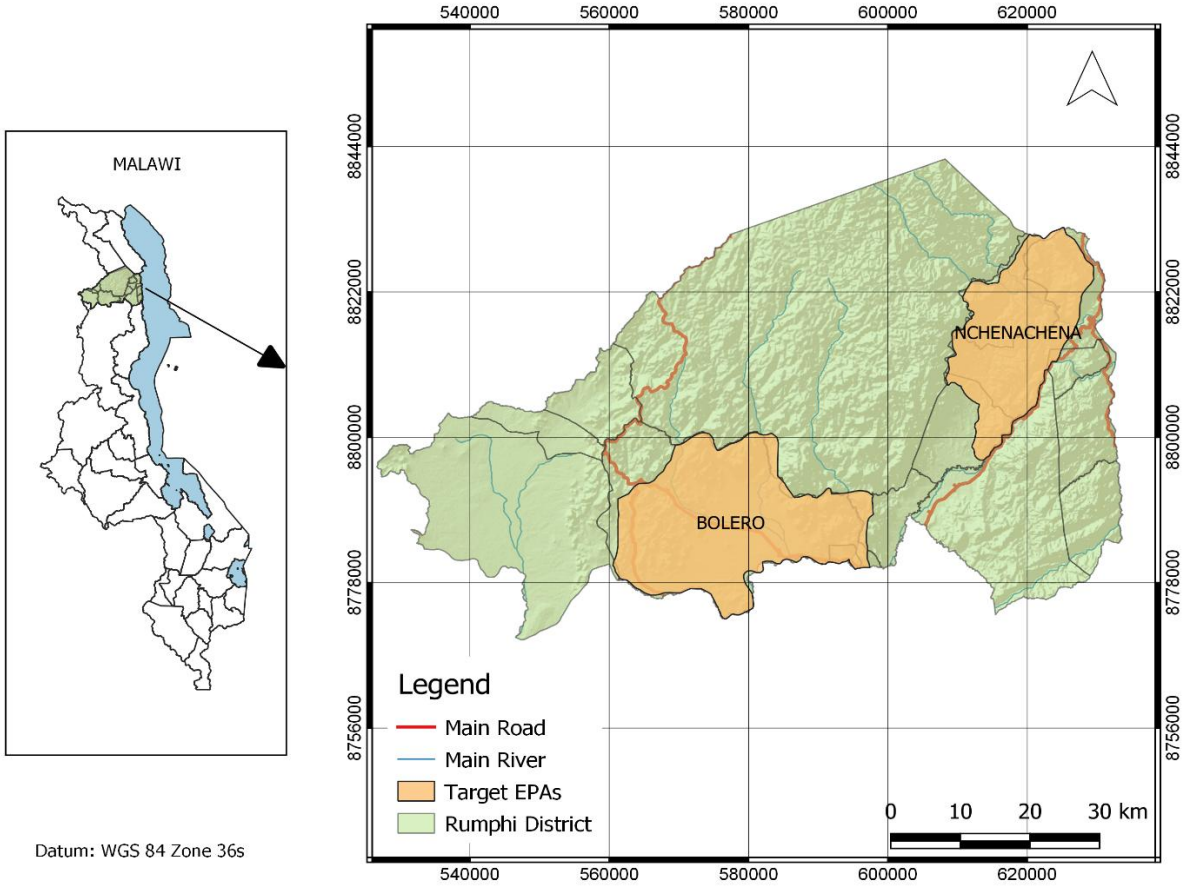

Figure 2: Map showing the study area, Bolero and Nchenachena EPA

3.3 Research approach and design

The study used an explanatory sequential design with a mixed-methods approach. This design was suitable because it allowed for collecting both quantitative and qualitative data within a set timeframe, providing a comprehensive understanding of how agricultural innovations are adopted in finger millet cultivation, along with farmers' knowledge and perceptions, and the consumption levels of finger millet among vulnerable groups in Malawi (Creswell and Angeles 2011). A mixed-methods approach facilitates triangulation of findings, leading to a more robust and detailed analysis of the research objectives (Creswell & Angeles 2011). The quantitative method was used to collect numerical data on the adoption of agricultural innovations, production levels, knowledge, perceptions, and consumption

patterns. This enabled the study to produce measurable insights through statistical analysis, thereby supporting the generalizability of the results to a larger population (Dawadi, Shrestha & Giri 2021). Structured questionnaires collected data from sampled farmers, including variables such as farm size, input use, and yield outcomes.

The qualitative approach, on the other hand, was used to complement the quantitative findings and provide deeper insights. Through key informant interviews and focus group discussions, qualitative data helped capture farmers' attitudes, perceptions, and experiences regarding finger millet cultivation and consumption. This approach allowed the study to understand the socio-cultural and economic factors influencing the adoption of finger millet, providing a richer contextual interpretation of the quantitative data (Fetters 2016). By combining the post-positivist and interpretivist paradigms, this mixed-methods design ensured methodological flexibility and improved the validity of findings (Enosh & Tzafrir 2014). The study's design enabled both a broad quantitative assessment and in-depth qualitative exploration, ensuring a comprehensive understanding of the factors influencing finger millet utilization in Malawi.

3.4 Study population

The study population consisted of smallholder farmers involved in finger millet cultivation and use in Nchenachena and Bolero EPAs. These areas were intentionally chosen for their suitability for finger millet farming based on their agro-ecological conditions. The population includes both men and women of different ages and socioeconomic backgrounds, with some directly or indirectly involved in finger millet farming, processing, and consumption. The aim was to gather diverse views on adopting agricultural innovations, consumption habits among vulnerable groups, and knowledge of finger millet production. Key informants were also included to provide valuable insights into the promotion and use of finger millet within the communities.

3.5 Sample size and sampling technique

3.5.1 Sample size

Choosing the right sample size is essential for ensuring the study's results are statistically sound and representative of the target population. For this research, Cochran's sample size formula for a known population was used to determine the needed sample size. Cochran (1977) offers a popular formula for calculating the minimum number of respondents required for reliable statistical inference. The formula is shown as follows:

$$n = \frac{Nz^2(P)(1-P)}{Ne^2 + z^2(P)(1-P)}$$

Where:

- **n** = Required sample size
- **N** = Total population size (19,028)
- **Z** = Critical Z-value at a 95% confidence level (1.96)
- **P** = Estimated proportion of the population with the attribute under study (assumed to be 0.5 for maximum variability)
- **e** = Margin of error (0.05)

After calculation, the necessary sample size was found to be 377 respondents. However, due to field constraints, only 353 respondents were successfully interviewed.

Cochran's formula is especially useful for large populations because it guarantees that the chosen sample is statistically representative and reduces sampling errors (Bartlett, Kotrlik, & Higgins 2001).

Table 1:Sample size distribution of Bolero and Nchenachena EPA

EPA	Section	Number of respondents
Nchenachena	Nchenachena A	30
	Mweyeye	25
	Mphachi	32
	Salawe	34
	Junju	32
	Sub-total	**153**
Bolero	Bolero A	20
	Bolero B	38
	Jalira	40
	Chozoli	42
	Luviri	40
	Sub-total	**200**
	Total sample	**353**

3.5.2 Sampling technique

A three-stage sampling method was used in this study to ensure a representative selection of finger millet farmers in the targeted areas. This approach combined purposive sampling and simple random sampling, creating a structured yet flexible selection process that improves the validity of the results (Etikan, Musa, & Alkassim 2016).

Stage 1: Purposive Sampling of EPA. Purposive sampling was used to select two Extension Planning Areas (EPAs), Nchenachena and Bolero, in Rumphi District. These EPAs were chosen based on their

significant involvement in finger millet production, as documented by agricultural reports and previous studies (Chinsinga 2009; Malawi Government 2020). Purposive sampling helps select study locations where the research topic is most relevant, ensuring that the collected data provides meaningful insights into the research objectives (Patton 2002).

Stage 2: Simple random sampling of sections. Within each selected EPA, simple random sampling was used to choose villages from the identified sections. Random selection at this stage reduced selection bias and ensured a diverse range of farming households participated in the study (Singh & Masuku 2014).

Stage 3: Random Sampling of Farmers. After selecting villages, random sampling was again used to choose individual finger millet farmers for interviews. A sampling frame of registered finger millet farmers was obtained from local agricultural extension offices, and a random selection was made to ensure fairness in respondent selection. This method helps reduce systematic bias and ensures that the data collected represent the broader farming community (Kumar 2011).

This three-stage sampling approach ensured that the study captured a broad range of experiences and perspectives on finger millet production, adoption of agricultural innovations, and consumption patterns. Using a combination of purposive and random sampling provided a balance between targeted selection based on relevance and unbiased participant selection, making the results more reliable and applicable to similar farming communities.

3.6 Data collection methods

Specifically, the study used a structured survey questionnaire, key informant interviews, and focus group discussion guides as the main data collection tools. Before collecting the main data, the research instruments questionnaire, key informant interview, and focus group discussion guides were pilot-tested to ensure clarity, reliability, and relevance. The pilot study was conducted in a community outside the

study areas but with characteristics similar to Nchenachena and Bolero EPAs. A total of 15 respondents took part in the pilot. Feedback from the pilot helped improve question wording, sequence, and response options for better understanding and consistency.

3.6.1 Survey questionnaire

The study mainly used a structured questionnaire to gather primary data from finger millet farmers in the selected areas. A survey questionnaire is a common tool in agricultural research because it enables systematic collection of both quantitative and qualitative data from many respondents, ensuring responses are consistent and comparable (Creswell & Creswell 2018). The semi-structured questionnaire was designed to collect information on the study's main goals, including farmers' adoption of agricultural innovations, their knowledge and perceptions of finger millet, and finger millet consumption among vulnerable groups.

Face-to-face interviews were conducted using semi-structured questionnaires administered via KoboToolbox, a digital data collection platform that enables efficient and accurate field data collection. The use of Kobo Toolbox improved data reliability by minimizing errors related to manual data entry and enabling real-time monitoring of responses (KoBoToolbox 2023). This approach allowed the study to collect both numerical data for statistical analysis and contextual information to better interpret the findings.

A semi-structured questionnaire was developed as the primary tool for collecting quantitative data. The complete questionnaire, including all questions and response options, is provided as Appendix B of this thesis. This instrument was designed to gather data on the key variables listed below.

3.6.2 Key Informant Interviews

Key informant interviews (KIIs) were conducted to gather qualitative data from individuals with expertise in finger millet cultivation, agricultural innovation adoption, and food security. KIIs are a

valuable qualitative research method that enables in-depth exploration of topics from the perspective of individuals with specialized insights on the subject (Kumar, 2019). Four KIIs were conducted in the study area(s). The key informants were purposively selected based on their expertise, professional roles, and direct involvement with finger millet systems in the selected EPAs. Two agricultural extension officers (one from each EPA) and two experienced farmers, chosen for their extensive historical and practical knowledge, actively engaged in finger millet cultivation. These key informants were purposefully selected based on their expertise, practical experience, and involvement in agricultural extension services and millet farming. The interviews aimed to examine key factors influencing the adoption of agricultural innovations, the challenges farmers face in millet production, market dynamics, and the role of agricultural policies in supporting finger millet farming.

3.6.3 Focus group discussions

Focus Group Discussions (FGDs) were also used to gather qualitative data on farmers' perceptions, knowledge, and experiences related to finger millet cultivation, consumption, and agricultural innovations. FGDs are a valuable qualitative research method for capturing group perspectives, encouraging discussion, and revealing shared experiences among participants (Krueger & Casey 2015). The study conducted 6 FGDs, 3 in each EPA, with 8 to 10 participants per group. The participants were finger millet farmers selected to represent diverse demographic groups, including male and female farmers, small-scale and larger-scale producers, and individuals with varying levels of experience in millet farming. This diversity ensured a wide range of perspectives on adopting agricultural innovations and the role of millet in household food security and nutrition. The discussions were recorded with participants' consent and later transcribed for thematic analysis. The insights gained from the FGDs added depth to the study by providing a collective view of finger millet production and its importance in sustainable livelihoods.

3.7 Variables and Measurement

The study's dependent variables include finger millet yield (measured in kg/ha), adoption of specific agricultural innovations (a Yes/No dichotomy for each practice), and consumption frequency among vulnerable groups (rated on an ordinal scale from daily to never). Independent variables encompass farmer and farm characteristics such as age, gender, education level, household size, farming experience, farm size, and access to extension services. Key agricultural innovation variables include the use of improved seeds, organic and inorganic fertilizers, and conservation tillage. Knowledge and perception attributes are assessed using a 5-point Likert scale. A comprehensive summary is provided in Table 2.

Table 2: Variables and measures

Variable Category	Variable Name	Measurement Scale
Dependent Variables	Finger Millet Yield	Continuous (kg/ha)
	Adoption of Innovation	Dichotomous (Yes/No)
	Consumption Frequency	Ordinal (Daily to Never)
Independent Variables	Age	Continuous (Years)
Farmer & Farm Characteristics	Gender	Nominal (Male/Female)
	Education Level	Ordinal (None to Tertiary)
	Farming Experience	Continuous (Years)
	Farm Size	Continuous (Hectares)
	Access to Extension	Ordinal (Never to Frequently)
Independent Variables	Use of Improved Seeds	Dichotomous (Yes/No)
Agricultural Innovations	Use of Organic Fertilizer	Dichotomous (Yes/No)
	Use of Inorganic Fertilizer	Dichotomous (Yes/No)
	Use of Conservation Tillage	Dichotomous (Yes/No)
Knowledge & Perception Variables	Knowledge	Likert Scale (1–5)
	Perception	Likert Scale (1–5)

3.8 Data analysis

The data were analyzed using a mixed-methods approach, where both quantitative and qualitative data were analyzed separately and then integrated to provide a comprehensive understanding of the research

problem. The analysis was organized around the three specific objectives of the study, allowing for triangulation of findings and enhancing the reliability and validity of the results (Creswell & Plano Clark 2018).

3.8.1 Quantitative data analysis

Quantitative data collected through structured questionnaires were processed, cleaned, and analyzed using the Statistical Package for Social Sciences (SPSS) version 20 and Microsoft Excel. Microsoft Excel was used to generate graphs and tables. Descriptive statistical techniques summarized the data and provided insights into the key variables. Measures such as means, standard deviations, frequencies, percentages, and cross-tabulations described farmers' adoption of agricultural innovations, their knowledge and perceptions of finger millet, and the consumption levels of finger millet among vulnerable groups.

3.8.1.1 Chi-Square Test for Independence

A Chi-square (χ^2) test was performed to analyze the relationship between categorical variables. Chi-square analysis was used to assess the connection between education, farmer size, experience, and access to information regarding the adoption of agricultural innovation. The Chi-square test statistic is provided by:

$$\chi^2 = \frac{(O-E)^2}{E} \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.1)$$

A significance level of 0.05 was used to determine whether the observed associations were statistically significant (Agresti 2018).

3.8.1.2 Regression analysis

A multiple linear regression analysis was performed to evaluate the impact of various agricultural innovations on finger millet yield.

The regression model was specified as

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \epsilon_i \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.2)$$

Where:

- Y_i= finger millet yield in kilograms
- X_1= Agriculture innovations adopted
- β_0 =Intercept
- $\beta_1\beta_2\beta_3$ = Coefficients of independent variables
- ϵ_i=Error term

3.8.1.3 Likert scale data analysis

The study used various analytical methods to evaluate farmers' knowledge and perceptions of finger millet. To gather attitudes and opinions, a Likert scale was applied, enabling respondents to indicate their level of agreement or disagreement with statements about finger millet production and consumption. These responses were initially analyzed using descriptive statistics, primarily by calculating the average score for each item on the scale. This provided an overview of the general trends in participants' knowledge and perceptions.

For a more detailed comparison across respondent groups, the study employed the Kruskal-Wallis Test, an alternative to one-way analysis of variance (ANOVA). Because Likert-scale data are ordinal, parametric tests such as the t-test and analysis of variance are not applicable. The Kruskal-Wallis Test is used to assess whether there are statistically significant differences among the medians of three or more independent groups. While ANOVA assumes normality and compares means, the Kruskal-Wallis Test ranks the data and compares the distributions of ranks across groups, making it ideal for ordinal data (Edriss, 2013). The Kruskal-Wallis Test`s two main hypotheses, the null hypothesis (H_o) and the alternative hypothesis (H_1), are presented as follows:

$$H_o: \mu_1 = \mu_2 = \mu_3 \ldots . \mu_m \quad Population\ have\ identical\ medians \ldots\ldots\ldots\ldots\ldots \quad (3.3)$$

$$H_a: \mu_1 \neq \mu_2 \neq \mu_3 \ldots . \mu_m \; Populations\ do\ not\ all\ have\ the\ same\ median\ldots. \quad (3.4)$$

3.8.2 Qualitative Data Analysis

Thematic analysis was applied to data from Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs). The process involved: Familiarization, where audio recordings were transcribed verbatim and read repeatedly to gain a deep understanding of the data. Coding: Initial codes were generated from the transcripts using NVivo 14. Codes served as descriptive labels for key ideas. Theme Development: Codes were collated and grouped into potential themes that directly related to the study objectives (e.g., "Themes under Barriers to Adoption," "Themes on Cultural Perceptions," "Themes on Nutritional Knowledge"). Integration with Quantitative Findings: The qualitative themes were used to explain, contextualize, and elaborate on the quantitative results. For example, if regression showed low adoption of improved seeds, qualitative data explored reasons such as cost, availability, or distrust, providing the why behind the numbers.

3.8.3 Analytical procedures

The knowledge and perspective of farmers on finger millet and millet products.

Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the socio-demographic characteristics of the farmers and their general knowledge levels. Likert Scale Analysis summarized responses from Likert scale questions on perceptions using descriptive statistics (mean scores). The internal consistency of the Likert scale was assessed with Cronbach's Alpha. The Kruskal-Wallis H Test, a non-parametric test, was employed to determine if there were statistically significant differences in median perception scores across different farmer groups (e.g., based on location (EPA), gender, or experience level). This test is appropriate for ordinal data, such as Likert scales.

Farmers' adoption of agriculture innovations on the productivity of finger millet cultivation.

Descriptive statistics, including frequencies and percentages, were used to calculate adoption rates for each agriculture innovation (e.g., the percentage of farmers using improved seeds). The Chi-Square Test of Independence was employed to examine the relationship between the adoption of specific innovations (categorical: Yes/No) and farmer characteristics, such as education level, access to information, and farm size (categorical groups). For example, it was used to determine if the adoption of improved seeds is independent of a farmer's education level. Multiple linear regression was the primary method for this objective. It was used to assess the collective and individual effects of several agricultural innovations on finger millet yield.

The level of finger millet consumption among vulnerable groups.

Descriptive Statistics: Frequencies, percentages, and cross-tabulations were used to summarize and visualize the consumption levels of finger millet among children under five, pregnant women, and lactating mothers. This offers a clear overview of how often and in what form finger millet is consumed.

3.9 Diagnostic tests and Quality assurance

To ensure the rigor and credibility of the study's findings, a series of diagnostic tests was conducted to validate the reliability, stability, and validity of the models and survey instruments used. These tests improved the robustness of the study's results and provided confidence that the methods applied were suitable for the data collected.

3.9.1 Consistency and reliability test

Cronbach's alpha was used to assess the internal consistency and reliability of the Likert-scale items measuring knowledge and attitudes toward finger millet products. Cronbach’s alpha is employed to examine the internal consistency or reliability of summated rating scales (Cronbach 1951). It is the most common estimate of the internal consistency among items in a scale. A Cronbach`s alpha value above 0.7 is generally considered acceptable, indicating that the items reliably measure the same underlying

construct. The test ensured that the survey instrument was reliable and that respondents interpreted the questions consistently, thereby enhancing the credibility of the Likert-scale-based results.

3.9.2 Normality Test

A normality test was performed to assess whether the data followed a normal distribution, which is a key assumption for many statistical analyses. When normality could not be assumed, non-parametric methods such as the Kruskal-Wallis test were used. The results of the normality test justified the selection of appropriate statistical methods, ensuring that suitable models were applied to the data.

3.10 Methodological Limitations

While this study employed a robust mixed-methods approach, several limitations were identified. The cross-sectional design limited the ability to determine causality between innovation adoption and productivity outcomes. Data were gathered from farmers' recall, which could have introduced recall bias, especially concerning yield and input use. Additionally, due to financial and logistical constraints, only two EPAs were included, restricting the applicability of the results to other regions. Although the qualitative data were detailed, they came from a small number of participants, which might not fully represent all community perspectives. Despite these limitations, combining different data sources improved the validity and reliability of the results.

3.11 Ethical consideration

Ethical approval was obtained from MZUNIREC before data collection (MZUNIREC/DOR/24/111). .Ethical considerations were applied, especially when working with minors and vulnerable respondents. Consent will be obtained from the district council office, the AEDC for Nchenachena, and Bolelo EPA.

Participants provided informed consent for the research; consent was voluntary. Voluntary consent was obtained after providing a full explanation of what the research involved. Participant confidentiality

during data collection was maintained. The anonymity and confidentiality of participants were maintained by not disclosing their names in the results presented.

CHAPTER FOUR: RESULTS

Chapter Introduction

This chapter presents the study's findings in line with the research objectives. The results are organized around key thematic areas, including the social demographic characteristics of the respondents, farmers' adoption of agricultural innovations for finger millet cultivation, their knowledge and perceptions of finger millet and its products, and the consumption levels of finger millet among vulnerable groups. Descriptive and inferential statistical analyses are used to present the data, while qualitative insights from focus group discussions and key informant interviews are integrated to add depth to the findings. Tables and figures are included to improve clarity and facilitate comparisons.

4.1 Social-demographic data of the respondents

The socio-demographic characteristics of the respondents are shown in Table 3. The sample includes nearly equal numbers of male (49.6%) and female (50.4%) participants. Most respondents (27.5%) are in the 36-45 age group, closely followed by those aged 46-55 (27.2%). Education levels differ among respondents, with the majority (57.2%) having only primary education, while 34% have completed secondary school. Farming remains the main source of income, representing 88.1% of respondents, underscoring the importance of agriculture in the livelihoods of the surveyed population.

Table 3: Social demographic data for Bolero and Nchenachena EPA

Variable	Description of the variable	Percentage
Gender	Male	49.6
	Female	50.4
Age	19	0.3
	20-35	17
	36-45	27.5
	46-55	27.2
	56-65	18.7
	Above 65	9.1
Education level	Adult literacy	1.1
	No education	5.1
	Primary	57.2
	Secondary	34
	Tertiary	2.5
Main source of income	business	5.4
	Farming	88.1
	Formal employment	3.1
	Piece work (ganyu)	3.4

Furthermore, the study also examined respondents' farm sizes, years of experience in finger millet cultivation, and the portion of land dedicated specifically to finger millet production in Nchenachena and Bolero. The results are shown in Table 4. Farm sizes among respondents ranged from 0.5 to 13

acres, with an average of 3.72 acres and a standard deviation of 1.65. The land allocated to finger millet cultivation varied from 0.1 to 5 acres, with an average of 0.76 acres and a standard deviation of 0.74 acres. Respondents had an average of 5 years of experience in finger millet farming, ranging from 1 to 43 years. Qualitative insights from a focus group discussion provided reasons for the small land allocation.

> *"We allocate limited land to finger millet because it is labor-intensive, making harvesting and processing difficult. Finger millet is not considered a main crop, with farmers focusing on staples like maize. The market for finger millet is unstable, discouraging large-scale cultivation due to unpredictable prices and demand. Additionally, agricultural extension workers rarely promote finger millet, instead concentrating on crops like maize that receive more attention and support". (FGD 002, 0001)*

Table 4: Farm size, experience and land allocation for finger millet production in Nchenachena and Bolero EPA

	Min	Max	Max	Std. Deviation
Total farm size owned (acres)	0.5	13	3.72	1.65
Experience in finger millet cultivation (years)	1	43	5.29	6.62
Land size allocated to finger millet production (acres)	0.1	5	0.76	0.74

4.2 Knowledge and perspective of farmers toward finger millet and millet products

4.2.1 Farmers' knowledge of finger millet in Nchenachena and Bolero EPA

The results in Table 4 reveal the diversity in farmers' knowledge levels about finger millet and its products. Most farmers reported having little or no knowledge (26%), followed by moderate to limited knowledge (18.7%), while only a small percentage considered themselves very knowledgeable (2.8%).

Table 5: Farmers knowledge on finger millet cultivation and its products

Variable	Percent
Very knowledgeable	2.8
Knowledgeable	27.4
Moderately knowledgeable	18.7
Slightly knowledgeable	26
Not knowledgeable	25.1

The results in Table 6 show a clear link between farming experience and knowledge of finger millet. A Pearson chi-square test confirmed this relationship was statistically significant ($\chi^2 = 28.355$, $p = 0.005$). Farmers with less than 10 years of experience mostly fall into the categories of not knowledgeable or slightly knowledgeable. The highest percentage of knowledgeable farmers is found among those with 11–15 years of experience. Additionally, the most experienced farmers, those with over 15 years of practice, have the highest share of individuals classified as very knowledgeable.

Table 6: Effect of Experience on Knowledge of Finger Millet Cultivation

Years	Knowledgeable	Moderately knowledgeable	Not knowledgeable	Slightly knowledgeable	Very Knowledgeable
1-5	13	10	27	22	1
6-10	21	18	30	30	2
11-15	36	19	15	28	2
15above	27	18	17	12	5
Pearson chi-square=28.355				p-value=0.014	

Results in Table 7. Respondents were asked to express their level of agreement with statements about their diversity in level of knowledge on finger millet and finger millet products on a Likert scale.

Results presented in Table 7 offer insights into farmers' diverse knowledge levels regarding finger millet and its products. On average, respondents held a neutral stance on most knowledge-related aspects. Farmers showed relatively higher knowledge of the nutritional benefits of finger millet products and traditional or modern processing methods, both with mean scores of 3. Similarly, understanding of agronomic practices and market potential remained within the neutral range. Awareness of different finger millet varieties had the lowest mean score (3.20).

A Cronbach`s alpha of 0.789 indicates strong internal consistency among the five statements about knowledge. This suggests that the statements are assessing the same underlying construct and are highly correlated. A key informant interview provided context to these findings:

'We know that finger millet is good for our health and that it gives us strength, especially when eaten as porridge or thobwa. However, when it comes to different varieties or marketing, most of us do not know much; we just plant the ones we have always used EPA". (kll 002, 0002)

Table 7: Knowledge levels on finger millet and its products

#	Parameters	Mean	SD	Cronbach Alpha
1	Varieties of finger millet	3.20	0.990	0.789
2	Nutritional benefits of finger millet products	3.54	1.030	
3	Agronomic practices needed to grow finger millet	3.24	0.978	
4	Processing methods for finger millet	3.54	1.030	
5	Market potential for finger millet	3.28	1.062	

Key (Mean): 1.00-1.79=Strongly Disagree, 1.80-2.59=Disagree, 2.60-3.39=Neutral, 3.40-4.91=Agree, 4.20-5.00=Strongly Agree

4.2.2 Farmers' knowledge of finger millet nutrition components in Nchenachena and Bolero EPA

The results in Table 8 highlight a significant gap in farmers' understanding of finger millet's main nutritional benefits. While most (44.0%) correctly identified carbohydrates as a key component, awareness of their more unique health advantages was notably low. Importantly, only 16.6% of farmers linked finger millet to its high mineral content (iron and calcium), and just 6.3% recognized its dietary fiber, even though these are among its most celebrated nutritional benefits for fighting malnutrition and supporting health.

Table 8: Knowledge of farmers on finger millet nutrition components

Nutrients	Percent
Proteins	9.50
Vitamin	18.80
Carbohydrates	44.00
Fiber	6.30
Minerals (iron and calcium)	16.60
I do not know	4.90

4.2.3 Farmers' Perception towards finger millet and finger millet products in Nchenachena and Bolero EPA

Farmers' perceptions were assessed on a 5-point Likert scale. The responses, shown in Table 9, reveal a mostly positive attitude. Farmers strongly agreed that finger millet farming is profitable and increases smallholder farmers' income (mean=3.97), and they acknowledged it as a nutrient-rich cereal (mean=3.94). There was a strong willingness to recommend finger millet cultivation to others (mean=4.03). The perception that finger millet is underused (mean=3.88) and adaptable to climate

change (mean=3.84) was also high. The Cronbach's alpha of 0.672 indicates moderate internal consistency.

A key informant highlighted the economic potential.

> *"Finger millet has a high market value and is very profitable," explained an important informant. "Even though it is not cultivated on a large scale, the demand is extremely high, and we sometimes need to buy from Zambia just to meet local demand. I sell mine at 35,000 MWK per 20-liter bucket, and people are willing to buy because they recognize its worth. With the money I earned from selling finger millet, I was able to build a house. If more farmers understood this, they would take finger millet more seriously." (Kll 001,0001)*

Table 9: Farmers' perceptions of finger millet and its products

Perception	Mean	SD	Cronbach Alpha
I am willing to adopt finger millet as a staple crop in my household.	3.31	1.00	0.672
I believe more farmers should grow finger millet to promote sustainable livelihoods.	3.82	0.87	
I prefer finger millet products over other cereal-based products.	3.31	0.93	
I am open to trying out new products made from finger millet.	3.92	0.70	
I would recommend finger millet cultivation to other farmers in my community	4.03	0.66	
Finger millet is adaptable to climate change.	3.84	0.76	
Finger millet is underutilized compared to other grains	3.88	0.67	
Finger millet farming is profitable and contributes to an increase in smallholder farmers' income	3.97	0.77	
Finger millet is a nutrient-dense cereal crop known for its numerous health benefits.	3.94	0.62	

Key (Mean): 1.00-1.79=Strongly Disagree, 1.80-2.59=Disagree, 2.60-3.39=Neutral, 3.40-4.19=Agree, 4.20-5.00=Strongly Agree

The Kruskal-Wallis test was conducted, as shown in Table 10, to assess whether there are significant differences in perceptions of finger millet and its products among farmers from different Extension Planning Areas (EPAs) and by gender. The results revealed a statistically significant difference in perceptions between the two EPAs (p-value = 0.000), indicating that farmers from Bolero and Nchenachena hold different views on the crop and its products. Conversely, no significant difference in perceptions was found between male and female farmers (p-value = 0.087), which exceeds the 0.05 threshold.

Table 10: Kruskal-Wallis Test Results on Perception by EPA and Gender in Nchenachena and Bolero EPA

	Variable	N	Mean Rank	p-value
Perception by EPA	Bolero	200	154.69	*0.000*
	Nchenachena	153	206.16	
Perception by gender	Female	175	167.6	0.087
	Male	178	186.16	

Key: $H_{o(\text{null hypothesis})}$=No significance difference between the age groups (Reject H_o if p-value <0.05)

4.2.4 Challenges to finger millet cultivation and utilization in Nchenachena and Bolero EPA

The results in Table 11 reveal that finger millet farmers encounter a variety of agronomic, economic, and systemic obstacles. The two most significant challenges, unpredictable weather (19.3%) and a lack of quality seeds (19.0%), are core production issues that directly limit yield potential from the outset. Additionally, when combined, market limitations and knowledge gaps restrict market access by 14.7% and knowledge by 14.6%, respectively, forming a notable secondary barrier of nearly 30%.

Table 11: Challenges to finger millet cultivation and utilization

Challenges	Percent
low productivity	15.70
limited market access	14.70
Pests and diseases	13.20
lack of quality seeds	19.00
No knowledge	14.60
Unpredictable weather	19.30

4.3 Farmers' adoption of agriculture innovations on the productivity of finger millet cultivation

4.3.1 Awareness of agriculture innovations in Nchenachena and Bolero EPA

The results presented in Table 12 show that a foundational level of awareness exists, with a majority of farmers (63%) familiar with agricultural innovations. However, over a third of farmers (37%) remain unaware**.**

> *"Extension efforts in agricultural innovation have mainly focused on maize production rather than finger millet. Most of our demonstrations, training sessions, and input support programs prioritize maize because it is considered the primary staple. Finger millet is often neglected, despite its great potential for nutrition and market value. Many farmers lack sufficient information or technical support to improve finger millet production, which limits their adoption of better practices". (KII 001,0002)*

Table 12: Awareness of agricultural innovations in Nchenachena and Bolero EPA

Aware	Percent
No	37
Yes	63

4.3.2 Determinants influencing the adoption of agricultural innovations in Nchenachena and Bolero EPA

A chi-square test was performed to examine the relationship between various factors and the adoption of agricultural innovations. The results, shown in Table 13, indicate that farm size ($p = 0.016$) and access to information ($p = 0.001$) are significantly associated with adoption, while education level ($p = 0.264$) and farming experience ($p = 0.638$) are not significantly associated with awareness.

Table 13: The relationship between socioeconomic factors and adoption of agriculture innovations

Factors	Chi-square	p-value
Education	10.016	0.264
Farm size	56.590	0.016
Experience	47.850	0.638
Access to information	82.352	0.001

4.2.3 Agriculture innovations adopted by finger millet farmers in Nchenachena and Bolero EPA

The adoption of agricultural innovations, shown in Table 14, clearly favors management-based practices over genetic or long-term soil investments. The most widely adopted innovations, modern planting methods (19.3%) and fertilizer use (18.2%), are practices that can be implemented within a single season. In stark contrast, the adoption of improved seed varieties, which are essential for productivity growth, is notably low at only 7.1%, indicating a significant bottleneck in the seed system.

> *"In the past, we used to cut down trees, burn them, and plant our finger millet without using any fertilizer. Now, we have learned to plant in ridges and apply a small amount of fertilizer. Too much fertilizer makes the finger millet taste bland" (kll 002,0002).*

Table 14Agriculture innovations adopted by farmers in finger millet cultivation

Innovation adopted	Percent
Improved Varieties	7.1
Water conservation	9.8
Agroforestry	11.3
Pest and disease management	13.5
Planting cover crops	6.9
Creating ridges	14
Modern planting methods	19.3
Use of fertilizer	18.2

4.3.1 Factors Influencing the Adoption of Agriculture Innovations in Nchenachena and Bolero EPA

Table 15 presents the results of various factors influencing farmers' adoption of agriculture innovations. The most significant factor was the potential to boost production (20.7%), followed by enhancing the quality of finger millet (13.7%). However, training (8.4%) had a relatively lower impact.

Table 15: Factors influencing the adoption of agriculture innovation

Influence on adoption	Percent
Knowledge	15
Weather	10.6
Land type	11.1
Training	8.4
Motivation	13.5
Increase production	20.7
Increase the quality of finger millet	13.7

4.3.4 Challenges that affect the Adoption of Agriculture Innovations in Nchenachena and Bolero EPA

Table 16 highlights the barriers to adopting agriculture innovations in finger millet cultivation. The most significant challenge reported by farmers was the labor-intensive nature of some innovations (20.9%), followed by high material costs (19.0%) and lack of knowledge (17.3%). Additionally, limited technical support (17.3%) and financial constraints (13.2%) were noted as barriers.

Table 16: Challenges that affect the adoption of agricultural innovations

Barriers	Percent
Lack of knowledge	17.3
High cost of materials	19
Labour intensive	20.9
Financial constraints	13.2
Lack of technical support	17.3
Lack of training	12.3

4.3.5 Effects of agriculture innovation on finger millet cultivation in Nchenachena and Bolero EPA

A multiple linear regression analysis was conducted to assess the effect of various agriculture innovations on finger millet yield. The results are presented in Table 17. The analysis revealed that three innovations had a statistically significant positive effect on finger millet yield: modern planting methods (p=0.022), the use of improved seed varieties (p=0.027), and the adoption of ridge-based planting techniques (p=0.038). According to one of the farmers, these innovations enhanced productivity.

> *"We have observed improved yields after switching to ridge-based planting and cultivating the Nyamutuwira variety, which was perceived as more productive than traditional varieties such as Upyole."* (*Kll 001,0001)*.

However, other innovations, such as pest and disease management, agroforestry, and plant cover crops, did not show a direct impact on yield.

Table 17: Effect of agriculture innovations on finger millet yield (regression analysis)

Variable	B	Standard Error	p-value
Improved Varieties	.198	.452	.027
Water conservation	.081	.421	.385
Agroforestry	-.042	.432	.677
Pest and disease management	.093	.353	.278
Planting cover crops	.090	.466	.317
Creating ridges	.172	.339	.038
Modern planting methods	.192	.329	.022
Use of fertilizer	-.072	.347	.415

4.4 Level of finger millet consumption among vulnerable groups

4.4.1 Consumption pattern of finger millet in Nchenachena and Bolero EPA

The results in Table 18 reveal a clear difference between occasional consumption and staple food status for finger millet. While most households (90.4%) eat finger millet, only 25.8% consider it a staple food. This gap between sporadic use and dietary importance is also explained by the fact that over two-thirds of households (68.3%) experience challenges that prevent regular consumption.

Table 18: Consumption and accessibility of finger millet products

Parameter	Description	Frequency (%)
Consumption	The farmer's household consumes finger millet products	90.4
Staple	Finger millet as a household staple food	25.8
Challenges	Face the challenges of consuming finger millet regularly	68.3

4.4.2 Frequency of consumption in Nchenachena and Bolero EPA

The data in Table 19 shows how often people in Nchenachena and Bolero eat finger millet. It shows that most people eat finger millet weekly (41.4%), while 30.9% eat it rarely.

Table 19: Frequency of finger millet consumption

Variable	Percent
Dairy	9.1
Weekly	41.4
Monthly	18.7
Rarely	30.9

4.4.3 Forms of finger millet consumption in Nchenachena and Bolero EPA

The results in Table 20 show a wide variety of utilization, indicating that finger millet in Nchenachena and Bolero is used in many forms, with beverages being the most common. Thobwa (a non-alcoholic fermented drink) accounts for 34.6%, and Masese (an alcoholic drink) makes up 13%. Snacks are the least common at 7.1%, reflecting limited processing into ready-to-eat products. A key informant confirmed that beverages made from finger millet are highly favored because they provide energy, are affordable, and hold cultural significance, especially during social gatherings and ceremonies.

Table 20: Forms of finger millet consumption

Form consumed	Percent
Non-alcoholic drink (Thobwa)	34.6
Alcoholic drink (Masese)	13
Porridge	14.90
Nsima	10.30
Snacks	7.10
Mixed with other grains	19.90

Plate 3: Thodwa, a traditional non-alcoholic beverage made from finger millet

Plate 4: Porridge made from finger millet flour

4.4.4 Patterns of Finger Millet Consumption Within Households in Nchenachena and Bolero EPA

The results in Table 21 show finger millet consumption among household members and vulnerable groups, indicating that it is mainly consumed by the entire family, with 68.7% of respondents reporting that all household members eat it equally; however, pregnant and lactating women make up only 10%. One participant from a focus group discussion reinforced this finding, saying that:

> ***"****We consume finger millet just like any other food in our household; we do not prepare it specifically for certain members. In our culture, we share whatever food is available among all family members. We do not have the practice of cooking special meals unless someone is seriously ill. As long as the food is nutritious, everyone eats together. So, even if finger millet is good for children or pregnant women, we do not isolate it for them; we just cook it as we do with any other food and share it equally".(FDG 001, 0002)*

Table 21: Patterns of Finger Millet Consumption Within Households

Groups	Percent
Children (under 5 years)	9.4
Elderly (above 60 years)	11.9
Pregnant and lactating women	10
The entire family equally	68.7

4.4.5 Diverse utilisation of uses of finger millet in Nchenachena and Bolero EPA

The results in Table 22 highlight a remarkable diversity of non-food applications, which underscores the multifaceted potential of finger millet beyond nutrition. Other uses of finger millet besides

consumption, animal feed, and traditional medicine are the most common, at 37.3% and 37.0% respectively. In traditional medicine, focus group participants shared that

> *"Finger millet is used for various treatments. When a child has a stomach tumor, nsima made from finger millet is prepared and applied around the child's stomach as a remedy. Additionally, women who have experienced stillbirths consume nsima mixed with finger millet flour to help restore their menstrual cycle. It is also used to aid children who struggle with bedwetting. Finger millet also holds cultural and ritual significance; some participants revealed that it is used in a traditional practice to determine fidelity in relationships. In this ritual, finger millet is soaked in water; if it sprouts, the person is considered faithful, but if it does not, it is believed they have been unfaithful": (FGD 2: 002,0001)*

Table 22: Diverse utilisation of finger millet

Use	Percent
Animal feed	37.30
Tradition medicine	37.00
Rituals	20.50

4.4.6 Factors Influencing Consumption of Finger Millet in Nchenachena and Bolero EPA

The results in Table 23 show the factors influencing finger millet consumption. The most important factors are taste and flavor (19.9%) and health benefits (19.8%). Affordability and ease of preparation are less influential, with 14.3% and 12.4% of respondents citing these as reasons for consumption.

Table 23: Factors influencing finger millet consumption

Factors	Percent
Taste and flavour	19.90
Health benefits	19.80
Cultural practices	15.70
Availability	17.60
Affordability	14.30
Ease of preparation	12.40

4.4.7 Challenges in Regular Consumption of Finger Millet among Vulnerable Groups in Nchenachena and Bolero

The results in Table 24 highlight the main challenges affecting the regular consumption of finger millet. These include high costs of finger millet (30.0%) and limited availability in markets (20.9%). Additionally, 22.6% of respondents mention a lack of knowledge about preparation methods.

Table 24: Challenges in regular consumption of finger millet among vulnerable groups

Challenges	Percent
High costs of finger millet	30.00
Limited availability in markets	20.90
Lack of knowledge of preparation methods	22.60

4.4.8 Awareness of nutrition and health benefits among vulnerable groups in Nchenachena and Bolero EPA

The results in Table 25 show a high level of awareness about the nutritional and health benefits of finger millet among vulnerable groups. Most respondents (88.4%) reported being aware of these benefits,

indicating that many recognize finger millet as a nutritious food. However, 11.6% of respondents said they were unaware.

Table 25: Awareness on the nutrition and health benefits of finger millet consumption on vulnerable groups

Aware	Percent
Not aware	11.6
Aware	88.4

4.4.9 Perceived benefit consumption of finger millet on vulnerable groups in Nchenachena and Bolero EPA

4.4.9.1 Benefit of finger millet consumption on children in Nchenachena and Bolero EPA

The results in Table 26 show the perceived benefits of finger millet consumption for children, with the most recognized advantages being improved nutrition (21.0%) and increased energy levels (20.9%). Digestive health (10.4%) and immunity boosts (8.7%) are also noted. During FGD, one of the participants said

> *"We give finger millet porridge to our children because it helps them grow strong. It keeps them full and provides energy, especially when they are going to school. Some children used to be weak, but after starting to use finger millet, we noticed they became more active and healthier. Moreover, when they are hungry between meals, we give them Thobwa made from finger millet; it fills them up and keeps them going." (FGD1:002,0002)*

Table 26:The benefit of finger millet consumption on children

Benefit	Percent
Improve nutrition	21.00
Enhance energy levels	20.90
Digestive benefit	10.40
Growth and development	19.70
Weight gain	19.30
Boost immunity	8.70

4.4.9.2 Benefit of finger millet consumption on pregnant women and lactating mothers

The results in Table 27 show the benefits of finger millet consumption for pregnant and lactating mothers. The most common benefit is increased milk production (31.0%), while the least reported is digestive benefits (12.1%). A key informant emphasized that:

> *"Finger millet products are very helpful for both pregnant and breastfeeding women. When a pregnant woman regularly eats finger millet, she is more likely to have a healthy baby. Also, for mothers having trouble with milk supply after birth, drinking Thobwa made from finger millet is thought to help increase milk flow'.(K11 001,002)*

Table 27: The benefit of finger millet consumption on pregnant and lactating mothers

Benefit	Percent
Improved Nutrition	28.80
Enhanced Energy Levels	28.10
Digestive benefit	12.10
Increase milk production	31.00

Chapter conclusion

The results also indicated that although awareness of agricultural innovations was relatively high, actual adoption rates remained low, particularly for improved seed varieties and cover cropping. Factors like access to information and farm size significantly influenced adoption decisions. Innovations such as ridge cultivation and improved seeds were shown to boost productivity, but barriers like labour intensity and cost limited their broader use. Regarding consumption, finger millet was widely consumed, mainly as a beverage and shared equally within households. However, its targeted use among vulnerable groups, such as pregnant and lactating women, was very low, hindered by high costs, limited market availability, and lack of knowledge about preparation methods. Despite these challenges, respondents demonstrated strong awareness of the nutritional benefits of finger millet, especially for children and mothers. The next chapter provides interpretation and discussion.

CHAPTER FIVE: DISCUSSION

Chapter introduction

This chapter provides a detailed analysis and interpretation of the study's main findings, relating them to the existing literature and theoretical frameworks discussed in Chapter Two. It thoroughly examines farmers' knowledge and perceptions of finger millet, the adoption of agricultural innovations, and consumption habits among vulnerable groups. The discussion links the empirical results to the study's goals, highlighting similarities and differences with prior research. Furthermore, the chapter explores the implications of these findings for sustainable finger millet production, food security, and nutrition in Malawi. Overall, it aims to offer a comprehensive view of the factors influencing finger millet cultivation and use, while also identifying opportunities and challenges to inform policy and practice.

5.1 Knowledge and perspective of farmers toward finger millet and millet products

5.1.1 Farmers' Knowledge of Finger Millet Cultivation

The significant knowledge gaps identified, with over a quarter of farmers self-reporting that they are not knowledgeable, are a critical barrier to the utilization of finger millet. This finding aligns with the Theory of Planned Behaviour (TPB), as this lack of knowledge directly undermines perceived behavioral control (Ajzen 1991). These results suggest substantial knowledge gaps among farmers concerning finger millet cultivation and millet products. This diversity reflects unequal access to information, training, and extension services. It also emphasizes the potential for capacity-building programs to address these gaps. This limited awareness could be a major factor contributing to the crop's low production levels, despite its well-documented resilience and nutritional benefits. Without adequate knowledge, finger millet is likely to remain underutilized. These findings are consistent with Mwenda et al. (2022), who observed that finger millet is often overlooked in favor of maize and rice, mainly due to farmers' limited knowledge of its agronomic and nutritional advantages. This work extends Damar et al. (2016) by explicitly framing knowledge deficits as a psychological barrier to adoption, rather than just a technical one. Recent studies, such as Muthini et al. (2023), confirm that targeted, practical training is more effective at building this perceived control and fostering adoption than simply disseminating information.

5.1.2 Experience and Knowledge of Finger Millet

The positive correlation between farming experience and knowledge makes sense; however, the low awareness of market opportunities, even among experienced farmers, is worrying. This implies that knowledge transfer has been limited to traditional farming practices and has not addressed the crop's commercial potential. While farmers recognize the nutritional value (a positive attitude), the weak subjective norm, where finger millet is still seen as a "low-income crop" (Yadav et al. 2021), is concerning. These findings align with those of Singh et al. (2021) and Gaikwad et al. (2018), who found that household views of finger millet vary with socioeconomic and experience levels. Farmers with more experience tend to see millet products as nutritious and suitable for daily use. Farming experience seems to increase perceived behavioral control, as experienced farmers are more confident in managing finger millet cultivation. The Theory of Planned Behavior indicates that the more confidence people have in a behavior, the more likely they are to do it.

Table 7 shows that farmers have varied levels of knowledge about different aspects of finger millet. They have moderate awareness of varieties and farming practices, but know more about its nutritional benefits and processing methods. This suggests that while farmers value its health advantages and know how to produce traditional products, their limited knowledge of farming techniques could hinder the adoption of better cultivation practices and improved varieties. Low awareness of market opportunities implies that farmers may not fully appreciate the economic potential of finger millet products, which could reduce their enthusiasm for expanding production. These findings support Pradhan et al. (2019), who pointed out finger millet's nutritional advantages due to its high calcium, iron, and dietary fiber content. Despite these benefits, Kumar et al. (2024) in their study of smallholder value chains in India stressed that incorporating market literacy into extension services is essential to turning subsistence farming into a profitable business. These results also align with TPB theory, which stresses that a positive attitude depends on believing that cultivating finger millet will lead to good outcomes, such as

increased income and food security. While farmers understand the nutritional value of finger millet, their limited awareness of farming techniques and market opportunities may negatively influence their attitude toward the crop and its products.

5.1.3 Farmers' Knowledge of Finger Millet Nutrition Components

Farmers showed varied awareness of the nutritional makeup of finger millet. Most (44.0%) identified carbohydrates as a primary nutrient, but fewer recognized its richness in proteins, dietary fiber, and essential minerals like calcium and iron. These findings imply that incomplete knowledge may affect both consumption and farming choices, as farmers might not fully understand finger millet's potential role in improving nutrition. These results align with Mwenda et al. (2022), who noted that although finger millet is culturally significant and used in traditional ceremonies, many farmers are unaware of its full health benefits. Similarly, Pradhan et al. (2019) highlighted its nutritional advantages.

5.1.4 Perception of farmers on Finger Millet and Its Products

Farmers generally have positive perceptions of finger millet, especially regarding its profitability and climate adaptability. This indicates a strong positive attitude towards its potential to reposition finger millet as a strategic livelihood crop. These findings align with Kumar et al. (2019), who noted its resilience in harsh conditions, making it a sustainable farming option.

However, farmers showed less agreement on adopting finger millet as a staple crop and on preferring its products over those of other cereals. This suggests that despite its advantages, cultural preferences and market limitations prevent its widespread adoption. Yadav et al. (2021) noted that finger millet is often considered a "poor man's crop," which discourages some farmers from prioritizing its cultivation.

Additionally, a key informant reported that traders import finger millet from Zambia due to insufficient local production. This implies that demand for finger millet locally exceeds what farmers currently produce. It also shows that finger millet has commercial value, and increasing local production could

help farmers benefit economically. This aligns with Singh et al. (2021), who found that while millet products are nutritious and affordable, local supply chains remain weak. The farmers' willingness to recommend finger millet indicates a positive attitude toward its potential benefits, consistent with TPB expectations.

The significantly more positive perception in Nchenachena EPA compared to Bolero, as indicated by the Kruskal-Wallis test, is a key finding. It shows that local factors, such as the availability and quality of extension services, clearly influence farmers' attitudes. This supports the TPB's concept of subjective norms, where extension agents and early adopters can foster a supportive social environment for adoption. This suggests that a single national policy is not sufficient. It emphasizes the need for a geographically tailored extension approach, a point supported by Tsan et al. (2022), who found that customized communication strategies significantly increased the adoption of climate-smart agriculture in sub-Saharan Africa.

5.1.5 Challenges in Finger Millet Cultivation and Utilisation

The study identified several challenges affecting finger millet production, with the most frequently reported being unpredictable weather and a lack of quality seeds. The results imply that agronomic constraints are key barriers to production. The lack of quality seeds indicates that farmers either lack access to improved varieties or depend on recycled seed, pointing to a significant failure in the seed system, a crucial part of the value chain. These findings are similar to those of Damar et al. (2016), who found that inadequate support from government and non-governmental organizations hindered finger millet production in Nigeria.

Additionally, 14.6% of farmers identified a lack of knowledge as a major barrier to finger millet production and use. This suggests that farmers may not be fully equipped with the necessary skills or information to adopt best practices, such as optimal planting time and spacing. This lack of knowledge

limits the crop's potential. This aligns with Mwenda et al. (2022), who reported that smallholder farmers often lack technical training and access to extension services on improved agronomic practices, further reducing finger millet yields and keeping finger millet marginalized.

5.2 Farmers' adoption of agriculture innovations on the productivity of finger millet cultivation

5.2.1 Awareness of Agriculture Innovations

The study found that 63% of farmers are aware of agriculture innovations. This implies that there is still a significant knowledge-sharing gap, especially regarding how agricultural innovations can boost finger millet yields, improve food security, and create market opportunities. Lower awareness underscores a major dissemination gap for a crop that is not a priority. This supports the Diffusion of Innovation Theory (DOI), which holds that awareness is the crucial first step in the innovation-decision process (Rogers 2003). This finding also agrees with Gitu, Onyango & Obara (2014), who highlighted that awareness is a key factor in adoption, as farmers need to know about a technology before they can consider using it. However, qualitative insights showed that extension efforts have focused more on maize than on finger millet, indicating a dissemination gap.

5.2.2 Determinants Influencing the Adoption of Agriculture Innovations

The chi-square results show that farm size and access to information are significant factors influencing adoption, while formal education is not, challenging some common assumptions. This aligns strongly with the Diffusion of Innovations (DOI) Theory (Rogers 1991). Adoption is more about compatibility with the farmer's resources (land) and the effectiveness of communication channels (extension services) rather than just abstract knowledge. The findings suggest that farmers with large landholdings might be more willing to allocate their land for innovation. This supports Srinivas, Sukanya & Rao (2024), who noted that landownership affects a household's capacity to invest in agricultural technologies. Access to agricultural information is crucial in shaping adoption,

emphasizing the role of extension services and farmer training. The significant impact of access to information backs Gitu, Onyango & Obara (2014), who argued that extension services and farmer-to-farmer interactions are vital for adoption decisions. The lack of significance for education and experience suggests that practical exposure to new techniques might be more influential than formal education. This indicates that simply having education and experience does not necessarily equip farmers with the practical knowledge needed to adopt new agricultural practices. This conflicts with Rebecca et al. (2018), who found that education facilitates adoption by improving access to information.

5.2.3 Adopted agriculture Innovations on finger millet cultivation

The results showed a variety of agricultural innovations adopted by farmers. The most common innovations included modern planting techniques, fertilizer use, and ridge creation. These findings imply that farmers tend to adopt innovations that provide quick, visible benefits. However, the low adoption of improved varieties indicates limited access to quality seeds. This supports Srinivas, Sukanya & Rao (2024), who reported an 82% increase in the adoption of improved varieties in other contexts, highlighting a gap in finger millet production. The focus group discussion also confirmed that traditional methods, such as broadcasting seeds, are gradually being replaced by ridge planting and fertilizer application. These findings imply that conservation tillage and soil management innovations are increasingly valued for their impact on yield, aligning with Rebecca et al. (2018).

5.2.4 Factors influencing the adoption of agriculture innovations on finger millet

The most influential factor in adoption was the potential to increase production, followed by knowledge of innovations. These results imply that farmers' decisions are driven primarily by tangible economic and product-quality outcomes. When the innovations are linked to higher yields or income, farmers are more willing to invest their limited resources. This highlights the importance of demonstrating the benefits of new techniques. While the lower impact of weather and land type suggests that external

conditions may not be substantial barriers to adoption, these findings reinforce Jasmine's (2014) argument that finger millet's resilience and minimal input requirements make productivity-focused innovations more attractive to farmers. Additionally, the role of knowledge in adoption aligns with Rebecca et al. (2018), who emphasized that training and literacy enhance the ability to adopt new technologies effectively. Theoretically, these findings reflect the stages of the Diffusion of Innovation Theory (Rogers 1991). When farmers are exposed to innovations and begin to understand their purpose and benefits (knowledge stage), they may form favorable attitudes toward adopting them (persuasion stage). Furthermore, training opportunities support the implementation stage by equipping farmers with the confidence and skills needed to apply the innovation effectively, leading to sustained use during the confirmation stage.

5.2.5 Challenges that affect the Adoption of agriculture innovation on finger millet

Recognizing labor intensity and high material costs as primary barriers to adoption is a common challenge in smallholder farming. This indicates that many agricultural innovations may demand more effort or time than traditional practices, which can be especially tough in rural areas where labor is already stretched thin by farming and household chores. Farmers are likely to resist adopting technologies that substantially increase workload unless the benefits clearly outweigh the effort. From a diffusion perspective, these factors raise the perceived difficulty of implementing new practices. If the practices appear labor-intensive or clash with existing routines, farmers may delay or avoid adoption even if they see the benefits. Findings support Jerop et al. (2020), who identified socio-cultural and economic constraints as key obstacles in rural farming communities. Moreover, the influence of financial constraints on adoption aligns with Srinivas, Sukanya & Rao (2024), who found that resource-poor households have limited access to agricultural innovations due to their economic vulnerability.

5.2.6 Effects of agriculture innovations on finger Millet Productivity

The regression analysis confirmed that specific innovations, such as ridge cultivation and improved varieties, have a statistically significant positive effect on yield. Farmers also reported that adopting improved varieties, such as Nyamutuwira, significantly increased production. The results suggest that agronomic practices, especially planting methods and improved varieties, are crucial for boosting finger millet yields. The importance of ridge planting emphasizes the role of soil and water management in enhancing crop establishment and nutrient uptake. These findings align with those of Rebecca et al. (2018), who demonstrated that conservation tillage and better seed varieties increase millet yields. Additionally, the positive impact of ridge planting on yield is supported by Jasmine (2014), who identified soil conservation practices as essential innovations for improving productivity.

5.3 Level of finger millet consumption among vulnerable groups

5.3.1 Consumption of finger millet

The study revealed that 90.4% of farming households consume finger millet, indicating its widespread use. This shows that finger millet holds strong cultural and nutritional importance in these communities. It suggests that its consumption may be due to health benefits and its traditional role in household diets. However, the fact that only 25.8% consider finger millet a staple food indicates that it is not the primary grain in most households. This implies that, although many people consume finger millet, its role as a staple remains limited, possibly because of preferences for maize or other cereals that are more readily available, as seen in studies by Onyango et al. (2016) and Kumar et al. (2020). These studies found that, while finger millet is valued for its health benefits, it still faces competition from maize and rice because of faster cooking times, processing difficulties, and limited availability, which often prevent it from replacing more common staples. These findings reflect the utilization aspect of the Food and Nutrition Security Framework (FAO 2008), as many households use finger millet, but not as a staple. The low

percentage that considers it a staple suggests limited availability and a cultural preference for other cereals, which may prevent finger millet from playing a central role in household food security.

5.3.2 Frequency of Consumption of Finger Millet

The results show that weekly consumption is most common, indicating that while finger millet is widely eaten, it is not consumed daily in most households. This suggests that although finger millet is nutritionally important, it does not yet function as a staple grain for most families. This aligns with Patel et al. (2018), who found that in some rural and semi-urban areas, finger millet is consumed more occasionally or weekly rather than daily due to its perceived lower status compared to grains like maize or rice. Similarly, Kumar et al. (2020) reported that longer cooking times and the difficulty of traditional processing methods associated with finger millet limit its everyday use. This irregular consumption pattern indicates a lack of consistency in finger millet intake, as defined in the FAO framework. For a food to effectively contribute to nutrition security, its availability and consumption must be steady over time, not sporadic.

5.3.3. Forms of Finger Millet Consumption

Consumption patterns showed a variety of utilization methods. The study results indicate that beverages containing Thobwa and Masese are the most common forms of finger millet consumption. This suggests that finger millet is deeply embedded in cultural practices, where beverages made from it are often preferred for their cultural significance and perceived energy-boosting qualities. This indicates that finger millet continues to hold a significant place in local food heritage and informal nutrition, as confirmed by a key informant. Similarly, Onyango et al. (2016) observed that traditional millet-based drinks are favored among men and laborers because of their refreshing and energizing effects. Conversely, the low consumption of finger millet snacks highlights a potential gap in value addition and market innovation. This suggests that the commercialization of finger millet products, especially

ready-to-eat items such as snacks and baked goods, remains underdeveloped. This aligns with Yadav et al. (2021), who noted that low processing capacity and limited product diversification hinder the appeal of the millet market.

5.3.4 Household Consumption and Vulnerable Groups

Regarding household consumption of finger millet, the results showed that 77.3% of respondents consume it equally across the household, including children, the elderly, and the whole family. This implies that finger millet is generally accepted and valued across different age groups within families. However, only 10% of households specifically prepare finger millet for pregnant or lactating women, which implies that the consumption among these vulnerable groups is still limited. This points to a gap in awareness about its role in meeting the dietary needs of nutritionally at-risk groups. It also reveals a weakness in the food security pillar of utilization. Although finger millet is nutritious and culturally accepted, it is not explicitly used to address the increased dietary needs of pregnant and lactating women or young children, thereby diminishing its potential to improve nutrition outcomes for these groups. This finding highlights the need for targeted nutrition interventions for vulnerable populations, as Sharma et al. (2020) emphasized the importance of including pregnant and lactating women in nutrition programs focused on iron- and calcium-rich foods such as finger millet. The study by Patel et al. (2018) further supports that lactating women benefit from finger millet's high iron and calcium content, which are essential for postpartum recovery and milk production.

5.3.5 Diverse Utilization of Finger Millet

The study results show that finger millet is also used for non-food purposes, such as animal feed and traditional medicine. Its use in traditional medicine includes treating conditions like stomach problems, bedwetting in children, and restoring menstrual cycles in women who have had stillbirths. This suggests that finger millet has multiple functions in farming communities beyond just being a staple crop. It

reflects diverse ways the crop is used. These alternative uses offer potential opportunities for livelihoods to diversify. Medicinal uses highlight the deep cultural and indigenous knowledge associated with the crop, which remains relevant in rural healthcare. This aligns with Maharajan et al. (2022), who also recognize the traditional importance of finger millet, though its medicinal use is still not fully explored in some regions. The use of finger millet as animal feed adds to its economic value, especially in mixed farming systems.

5.3.6 Factors Influencing Finger Millet Consumption

The factors influencing finger millet consumption were primarily taste and flavour, followed closely by health benefits, this implies that venerable group such as children, the elderly and pregnant or lactating women are particularly influence to consume finger millet by its nutritional value, health benefit and test, which reinforces findings by Rashmi et al. (2019), who reported that the nutritional value of finger millet, particularly its high fiber, iron, and calcium content, is a major factor driving its consumption. However, despite the health benefits, affordability and ease of preparation were identified as secondary factors, underscoring the need for more accessible, easy-to-prepare millet products.

5.3.7 Challenges in Regular Consumption of Finger Millet among Vulnerable Groups

The primary challenges to regular finger millet consumption, especially among vulnerable groups, are its high cost and limited availability in markets. This shows that economic and supply-related barriers greatly restrict access to finger millet, even for households that understand its nutritional benefits. Those on tight budgets may find it hard to afford finger millet consistently. Similarly, when finger millet is not readily available at nearby markets, households tend to choose more readily available foods. These barriers align with findings from Mubaiwa et al. (2021), who argued that economic constraints and limited local market availability hinder the consumption of nutrient-rich foods, such as finger millet, especially among low-income households.

5.3.8 Awareness of Finger Millet Nutrition and Health Benefits Among Vulnerable Groups

The results show a high awareness (88.4%) of finger millet's nutritional benefits among vulnerable groups. This implies that community education and traditional knowledge sharing occur through local health workers, who promote this via cooking demonstrations. Community gatherings are crucial in spreading awareness and encouraging recognition of finger millet as a nutritious food. However, 11.6% remain unaware, highlighting gaps in information dissemination. These findings align with studies by Sharma et al. (2020), who emphasized finger millet's rich nutrient profile, especially its fiber, calcium, and iron content, which are vital for children, pregnant women, and lactating mothers.

5.3.9 Benefits of finger millet on vulnerable groups

5.3.9.1 Benefit of consuming finger millet in Children

The results indicate that finger millet is widely seen as beneficial for children, mainly due to its improved nutrition and increased energy levels. This implies that people are aware of finger millet's potential to help children, suggesting that parents and caregivers not only know about the grain but also see its value in supporting child development. This could lead to more inclusion of finger millet in children's diets. These findings align with research highlighting its rich nutrient profile, which is vital for growth, bone health, and immune function. These nutrients are essential for bone development, immune support, and maintaining energy during childhood growth stages (Rashmi et al. 2019).

5.3.9.2 Benefits of consuming finger millet for Pregnant women and lactating Mothers

The results emphasize the perception that finger millet offers significant benefits for pregnant and lactating women, with increased milk production being the most commonly reported advantage. This indicates that the nutritional benefits of finger millet for nursing mothers are widely recognized, as its iron and calcium content are known to support postpartum recovery and milk production (Patel et al. 2018). The belief that finger millet stimulates milk flow is probably rooted in cultural traditions, where

Thobwa (fermented finger millet drink) is commonly consumed to boost lactation. This aligns with the findings of Sharma et al. (2020), which showed that traditional practices involving finger millet consumption play an important role in promoting maternal health during pregnancy and postpartum recovery.

Summary of the Chapter

This chapter provides a comprehensive analysis of the study's findings, connecting them to existing literature and theoretical frameworks. The discussion highlights farmers' moderate knowledge and generally positive perceptions of finger millet, along with the low yet significant adoption of agricultural innovations influenced by socioeconomic factors. It also underscores consumption patterns among vulnerable groups and challenges such as limited access and affordability. The chapter demonstrates how these findings enhance understanding of the dynamics of finger millet production and use in Malawi, offering valuable insights for policymakers, extension services, and development initiatives focused on promoting this nutritious and climate-resilient crop.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

This chapter concludes the study by outlining practical recommendations to enhance finger millet knowledge, the adoption of agricultural innovations, and consumption among vulnerable groups. Finally, it reflects on the study's contributions and suggests areas for further investigation.

6.1 Conclusions

The study finds that farmers' positive perceptions of finger millet, along with notable knowledge gaps, reveal a key opportunity for human capital development. The willingness to recommend cultivation creates a strong social foundation. However, insufficient knowledge about agronomy and markets remains a significant obstacle. For transformative growth, this indicates that community empowerment programs should be the first step. Developing local expertise through practical, accessible training is not just an extension activity but a crucial strategy to transition communities from traditional subsistence farming to informed, market-oriented agriculture, thereby establishing the basis for economic resilience.

The study concludes that the current pattern of innovation adoption exposes a systemic failure in the agricultural support system. The low adoption of high-impact innovations, such as improved seeds, due to costs and access barriers, keeps community productivity and incomes trapped in a low-level equilibrium. The broader implication for development is that overcoming these barriers provides a leverage point for systemic change. Interventions that reduce risks, such as input subsidies, strengthening seed systems, and improving access to credit, can catalyze a shift from vulnerable, low-yield farming to a more productive and climate-resilient agricultural system, directly boosting household economic security.

Regarding the third objective, the study finds that current consumption habits are a missed opportunity to improve community health and nutrition. The low targeted intake by pregnant women and children,

despite widespread awareness, shows that a powerful, locally available tool to combat malnutrition is not being fully utilized. This emphasizes that improving household nutrition involves more than just production; it requires intentional consumption. To enhance community health outcomes, it is important to incorporate finger millet into maternal and child health programs, promote convenient, value-added products, and implement behavior-change campaigns focused on intra-household food sharing. This elevates the crop from a simple food source to a vital part of the community's health strategy.

This research demonstrates that transforming communities through finger millet requires a combined approach that simultaneously develops human capital, enhances market systems, and prioritizes nutrition. Addressing these three key areas together can break the cycle of underuse and unlock the crop's full potential, fostering sustainable, community-driven development in Malawi.

The study concludes that finger millet remains an underused but highly valuable crop with strong potential to boost food security, nutrition, and livelihoods in Malawi. Although farmers have positive attitudes and are willing to cultivate it, limited agronomic knowledge, weak market systems, and low adoption of innovations hinder productivity. Consumption among vulnerable groups is also low despite high awareness of its health benefits. Closing these gaps through farmer training, better access to innovations, and nutrition-focused programs can unlock the crop’s full potential. An integrated, multi-sectoral approach will be vital to turning finger millet into a key driver of sustainable, nutrition-sensitive agricultural growth.

6.2 Recommendations

The study aimed to evaluate farmers' knowledge and perceptions of finger millet and its products, the adoption of agricultural innovations, and their impact on finger millet productivity, as well as the consumption levels among vulnerable groups. Based on the study's findings and conclusions, the following recommendations are provided.

- Given that farmers' knowledge levels about improved practices and nutritional benefits vary and are often limited, it is advised that the Ministry of Agriculture, in partnership with NGOs and community-based organizations (CBOs), develop and implement training programs for farmers and community awareness campaigns. These initiatives should aim to address existing knowledge gaps and provide farmers with thorough information on improved cultivation techniques, nutritional benefits, and processing methods. Furthermore, these groups should encourage value addition by training farmers to process finger millet into snacks and bakery items. This strategy can boost market appeal, profitability, and household use, making it a more appealing crop to cultivate.
- Given the study's finding that access to improved seeds was a major constraint and adoption of innovations like ridge cultivation was limited, government agricultural departments and extension services must take the lead, supported by NGOs and private seed companies. They should work to improve access to improved finger millet seed varieties by fostering partnerships with seed companies, government agencies, and NGOs to help farmers gain access to affordable, high-yielding finger millet seeds, thereby maximizing the potential of innovation to boost productivity. Extension programs and awareness campaigns should expand their focus beyond maize to include finger millet. These campaigns and practical demonstration plots should be used to promote the adoption of proven innovations like ridge cultivation and improved varieties, ensuring farmers fully understand the benefits of these technologies.
- Given the low, seasonal consumption and use of finger millet among children, pregnant women, and lactating mothers, mainly due to limited market access and lack of preparation knowledge, a coordinated initiative led by the Ministry of Health, in partnership with nutrition NGOs, schools, and community health workers, should be launched. This initiative would help smallholder farmers by improving market linkages, providing financial incentives, and

developing infrastructure to strengthen local supply chains, increase finger millet availability in local markets, and diversify finger millet products. Nutritional education should be expanded to emphasize the specific benefits of finger millet, especially for vulnerable groups and to include practical cooking demonstrations featuring simple, nutritious recipes. Finger millet should also be integrated into national nutrition programs, focusing on maternal and child health, such as school feeding and antenatal care services, to enhance its role in improving nutrition. Furthermore, both public and private sectors should be encouraged to invest in processing technologies and packaging improvements that extend shelf life, make preparation easier, and enhance marketability of finger millet products.

6.3 Area of further study

Other studies can be done in the following areas

Future research should focus on validating the nutritional and medicinal properties of finger millet. While traditional knowledge emphasizes its health benefits, limited laboratory and clinical evidence support these claims. Studies should, therefore, assess nutrient bioavailability, active compounds, and safety through biochemical and clinical analyses. Such validation will bridge traditional beliefs and scientific understanding, strengthening the use of finger millet as a nutritional and therapeutic food for improving public health and food security.

Improvement of Finger Millet Varieties through Morphological Analysis

Further research should include detailed morphological and agronomic analysis of various finger millet varieties to identify traits that are most effective for increasing yield, drought resistance, and nutrient content. This understanding is essential for developing improved varieties that can enhance productivity and ensure food security.

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Appendices A: Methodology matrix

Objective	Variables	Method of data of collection	Data collection tools	Analysis
1. To analyze farmers' adoption of agricultural innovation on the productivity of finger millet	• Agriculture innovation adopted • Productivity (plot size and yield) • Planting geometry • Planting system (seed or seedling) • Use of Fertilizer or no fertilizer • Type of fertilizer (Inorganic or organic) • Plant height at harvesting • Number of tillers per hill at harvesting • Straw yield at harvest • Ear size, •	• survey • key informant interviews • focus group discussion • observation	• Semi-structured questionnaire • Interview guide • Check list	• Descriptive statistics using SPSS to generate frequencies, percentages, mean and std deviation. • Oneway ANOVA • Multipal regression • Chi-square • Narrative analysis
2. Assess the knowledge, perceptions and attitudes of farmers towards finger millet	• finger millet cultivation knowledge • nutrition knowledge • perceived benefit • perceived barriers • attitudes towards adoption	• survey • key informant • focus group discussion	• Semi-structured questionnaire • Interview guide	• Descriptive statistics using SPSS to generate frequencies, percentages, mean and std deviation. • Chi-square • Narrative analysis

3. Assess the consumption level of finger millet among vulnerable groups	• Frequency of consumption • Portion size • Dietary diversity • Preparation methods • Accessibility and availability • Utilization	• survey • key informant • focus group discussion	• Semi-structured questionnaire • Interview guide	• Descriptive statistics • Chi-square test • Narrative analysis

Appendices B: Questionnaire

DIVERSITY AND POTENTIAL OF FINGER MILLET UTILIZATION

Introduce yourself to the respondent/Rephrase the following in your own words

I am …….. from **the Department of Agriscience** in the Faculty of Environmental Sciences at Mzuzu University. I am conducting a research study on the **Diversity and potential of finger millet for sustainable development.** I would like to ask you a few questions in relation **to** farmers' adoption of agriculture innovation, knowledge and perceptions, and level of consumption. Please be assured that any information you provide will be treated confidentially and your responses will be used solely for research purposes.

Would you kindly give your consent to participate in this study?
1=Yes
2=No
If 'No', terminate the survey and thank the respondent.

SECTION 0: GENERAL INFORMATION

No.	*Question*	*Response options*
Q0.1	Name of interviewer [Full Name]	/……./
Q0.2	Date of interview	/_ _ _/ /_ _ _/ /_ _ _/
Q0.3	Start time	/…./ /…/
Q0.4	District Name	/……./
Q0.5	Name of Traditional Authority	/……./
Q0.5	Name of Group Village Headman	
Q0.6	Name of EPA	/……./
Q0.7	EPA section	/……../

SECTION 1: SOCIO- DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

No.	*Question*	*Response options*	*Skip logic*
Q1.1	Name of respondent [Optional]	/……./	
Q1.2	Gender of respondent	1=Female 2=Male	
Q1.3	Age of respondent (in years)	/…../	
Q1.4	Respondent's highest education level [**Completed**]	1=No education 2=Primary 3=Secondary 4=Tertiary 5=Adult literacy 6=Other	
Q1.5	Main source of income (occupation) of the respondent	1= Farming 2=Formal employment 3=Piece work (Ganyu)	

No.	*Question*	*Response options*	*Skip logic*
		4=Business 5=Other	
Q1.6	Are you actively involved in any farming activity?	1=Yes 0=No	
	What type of crops do you grow on your farm?	1=Maize 2=Beans 3=G/nuts 4=Finger Millet 5=Horticultural crops 6=Other	
Q1.7	What is your total size of your farm (**in acres**)?	/…../	

SECTION 2: ASSESS FARMERS' ADOPTION OF AGRICULTURE INNOVATION ON THE PRODUCTIVITY OF FINGER MILLET CULTIVATION

No.	Question	Response	Skip logic
Q2.1	Do you cultivate Finger Millet on your farm?	1=Yes 0=No	Skip to Q3
Q2.2	If yes, how long have you been cultivating Finger Millet (**Years**)?	/…../	
Q2.3	What proportion of your farm (**Acres**) is allocated to finger millet cultivation?	/…/	
Q2.4	Are you aware of any agricultural innovations in finger millet?	1= Yes 0=No	IF yes go to Q 2
Q2.5	Have you adopted any of these agricultural innovations	1= Yes 0= No	
	What are your primary sources of information on the adoption of agricultural innovations on finger millet cultivation	1=Extension officers 2=Farmer groups 3=Radio programs 4= Social media 5=NGOs 6= others	
Q2.6	What are the agriculture innovations have you adopted?	1=Improved varieties 2=Water conservation 3=Agroforestry 4=Improve soil fertility 5 = Pest and disease management 6=Planting cover crops 7=Creating ridges 8= Modern planting methods	

		9= Use of fertilizer 10= others	
Q2.7	What factors influence your decision to implement agricultural innovation on your finger millet farm?	2=Knowledge 3=Weather 4=Land type 5=Training 6= Motivation 7= Increase production 8= Increase the quality of finger millet 7=Other (Specify)	//
Q2.8	Are there any barriers you face while practicing this innovation on your finger millet farm?	1=Yes 0=No	
Q2.9	If yes, what barriers do you face when adopting water conservation practices on finger millet?	1=Lack of knowledge 2 = High cost of materials 4=labour intensive 5=financial constraints 6=Lack of technical support 7=Lack of training 8= Others	
	Planting geometry		
Q2.10	Do you plant using seeds or seedlings on your finger millet farm?	1=Seeds 2=Seedlings	
Q2.11	How many seeds/seedlings do you plant per hole?	1=1-2 2=3-4 3=5 or more	
	Use of fertilizer		
Q2.12	Do you apply fertilizer on your finger millet field?	1=Yes 2=No	
Q2.13	If you do not apply fertilizer, why not?	1=Cost 2=Availability 3=Soil fertility is already high 4=Other:	
Q2.14	What type of fertilizer do you apply on the finger millet field?	1=Inorganic 2= Organic 3=Both	

	Productivity		
Q2.16	What is the size of your plot(s) used for finger millet farming?	1=Less than 1 acre 2=1-2 acres 3=3-5 acres 4=More than 5 acres	
Q2.17	How many kg of finger millet do you produce in one farming season?	1=Less than 50 kg 2=50-100 kg 3=100-100 kg 4=More than 200kg	
Q2.18	How does the current yield compare to before you adopted the innovations?	1=Significantly increased 2=Slightly increased 3= No change 4= Decreased	
	Plant height at harvest		
Q2.20	What is the average plant height of finger millet at the time of harvesting (in centimeters)?	1=50-75 cm 2=75-100 cm 3=100-125 cm 4=More than 125 cm	
Q2.21	Is there a variation in plant height across your finger millet field?	1=Yes 0=No	
Q2.22	If yes, what do you think causes the variation in finger millet height?	1=Uneven fertilizer application 2=Soil variability 3=Pest or disease damage 4=Other	
	Number of Tillers per Hill at Harvesting		
Q2.23	How many tillers per hill are present at the time of harvest of finger millet?	1=1-4 2=5-8 3=8-10 4=10 or more	
Q2.24	What do you consider an ideal number of tillers per hill?	1=1-2 2=3-4 3=5 or more	
Q2.25	What factors affect the number of tillers per hill in your field?	1=Planting density 2=Fertilizer use 3=Soil quality 4=Other	
Q2.27	How do you utilize the straw after-harvest finger millet?	1=Leave it in the field 2=Use as animal feed	

		3=Other:	
Q2.28	Do you consider finger millet ear size important for yield estimation?	1=Yes 0=No	
Q2.29	If yes, why is ear size important?	1=It reflects better grain fill 2=It indicates healthier plants 3=Other	

SECTION 3: FARMERS KNOWLEDGE AND PERCEPTION TOWARDS FINGER MILLET & FINGER MILLET PRODUCTS

No.	Question	Response	Skip logic
Q3.1	How long have you been growing finger millet (years)?	1=1 to 5 2=6 to 10 3=11 to 15 4=16 to 20 5=20 above	
Q3.2	How knowledgeable are you about the different varieties of finger millet?	1=Not knowledgeable 2= Slightly knowledgeable 3=Moderately knowledgeable 4=Knowledgeable 5=Very Knowledgeable	
Q3.3	I understand the climate conditions suitable for finger millet cultivation	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	
READ TO THE RESPONDENT I`m going to read you some statements/Questions about your knowledge and perception on Finger Millet and finger millet products. To show your level of knowledge or perception tick only once against each statement/Question where 1=strongly disagree (SD); 2=disagree (D); 3=undecided (U); 4=agree (A); 5=strongly agree (SA) to show the extent of your agreement with the statement			
Q3.4	I am aware of different varieties of finger millet	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	

Q3.5	I know the nutritional benefits of finger millet and finger millet products (e.g. flour, porridge, snacks)	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	
Q3.6	I understand the agronomic practices needed to grow finger millet successfully	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	
Q3.7	I am familiar with traditional or modern processing methods for finger millet.	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	
Q3.8	I know adequately about the market potential for finger millet and its products.	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	
Q3.9	What are the challenges you faced when cultivating finger millet?	1=low productively 2=limited market access 3=pest and diseases 4=limited access to seeds 5=no knowledge 6=others specify	
Q3.10	What nutrients are contained in finger millet and its product	1=Vitamins 2=Carbohydrates 3=Minerals (calcium, and iron) 4=Fiber 5=Proteins	
Q3.11	What sources do you rely on to get information on the nutritional benefits of finger millet and finger millet products?	1=Extension workers 2=Internet 3=Healthcare personnel 4= Family/Friends 5= Other	
Perception Towards Finger Millet			
Q3.12	I am willing to adopt finger millet as a staple crop in my household.	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided	

		4=Agree 5=Strongly Agree	
Q3.13	I believe more farmers should grow finger millet to promote sustainable livelihoods.	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	
Q3.14	I prefer finger millet products over other cereal-based products.	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	
Q3.15	I am open to trying out new products made from finger millet.	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	
Q3.16	I would recommend finger millet cultivation to other farmers in my community. **(Hint: Read statement to respondent)**	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	
Q3.17	Finger millet is adaptable to clime change. **(Hint: Read statement to respondent)**	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	
Q3.18	Cultural preference influences the choice of finger millet and its product? **(Hint: Read statement to respondent)**	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	
Q3.19	Finger millet is underutilized than other grain **(Hint: Read statement to respondent)**	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	
Q3.20	Finger millet farming is profitable and contributes to an increase in smallholder farmers income	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree	

		5=Strongly Agree	
Q3.21	Finger millet is a nutrient-dense cereal crop known for its numerous health benefits.	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	
Q3.22	How did you first learn about finger millet and finger millet products?	1=Family 2=Friends 3=Media 4=Health Professionals 5 =Other Specify	
Q3.23	What farming activities do you practice to make sure finger millet grows well?	1=Land preparation 2=Seed selection and treatment 3=Water management 4=Weed control 5 = Pest and disease management 6=Soil and fertilizer management 7= Harvesting and post-harvest handling	
Q3.24	What are the perceived benefits of finger millet and finger millet products?	1= Nutritional benefits 2=Grows with minimal inputs 3=Survives in harsh climate conditions 4=Easy to digest 5= Others	
Q3.25	What are the perceived barriers to using finger millet products?	1= Availability 2= Lack of awareness 3=Preparation difficulty 4= Cost 5=Cultural factors 6=Others	

SECTION 4: THE LEVEL OF FINGER MILLET CONSUMPTION AMONG VULNERABLE GROUPS

No.	Question	Response	Skip logic
Q4.1	Do you or your household consume finger millet products?	1=Yes 0=No	

Q4.2	How often do you or your household consume finger millet products?	1=Daily 2=Weekly 3=Monthly 4=Rarely	
Q4.3	What forms of finger millet do you consume?	1=Porridge 2=Nsima 3= Snacks 4=Beverages 5=Mixed with other grains 6=Other Specify	
Q4.4	On average, how much finger millet do you or your household consume per month (Kilograms)?	1=Less than 5kg 2=5-10kg 3=10-20kg 4=More than 20kg	
Q4.5	Who in your household consumes the most finger millet products?	1=Children (under 5 years) 2=Elderly (above 60 years) 3=Pregnant or lactating women 4=Entire family equally	
Q4.6	Is finger millet a staple food in your household?	1=Yes 0=No	
Q4.7	Are there other ways of using finger millet apart from consumption?	1=Yes 0=No	
Q4.8	What are other uses of finger millet apart from food?	1=Animal feed 2=Tradition medicine 3=Soil improvement 4=Others	
Q4.9	Do you find finger millet products easily accessible in your area?	1=Yes 2=No 3=Sometimes	
Q4.10	Where do you usually access finger millet?	1=Local markets 2=Local vendors 3=Farming 4=Others (specify)	
	How do you store finger millet to ensure its availability throughout the year	1= Drying 2=Sacks 3=Use Pesticides 4= Proper Ventilation 5= Use Airtight Containers	

Q4.11	What factors influence your decision to consume or include finger millet in your diet	1=Taste and flavour 2=Health benefits 3=Cultural practices 4=Availability 5= Affordability 6= Ease of preparation 7=Nutritional value	
Q4.12	Do you provide finger millet products to pregnant or lactating women, the elderly, and under-five children in your household?	1=Yes, regularly 2=Occasionally 3=No	
Q4,13	Are there any challenges that you face in consuming finger millet regularly?	1=Yes 0=No	
Q4,14	If yes, what challenges do you face in consuming finger millet regularly?1	1=High costs 2=Limited availability in markets 3=Lack of knowledge on preparation methods 4=Preference for other grains 5=Other	
Q4.15	What initiatives could enhance the consumption of finger millet among pregnant mothers, lactating mothers, and children under five?	1=Lowering prices 2=Increasing availability 3=Promoting awareness campaigns 4=Providing cooking demonstrations 5=Other (please specify)	
Q4.16	Are you aware of the benefits of finger millet for vulnerable groups such as children under five, pregnant women, lactating mothers, and the elderly?1	1=Yes 0=No	
Q4.17	If yes, what impact does finger millet consumption have on pregnant women or lactating mothers	1=Improved Nutrition 2=Enhanced Energy Levels 3=Digestive benefit 4=Increase milk production 5=Others	
Q4.18	What impact does finger millet consumption have on under-five children	1=Improve nutrition 2=Enhance energy levels 3=Digestive benefit 4=Growth and development	

		5=Weight gain =Boost immunity	
Q4.19	I would recommend finger millet consumption to pregnant mothers, lactating mothers and children under five	1=Strongly Disagree 2=Disagree 3=Neutral/Undecided 4=Agree 5=Strongly Agree	

END OF QUESTIONNAIRE

THANK YOU!!

INTERVIEW GUIDE AND CHECK LIST

SECTION 1 : ASSESS FARMERS' ADOPTION OF AGRICULTURE INNOVATION ON THE PRODUCTIVITY OF FINGER MILLET CULTIVATION

Key Informant Interview (KII) Guide

1. What agricultural innovations have been introduced to improve finger millet production in this community?
2. How interested have farmers been to these innovations? What factors influence their willingness to adopt them?
3. What are the most common sources of information farmers relying on to learn about these innovations?
4. From your experience, what types of innovations (e.g., improved varieties, water conservation, agroforestry) have shown the most promise in increasing productivity? Why?
5. What barriers do farmers often face when trying to adopt these practices?

Focus Group Discussion (FGD) Guide

1. What motivated you to grow finger millet?
2. What agricultural innovations have you heard of or tried on your finger millet farm?
3. What benefits have you observed after adopting agricultural innovations (e.g., yield, plant health, soil condition)?
4. What challenges did you face when adopting these innovations? (e.g., cost, labour, training, knowledge)
5. What kind of support or information helped you the most in adopting new practices?

SECTION 2 : FARMERS KNOWLEDGE AND PERCEPTION TOWARDS FINGER MILLET & FINGER MILLET PRODUCTS

KEY INFORMANT INTERVIEW (KII) GUIDE

1. In your opinion, how knowledgeable are farmers in this area about finger millet varieties and their cultivation?
2. What role do agricultural extension workers or institutions play in educating farmers about finger millet?
3. Do you believe farmers are aware of the nutritional benefits of finger millet? Please explain.
4. What are the traditional or modern processing methods commonly practiced in this area?
5. What is your assessment of farmers' knowledge of market opportunities for finger millet and its products?
6. What major challenges do farmers face when cultivating or marketing finger millet?
7. How would you describe farmers' perception of finger millet compared to other cereal crops?

Focus Group Discussion (FGD) Guide

1. What influenced your decision to start growing finger millet?
2. What varieties of finger millet do you know or grow?
3. How would you describe your knowledge of finger millet cultivation practices?
4. What do you know about the nutritional value of finger millet and its products?
5. Do you consider finger millet an important crop in your household or community? Why or why not
6. How do you perceive the profitability of finger millet farming compared to other crops?
7. Would you recommend finger millet to other farmers? Why or why not?
8. Do you believe finger millet adapts well to climate change? Please share your experiences.
9. Do cultural beliefs influence whether you grow finger millet?

SECTION 3: THE LEVEL OF FINGER MILLET CONSUMPTION AMONG VULNERABLE GROUPS

Key Informant Interview (KII) Guide

1. What is the general consumption pattern of finger millet in your community?
2. Apart from consumption what are other uses of finger millet?
3. What are the key challenges faced by vulnerable groups in accessing or consuming finger millet?

4. How aware are vulnerable groups about the health benefits of finger millet?
5. What role do cultural factors play in the consumption of finger millet by these vulnerable groups?
6. What could be done to improve the consumption of finger millet among vulnerable groups in the community?
7. What are the potential impacts on food security and nutritional status if consumption of finger millet is increased among vulnerable groups?

Focus Group Discussion (FGD) Guide

1. Who in your household consumes the most finger millet?
2. Is finger millet a staple food in your household? Why or why not?
3. Are there any other uses for finger millet in your household apart from food?
4. How easy is it for you to access finger millet products in your area?
5. What factors influence your decision to include finger millet in your diet?
6. How do you store finger millet to ensure it is available year-round?
7. Do you face any challenges when consuming finger millet regularly? If so, what are they?
8. Have you observed any health benefits for vulnerable groups from consuming finger millet?

Appendices C: Ethical Approval

MZUZU UNIVERSITY

DIRECTORATE OF RESEARCH

Mzuzu University
Private Bag 201
Luwinga
Mzuzu 2
MALAWI
TEL: 01 320 722
FAX: 01 320 648

MZUZU UNIVERSITY RESEARCH ETHICS COMMITTEE (MZUNIREC)

Ref No: MZUNIREC/DOR/24/111 03/09/2024.

Bakhita Malombe.
Mzuzu University,
P/Bag 201,
Luwinga, Mzuzu
2.

Email: malombebakhita@gmail.com

Dear Bakhita,

LETTER OF INTENT TO ISSUE A RESEARCH ETHICS AND REGULATORY PERMIT FOR PROTOCOL REF NO. MZUNIREC/DOR/24/111: DIVERSITY AND POTENTIAL OF FINGER MILLET UTILIZATION FOR SUSTAINABLE DEVELOPMENT.

The Mzuzu University Research Ethics Committee (MZUNIREC) reviewed your submission. The committee is now pleased to inform you that the protocol is at the stage at which the Principal Investigator is being required to pay the stipulated 10% regulatory fee of the actual budget as indicated in the research protocol being a regulatory **compliance and capacity building fee** before ethics approval and regulatory permit could be issued. This fee is required to be paid to the Committee. The mode of payment is either a cash or cheque deposit into the following bank account:

Description	Details
Beneficiary name and address	Mzuzu University, Private Bag 201, Luwinga, Mzuzu 2, Malawi
Beneficiary account name	MZUNIREC
Beneficiary account No.	1007578888

Bank name and address	National Bank of Malawi, Mzuzu Branch, PO Box 20, Mzuzu
Swift code or ABA number	N/A

Once payment is made, send a deposit slip/wire transfer slip for verification of our Accounts Department.

Yours Sincerely,

Wanangwa K. Msowoya

MZUNIREC Secretariat
FOR: MZUNIREC CHAIRPERSON

Mzuzu University Research Ethics Committee
Directorate of Research
Mzuzu University
P/Bag 201
Luwinga
Mzuzu 2
Email: mzunirec@mzuni.ac.mw

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Luwinga
Mzuzu 2
MALAWI
TEL: 01 320 722
FAX: 01 320 648

MZUZU UNIVERSITY RESEARCH ETHICS COMMITTEE (MZUNIREC)

Ref No: MZUNIREC/DOR/24/111 25/10/2024.

Bakhita Malombe,
Mzuzu University, P/Bag
201, Luwinga, Mzuzu 2.

Email: malombebakhita@gmail.com

Dear Bakhita,

RESEARCH ETHICS AND REGULATORY APPROVAL AND PERMIT FOR PROTOCOL REF NO. MZUNIREC/DOR/24/111: DIVERSITY AND POTENTIAL OF FINGER MILLET UTILIZATION FOR SUSTAINABLE DEVELOPMENT.

Having satisfied all the relevant ethical and regulatory requirements, I am pleased to inform you that the above referred research protocol has officially been approved. You are now permitted to proceed with its implementation. Should there be any amendments to the approved protocol in the course of implementing it, you shall be required to seek approval of such amendments before implementation of the same.

This approval is valid for one year from the date of issuance of this approval. If the study goes beyond one year, an annual approval for continuation shall be required to be sought from the Mzuzu University Research Ethics Committee (MZUNIREC)

in a format that is available at the Secretariat. Once the study is finalised, you are required to furnish the Committee with a final report of the study.

The Committee reserves the right to carry out compliance inspection of this approved protocol at any time as may be deemed by it. As such, you are expected to properly maintain all study documents including consent forms.

Wishing you a successful implementation of your study.

Yours Sincerely,

Wanangwa K. Msowoya
MZUNIREC Secretariat
FOR: MZUNIREC CHAIRPERSON

Mzuzu University Research Ethics Committee
Directorate of Research
Mzuzu University
P/Bag 201
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Appendices D: Mzuzu university research ethics committee informed consent form (english)

Mzuzu University Research Ethics Committee (MZUNIREC)

Informed Consent Form for Research in
Diversity and potential of finger millet for sustainable development

Introduction

I am **Bakhita Malombe** from **the Department of Agriscience** in the Faculty of Environmental Sciences at Mzuzu University. We are doing research on the **diversity and potential of finger millet for sustainable development.** This consent form may contain words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them of me or another researcher.

Purpose of the research

This research aims to **assess the diversity and potential of finger millet utilization for sustainable development**

Type of Research Intervention

This research will involve your participation in a group discussion and/or individual interview.

Participant Selection

You are being invited to participate in this research because you are involved **in finger millet production and utilization.**

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. If you choose not to participate nothing will change. You may skip any question and move on to the next question.

Duration

The research takes place for a period of one months januray

Risks

You do not have to answer any question or take part in the discussion/interview/survey if you feel the question(s) are too personal or if talking about them makes you uncomfortable.)

Reimbursements
You will not be provided any incentive to take part in the research.

Sharing the Results
The knowledge that we get from this research will be shared with you and your community before it is made widely available to the public. Following this, we will publish the results so other interested people may learn from the research.

Who to Contact

If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact: Dr. Ulemu Msiska (who is my supervisor and program coordinator) Mzuzu University, Private Bag 201, Luwinga, Mzuzu 2. Email: msiska.u@mzuni.ac.mw Phone: 0994954025

This proposal has been reviewed and approved by Mzuzu University Research Ethics Committee (MZUNIREC), whose task is to ensure that research participants are protected from harm. If you wish to find out more about the Committee, contact Mr. Gift Mbwele, Mzuzu University Research Ethics Committee (MZUNIREC) Administrator, Mzuzu University, P/Bag 201, Luwinga, Mzuzu 2, Phone: 0999404008/0888641486

Do you have any questions?

Appendices E: Mzuzu University research ethics committee informed consent form (Chichewa)

Mzuzu University Research Ethics Committee (MZUNIREC)

Mau oyamba

Dzina langa ndi **Bakhita Malombe** kuchokera ku gawo la maphunziro la Agrisciences mu nthambi ya Environmental Sciences ku Mzuzu University. Ndikuchita **kafukufuku pa kusisanasiyana kwa miludu ya mapira ndi kuthekela kogwilitsa tchito mapira pothandizila kukhala ndi chitukuko chokhazikika .**Kalata ya chilolezoyi itha kukhala ndi mau oti simukutha kuwamvetsa bwino. Chonde muzindiuza kuti ndiime ndifotokozele pamene tikuchita kafukufukuyu. Ngati muli ndi mafuso ena, ndifunseni ineyo kapena amzanga omwe ndikuchita nawo kafukufukuyu.

Cholinga cha kafukufuku

Kafukufukuyu akufuna kuunika **kafukufuku pa kusisanasiyana kwa miludu ya mapira ndi kuthekela kogwilitsa tchito mapira pothandizila kukhala ndi chitukuko chokhazikika**.

Mtundu wa kafukufuku

Kafukufukuyu akudalila kutengapo gawo kwanu poyankha mafuso amene ndikufuseni mkucheza kwathu.

Mchifukwa chani mwasankhidwa?

Mwasankhidwa kuti muchite nawo kafukufukuyu potengela kuti mumalima ndikugwilitsa tchito mapira.

Kutengapo gawo pa kafukufuku mosakakamiza

Kutengapo gawo kwanu pa kafukufukuyu mkosakakamiza. Muli ndi ufulu kutengapo gawo kapena ayi. Mukasankha kusachita nawo kafukufukuyu palibe icho chisinthe kapena kukuchitikilani. Muli ndi ufulu kusiya mafuso ena osayankha mkuyankhako ena.

Kafukufukuyu atenga nthawi yotalika bwanji?

Kafukufukuyu atenga miyezi umodzi wa janunary chaka chino cha 2025 mpaka mwezi wa June .

Zodetsa Nkhawa

Simukuyenera kuyankha mafuso kapena kutengapo mbali mkucheza ngati mukuona kuti mafunso ena salibwino kapena simunasangalare nawo, kapena mukuganiza kuti kuyankhapo kukhoza kubwelesa chiopsezo paumoyo wanu.

Cholowa/Kulipidwa

Kutenga nawo gawo pa kafukufukuyu ndi kwa ulere ndipo simudzalandira kalikonse.

Kugawana zotsatila za Kafukufuku

Zotsatila za kafukukuyu zidzagawidwa kwa inu amene mutengepo mbali ndi anthu a mdela lanu zisanagawidwe ku mtundu wose wa aMalawi. Zotsatila za kafukufukuyu zidzasindikizidwa mu buku kuti anthu ose ofuna kumva zambiri za kafukufukuyu athe kutero.

Oti mungathe kulumikizana nawo

Ngati muli ndi mafuso, mutha kufusa panopa kapena nthawi ina. Ngati mukufuna kudzafunsa nthawi ina chonde alembeleni kalata a Doc ulemu msiska omwe ndi aphuzitsi amene akundiyang'anira pa kafukufuku ameneyu ku Mzuzu University ndipo ndiamenso amayanganira zones zokhuza ophuzila amene akuchita pologalamuyi pansi pa nthambi ya angriscience .pa adilesi iyi: Private Bag 201, Luwinga, Mzuzu, kapena aimbileni foni pa 0994954025. Mutha kutumizaso kalata pa makina a intaneti ku adilesi iyi:msiska.u@mzuni.ac.mw.

Kafukufukuyu waunikidwa ndi kuvomerezedwa ndi nthambi ya koleji yotchedwa Mzuzu University Research Ethics Committee (MZUNIREC) yomwe ndi komiti yoonetsetsa kuti ochita nawo kafukufuku ndi otetezedwa mu njira ina iliyose. Ngati mukufuna kumva zambiri za komitiyi lumikizanani ndi a Gift Mbwele pa adilesi iyi: Mzuzu University Research Ethics (MZUNIREC) Administrator, Mzuzu University, P/Bag 201, Luwinga, Mzuzu 2, Ma nambala awo a foni ndi: 0999404008/0888641486

Muli ndi fuso Lirilonse?