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EVALUATING THE AWARENESS AND USE OF MORINGA PRODUCTS IN LILONGWE, MALAWI

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Global Development studies

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ABSTRACT

Moringa oleifera can simultaneously address health, nutritional and socioeconomic objectives in Malawi. Moringa products such as powder, seeds and oil are readily available in towns and cities, including Lilongwe. Consumers can purchase these Moringa products from a range of sources, including local markets, supermarkets, and pharmacies. However, there remains a dearth of research that delves into the extent of Moringa product utilization within Malawi. This study employed the quantitative research approach to comprehensively assess the awareness, consumption choice and purchase intentions (willingness to pay), and perceptions of Moringa products among the local population of Lilongwe.

The study revealed the prominence of Moringa products in Lilongwe, with a significant majority of respondents reporting their purchase or usage. The study also established that a matrix of factors influenced the consumption of Moringa products. The study established that health, accessibility and broader societal contexts, such as family influence and pricing, impact customers' purchasing decisions. Finally, the study showed that certification, gender, age, monthly earnings, and levels of education were influential in informing consumers' willingness to pay for Moringa products.

The study recommends that future studies can focus on elucidating the specific health benefits and nutritional profile of different Moringa products. This can help in establishing evidence-based health claims and expanding the understanding of the nutritional value of Moringa as a functional food ingredient.

DEDICATION

To my beloved wife (Priscilla Addae) and lovely children (Kermilda Gyinaa Agyei and Cassandra Oforiwaa Agyei)

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CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

Moringa oleifera is a versatile tree popular for its nutrition, health and environmental benefits. The Moringa species are occasionally referred to as “Miracle Tree” because of its medical and nutritional benefits. It is believed that almost all of its parts: flowers, leaves, pods, roots, seeds and stems/barks carry therapeutic, nutritional and/or industrial applications (Gopalakrishnan et al., 2016; Sagona et al., 2020; Patil et al., 2022; Mollel et al., 2021). Moringa tree species are fast gaining recognition worldwide for preventing and alleviating malnutrition challenges associated with health conditions and micronutrient deficiency or hidden hunger (Patil et al., 2022; Muthayya et al., 2013; Mollel et al., 2021).

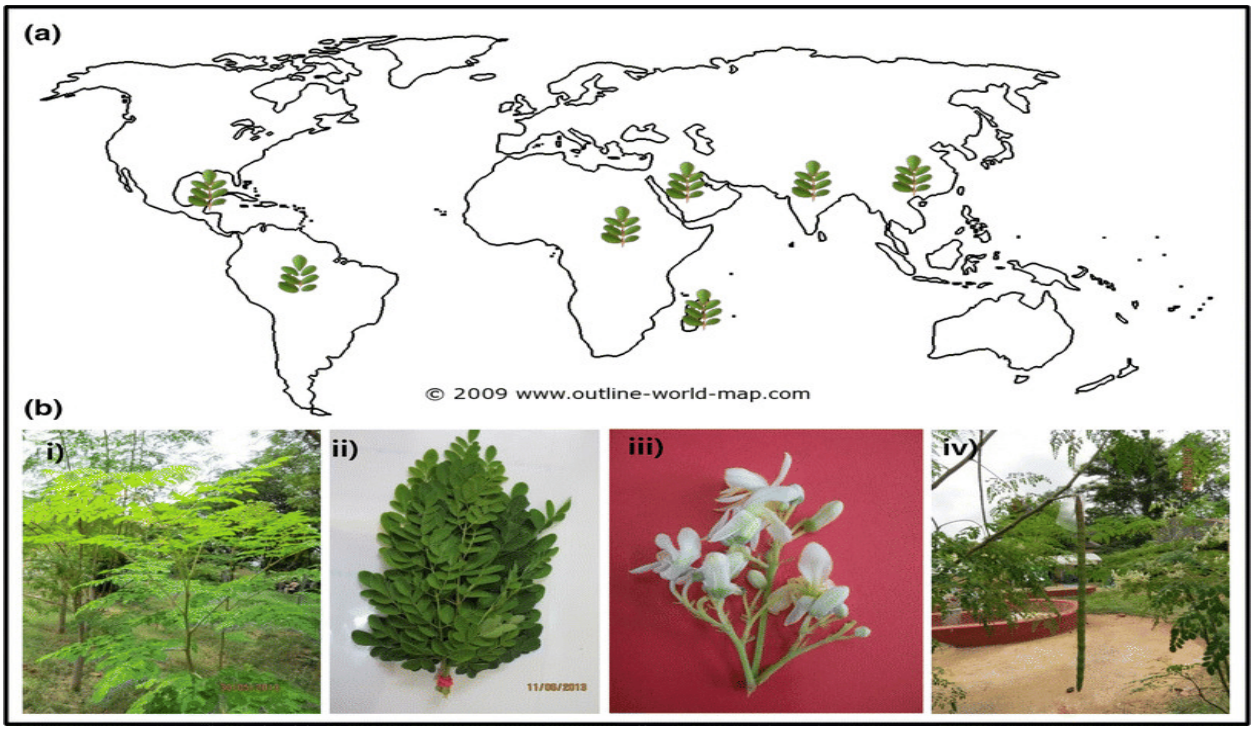

Figure 1: Moringa distribution in the world and parts of the tree (Source: adapted from Saini et al., 2016).

(a) The distribution of Moringa oleifera in the World. (b) Parts of M. oleifera tree; (i) field grown tree, (ii) bundle of foliage, (iii) flowers, and (iv) fruit (pod)

Moringa oleifera, a fast-growing tree native to the Indian subcontinent, has spread naturally to tropical and subtropical regions throughout the world. Moringa oleifera has gained significant attention in recent years due to its wide range of potential benefits (Saini et al., 2016; Gandji et al., 2018; Seifu and Teketay, 2020). There are twelve other species of Moringa, including Moringa arborea, Moringa borziana, Moringa concanensis, Moringa drouhardii, Moringa hildebrandtii, Moringa longituba, Moringa ovalifolia, Moringa peregrina, Moringa pygmaea, Moringa arivae, Moringa ruspolian and Moringa stenoprtala. Unlike other plants, the Moringa tree grows quickly and can withstand adverse climatic conditions like drought, extreme heat, and mild frost (Price, 2007; Mridha and Al-Barakah, 2015; Gopalakrishnan et al., 2016).

Moringa has been documented as having numerous applications (Adebayo et al., 2011; Leone et al., 2015). This includes its usage as a supplement for nutrition through the consumption of its leaves, seeds, and flowers. In many developing countries and among low-income populations, certain types of food are beyond financial reach or only available during specific seasons. Drewnowski (2009) asserts that in times of financial constraint, consumers tend to prioritize food choices that offer high caloric content, resulting in a preference for energy-dense foods. Within tropical regions, for example, meals typically revolve around a single staple food that is high in carbohydrates but lacks nutritional value, such as a dough derived from yam, maize, or cassava (Dhakar et al., 2011; Ferraro et al., 2016). Thus, consistently adhering to such a limited diet on a daily basis contributes to the onset of chronic malnutrition (Dhakar et al., 2011).

The increasing global demand for sustainable and natural solutions to malnutrition has led to a renewed interest in traditional herbal remedies and botanical products. The Moring tree's entire body, including the leaves, flowers, immature pods, stems, and even the roots, are edible (Koul and Chase, 2015; Gopalakrishnan et al., 2016). The Moringa leaves, pods, seeds, gums, bark, and flowers are used in several ways including to treat mineral and vitamin deficiencies, support a healthy cardiovascular system, encourage normal blood sugar levels, offer excellent anti-inflammatory support, enrich anemia blood, and support the immune system (Mahmood et al., 2010; Koul and Chase, 2015; Gopalakrishnan et al., 2016). Additionally, it enhances bone strength, mental clarity, and eyesight (Mahmood et al., 2010; Chukwuebuka et al., 2015). It may help those who are malnourished, generally weak, nursing moms, women going through menopause, depressed, or have osteoporosis (Mahmood et al., 2010).

Moringa oleifera is widely recognized as a medicinal plant with remarkable nutritional value due to its high protein content, vitamins, beta-carotene, and amino acids, making it a potentially beneficial food supplement for both humans and animals (Moyo et al., 2011; Gopalakrishnan et al., 2016). Phytochemical analysis has revealed that the leaves of Moringa are particularly abundant in potassium, calcium, phosphorous, iron, vitamins A and B, essential amino acids, and various antioxidants such as beta-carotene, vitamin C, and flavonoids (Amaglo et al., 2010). According to Animashaun et al. (2013), these nutritional and therapeutic properties have been harnessed in traditional medicine to address various health disorders across different cultures.

The Moringa tree is also utilized in alley cropping for biomass production, serving as a source of biodiesel and fertilizer. It is utilized to create fertilizer and feed for cattle as well as an agent to purify water (Price, 2007; Mulugeta and Fekadu, 2014). Moringa finds value in animal

forage through its leaves and treated seedpod cake. The leaves can be utilized for biogas production, while crushed leaves function as a domestic cleaning agent. The wood of Moringa can be used for blue dye, and living trees are employed for fencing purposes. The seed cake serves as a fertilizer, and the juice extracted from the leaves acts as a foliar nutrient. Moringa leaves can be utilized as green manure. Additionally, Moringa finds applications as gum (extracted from tree trunks), honey, and as a clarifier for sugar cane juice (using powdered seeds). The flower nectar is a source of honey, and all parts of the plant are utilized in traditional medicine. Moringa is also used for ornamental plantings, as a bio-pesticide (with soil incorporation of leaves to prevent seedling damping off), pulp (from wood), rope (from bark), and tannin for tanning hides (from bark and gum) (Kumar et al., 2012; Mulugeta and Fekadu, 2014, Fahey, 2019).

1.1 Research Problem

The utilization of Moringa leaves in various African dishes showcases the cultural significance and potential nutritional benefits of incorporating this plant into local diets. In Nigeria, Moringa leaves are commonly incorporated into a popular soup called "Egusi," which typically consists of melon seeds and spinach. The addition of Moringa leaves to this traditional dish not only introduces additional flavor and texture but also contributes to its nutritional value (Babayeju et al., 2014). In Kenya, fresh Moringa leaves are consumed as vegetables and also used to make tea. The leaves can be added to various dishes, such as stews or stir-fries, providing an additional source of nutrients and flavors (Kumssa et al., 2017). In Ghana, Moringa leaves have been employed as a means to fortify school lunch menus, particularly aimed at enhancing the vitamin A and mineral contents of meals served to children aged 4 to 12 years (Glover-Amengor et al., 2017).

Malawi faces pressing nutritional and health challenges that underscore the need for accessible, affordable interventions. According to UNICEF (2021), 37% of children under age of 5 in Malawi suffer from chronic malnutrition, reflected in high stunting rates. Anemia prevalence stands at 63% among children under 5, indicating widespread micronutrient deficiency. These nutritional inadequacies can impair child growth, cognitive development, and immunity. Sagona et al. (2020) argue that Moringa oleifera offers a promising solution, as its leaves contain abundant iron, zinc and vitamins A and C to address these deficiencies. Increased cultivation and consumption of Moringa products in Malawi could provide nutritional and health benefits to vulnerable groups. Beyond nutritional benefits, Moringa oleifera offers agricultural and economic potential for Malawi. Its ability to grow in marginal soil makes it highly adaptable, while the many uses of its leaves, pods, and seeds can support income generation (Fahey, 2005). Moringa products can provide business opportunities for local farmers and entrepreneurs. Thus, increased production and commercialization of Moringa oleifera can simultaneously address health, nutritional and socioeconomic objectives in Malawi.

Moringa products have gained substantial attention recently due to their potential health benefits, nutritional value, and environmentally friendly nature (Saini et al., 2016; Gandji et al., 2018; Seifu and Teketay, 2020). Coote et al. (1997) highlighted the Moringa tree's popularity in rural areas and its role in addressing significant nutritional and health challenges faced by local communities. This versatile plant thrives in various regions of Malawi, and an array of both raw and processed Moringa products, such as Moringa powder, seeds and oil among others, are readily available in towns and cities, including Lilongwe. Consumers can purchase these Moringa products from a range of sources, including local markets, supermarkets, and pharmacies.

However, there remains a dearth of research that delves into the extent of Moringa product utilization within Malawi. The primary objective of this research is to comprehensively assess the awareness, consumption choice and purchase intentions (willingness to pay), and perceptions of Moringa products among the local population of Lilongwe. The study acknowledges the existing gaps in understanding regarding the use of Moringa products in this specific context, with a particular emphasis on how local people are aware of, engage with, and view these products. Thus, by focusing on these aspects, the research aims to provide a comprehensive evaluation of the utilization of Moringa products in Lilongwe, Malawi.

1.2 Research Objectives

This research has the following objectives:

1. To highlight the popularity of Moringa products among consumers
2. To establish the factors that influence the consumption of Moringa products among consumers.
3. To assess consumers' perceptions of consuming Moringa products.
4. To examine consumers' willingness to pay for Moringa products

1.3 Significance of the Study

First, the research contributes to the existing literature on the use of Moringa products, specifically focusing on Lilongwe, Malawi. While Moringa has gained attention for its potential health benefits, nutritional value, and environmental sustainability, there is a lack of comprehensive understanding regarding its utilization in Malawi. By conducting a detailed investigation into the local population's awareness, consumption patterns, and perception of Moringa products, this study will add valuable insights to the existing body of knowledge. It will expand the literature on Moringa utilization in African contexts, providing specific insights into

the cultural acceptance, consumption practices, and potential benefits associated with Moringa use in Malawi.

Equally, the finding of the research will inform policy for improving the use of Moringa products in Malawi. By gaining insights into the awareness, consumption patterns, and perception of Moringa among the local population, policymakers and stakeholders can develop evidence-based strategies and interventions. This includes initiatives to promote the nutritional and health benefits of Moringa, enhance awareness among the community, support local entrepreneurship, and explore opportunities for sustainable cultivation and production. The research outcomes can guide the development of policies that foster the integration of Moringa into the local food system, ultimately contributing to improved nutrition, health outcomes, and socio-economic development in Malawi.

Finally, this research thesis will also pave way for future research in the field of Moringa utilization. The findings may highlight areas that require further investigation, such as exploring the potential for Moringa cultivation and value chain development in Malawi, assessing the long-term sustainability of Moringa production practices, and conducting nutritional studies to quantify the impact of Moringa consumption on specific health outcomes. Furthermore, the research may inspire comparative studies across different regions in Malawi or other African countries to gain a broader understanding of Moringa utilization and its implications.

1.4 Organization of the Study

This research is organized into five chapters. The first chapter introduces the background of the study, the statement of the problem, the research objectives as well as significance of the research, and the organization of the study. The second chapter presents a review of the existing literature based on the research objectives. It also includes sections on the definitions of the

concepts as well as the theoretical framework guiding the study. Chapter three details the methodology of the study. It consists of the research philosophy, research design, population, sample, and sampling procedure. The chapter further highlights the sources of data, instruments, data collection procedure and techniques for data analysis. The fourth chapter presents the results from the analysis and discusses these results within existing literature. The final chapter details the summary of the key findings, conclusions of the study, and recommendations of the study based on the findings as well as lessons for policy implementation and suggestions for further studies.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews related literature on the awareness and use of Moringa products. This chapter discusses the overview of Moringa globally and specifically in Malawi. The theoretical framework guiding the study is discussed. The chapter also presents the discussion of existing literature on the popularity of Moringa products; factors influencing consumption of Moringa products; consumers' perception of consuming Moringa products; and consumers' willingness to pay for Moringa products. The research gap informing the study is highlighted in the conclusion.

2.1 Moringa

Plants have traditionally produced secondary metabolites as a defense mechanism against various harmful pathogens (Jain et al., 2019). Humans have leveraged these bioactive compounds to combat microbial infections and have also explored their potential benefits beyond their antimicrobial properties, such as in the treatment of conditions like cancer, diabetes, inflammation, and cardiovascular diseases (Jain et al., 2019; Kapoor et al., 2020). Over the past few decades, numerous plants have been studied for their phytoconstituents, either for developing medicine or for nutritional purposes (Fabricant and Farnsworth, 2001; Leitzmann, 2016; Awuchi, 2019). Among these plants, Moringa oleifera Lam., commonly known as the "miracle tree," has garnered attention for its wide range of metabolites believed to have nutritional and medicinal properties (Moyo .., 2011; Gopalakrishnan et al., 2016). This plant has earned its nickname due to its claimed healing abilities across various diseases. Moringa oleifera, originally indigenous in India, has spread naturally to tropical and subtropical regions throughout

the world. There are twelve other species of Moringa, including Moringa arborea, Moringa borziana, Moringa concanensis, Moringa drouhardii, Moringa hildebrandtii, Moringa longituba, Moringa ovalifolia, Moringa peregrina, Moringa pygmaea, Moringa arivae, Moringa ruspolian and Moringa stenoprtala.

The introduction of Moringa in Malawi can be attributed to the Asian settlers who arrived in the country during the late 18th century (Hirsch, 2016). Moringa oleifera is predominantly found in hot, low-lying semi-arid regions, particularly along the Great Rift Valley in Africa (Sagona et al., 2020). This includes areas such as the lower Shire Valley and along the Lakeshore. Consequently, M. oleifera is widely distributed across various districts in Malawi, including Karonga, Rumphi, Mzimba, Nkhotakota, Ntchisi, Salima, Ntcheu (Bwanje Valley), Mangochi, Machinga, Balaka, Phalombe, Neno, Chikwawa, and Nsanje (Sagona et al., 2020). In Malawi, the Moringa species thrives best at altitudes ranging from 100 to 700 meters above sea level (masl), with an annual rainfall of 700-840 mm and a mean temperature of 22-25 °C (Sagona et al., 2020). It can also adapt to areas as high as 1000 meters above sea level, with a rainfall of 960 mm and mean temperatures of 19-21 °C (Sagona et al., 2020). The species' wide adaptability has facilitated its distribution in other parts of Malawi, including Lilongwe, Dedza, Dowa, and Kasungu, through various development projects.

2.1.1 Production and processing of Moringa products

Moringa oleifera thrives in hot, semi-arid tropical regions, making it well-suited to such growing conditions (Napoleão et al., 2019; Mashamaite et al., 2021). While the tree can withstand drought, it may suffer from excessive dryness caused by strong winds. Remarkably, this plant can also thrive in regions with infertile soil and can even be cultivated in home gardens. Moringa oleifera prefers sandy soil with a slightly acidic pH ranging from 6.2 to 7.0. It

typically reaches a height of 5 to 12 meters and features a straight trunk measuring 10 to 30 centimeters in thickness (Pérez-Rivera et al., 2021).

Moringa oleifera exhibits tolerance to mild frost, but severe frost can lead to the death of mature trees. However, the tree has the remarkable ability to regenerate and grow again. It is adaptable to various soil types, although it prefers well-drained sandy soil or loam (Price, 2007). The growth rate of Moringa trees is impressive, with potential annual growth of up to 4 meters. Once fully developed, these trees can reach heights between 6 and 15 meters. Regular pruning promotes new growth, resulting in an abundant supply of easily harvestable leaves (Price, 2007). In addition to its nutritional value, Moringa oleifera retains its full foliage even during the dry season when food sources are typically scarce, particularly in tropical regions (Mishra et al., 2012).

Moringa oleifera offers two primary methods of propagation: through seeds or cuttings. Seed germination is a relatively quick process, usually occurring within 1-2 weeks (Gandji, et al., 2018). It is noteworthy that providing shade during germination enhances success rates. Additionally, healthy stem cuttings measuring approximately 45-100 cm in length can also be employed for propagation, resulting in the growth of robust trees. However, it is important to consider that cuttings may have a shorter root system compared to seedlings, which can impact the tree's ability to withstand windy conditions. Consequently, the preferred choice for propagation is often through seeds or seedlings due to their potential for stronger root development and better anchoring in adverse weather situations (Saint and Broin, 2010).

Mishra et al. (2012) advance that to ensure the production of safe and high-quality Moringa leaf powder, it is of utmost importance to adhere to proper drying conditions. The initial step involves carefully handpicking mature and young leaves that exhibit optimal characteristics,

such as being healthy, free from diseases and fungi, and possessing a dark green color. This selection process is crucial to ensure that only the best leaves are used. Once the leaves are selected, a meticulous washing process is carried out in four stages. Firstly, the leaves undergo a thorough rinse in clean water to remove any impurities. Following this, they are immersed in a 1% saline solution ($NaCl_2$) for approximately 5 minutes. This saline soak helps in further cleansing and ensures the removal of any residual contaminants. Subsequently, the leaves are dipped in a 70% ethanol solution, which aids in disinfection. Lastly, the leaves are carefully rinsed with distilled water to eliminate any remaining traces of the saline solution and ethanol. This multi-stage washing process helps to guarantee the cleanliness and safety of the leaves (Mishra et al., 2012).

After the washing process, the leaves must be properly dried. Various drying methods can be employed, including shade drying, sun drying, or oven drying. Each method has its own advantages and considerations. Shade drying involves placing the leaves in a shaded and well-ventilated area, protecting them from direct sunlight. Sun drying, on the other hand, involves spreading the leaves under the sun to allow natural drying. Oven drying utilizes controlled heat to accelerate the drying process. The choice of drying method is critical, as it can impact the preservation of essential nutrients present in the leaves. Careful selection of the appropriate drying technique is vital to retain the nutritional value of the Moringa leaf powder (Mishra et al., 2012).

Babu et al. (2018) highlighted that shade drying is more effective in maintaining the nutritional integrity of Moringa leaves compared to sun drying and oven drying methods. Therefore, when choosing shade drying, it is crucial to ensure a sterile and well-ventilated drying room. To safeguard the leaves against contaminants like insects, covering them with nets, such as

mosquito nets, is recommended. To ensure even drying, it is important to periodically flip the leaves. Personnel involved in the drying process should prioritize personal protective equipment, such as sterile gloves, to prevent any potential contamination of the leaves (Mishra et al., 2012).

Once the leaves have undergone sufficient drying, they can be grounded to produce Moringa leaf powder. However, it is important to note that Moringa leaf powder has a high propensity for absorbing moisture. Therefore, an additional drying stage is essential after grinding. This involves subjecting the powder to a temperature of 50°C for 30 minutes to enhance its stability. To maintain the quality of the Moringa leaf powder, it is advised to store it in airtight or vacuum-sealed containers. It is preferable to keep the containers in a cool environment, away from light and excessive humidity. By following these storage conditions, the Moringa leaf powder can retain its quality for up to 6 months (Mishra et al., 2012).

2.1.2 Uses of Moringa Products

The Moringa plant's pods have significant potential as a nutritious vegetable and can be incorporated into a variety of culinary preparations such as soups, stews, and curries (Trigo et al., 2020). When harvested at an early stage, the pods possess a delightful taste, lack fibrous texture, and can be cooked and enjoyed similarly to green beans (Ekesa, 2017). Moreover, the Moringa root can serve as a viable substitute for horseradish and can be dried, ground, and utilized as a seasoning agent (Gopalakrishnan et al., 2016; Alhassan et al., 2022). Additionally, the Moringa leaves are edible and can be consumed as leafy greens, boiled, fried, added to soups and stews, or used for seasoning purposes (Ekesa, 2017; Rani and Arumugam, 2017). Remarkably, both the buds and flowers of the Moringa plant are fit for human consumption and can be creatively incorporated into a wide range of culinary creations. The flowers can be employed to prepare tea, adding a unique twist to the beverage experience (De-Heer, 2011). Lastly, the resin derived from

the Moringa tree's trunk holds valuable properties for thickening sauces, presenting an appealing option for culinary applications (Gonzalez and Van Der Maden, 2015).

Moringa leaves contain abundant vitamins A, B, and C, minerals (particularly iron and calcium), as well as the sulfur-containing amino acids methionine and cystine, offering exceptional nutritional benefits (Mishra et al., 2011; Chukwuebuka, 2015). Moreover, Moringa leaves serve as a rich natural source of antioxidants due to the presence of diverse antioxidant compounds like ascorbic acid, flavonoids, phenolics, and carotenoids (Anwar et al., 2007). The leaf powder can be conveniently incorporated as a nutritional supplement into various meals. Anwar et al. (2007) opine that while Moringa pods have relatively lower nutritional content, they still serve as a valuable source for supplementing essential nutrients in the daily diet. This is particularly significant in cultures where the staple diet primarily consists of starchy dishes like rice, wheat, corn, cassava, or millet. In such dietary contexts, side dishes play a crucial role in providing proteins, vitamins, and minerals. Moringa can be easily incorporated into these side dishes, effectively offering the necessary nutrients and contributing to nutritional security.

Moringa is a versatile plant with numerous industrial uses. The oil extracted from de-hulled Moringa seeds, comprising about 42% of the seed's weight, is of high quality and can be used for cooking and as a lubricant for delicate machinery (Gonzalez and Van Der Maden, 2015). It is also valued in the perfume industry due to its capacity to absorb and retain volatile substances. The oil's composition, rich in oleic acid (around 70%), saturated and unsaturated fatty acids, and low free fatty acid content make it suitable for cosmetic products such as soaps, lotions, and shampoos. The press cake, a by-product of oil extraction, contains protein, including active cationic polyelectrolytes. These proteins have the ability to neutralize colloids in muddy or dirty water, making them useful for water purification, as well as cleaning vegetable oil and

sediment fibers in the juice and beer industries. Moringa seed proteins work as a natural coagulant, forming bridges between colloid particles. They can be used in powder form for water purification, removing up to 99% of colloids (Mehdinejadand Bina, 2018).

Figure 2: Types of moringa products in Malawi
(Source: Author's Fieldwork, 2023)

Moringa oleifera has various medicinal uses across its different parts (Anwar et al., 2007). The root of Moringa is known for its antilithic, rubefacient, vesicant, and carminative

properties (Ravindra et al., 2019; Mali et al., 2022). It acts as a cardiac/circulatory tonic, laxative, and anti-inflammatory agent. Additionally, it is used to treat paralytic afflictions, rheumatism, inflammations, pains, and constipation. Moringa leaves possess purgative qualities and can be applied as poultices to treat sores. They are also used for headaches, piles, fevers, sore throat, bronchitis, eye and ear infections, scurvy, and catarrh, and to control glucose levels. The stem bark of Moringa is considered rubefacient and vesicant. It is utilized in the treatment of eye diseases, delirious patients, spleen enlargement, tuberculous glands, tumors, ulcers, and earaches. The juice from the root bark acts as a pain reliever and exhibits anti-tubercular activity.

Moringa gum is astringent and rubefacient. It is used for dental caries and mixed with sesame oil to relieve headaches, fevers, intestinal complaints, dysentery, asthma, and sometimes as an abortifacient. It is also used to treat syphilis and rheumatism. The flowers of Moringa have high medicinal value, functioning as stimulants, aphrodisiacs, and cholagogues. They are employed to treat inflammations, muscle diseases, hysteria, tumors, spleen enlargement, and lower cholesterol levels. They have shown beneficial effects on lipid profiles in hypercholesterolemia rabbits. Moringa seeds exert a protective effect by reducing liver lipid peroxides. Compounds with antihypertensive properties, such as thiocarbamate and isothiocyanate glycosides, have been isolated from the seed extract (Ravindra et al., 2019; Mali et al., 2022).

Due to its nutritional composition, the Moringa tree serves as an excellent source of fresh forage for livestock feed (Rodríguez et al., 2017; Su and Chen, 2020). The leaves are abundant in protein, carotene, iron, and ascorbic acid, while the pods contain lysine, an important amino acid. Feeding animals with Moringa has been associated with enhanced milk production, improved nutrient absorption, and faster weight gain compared to other feed options. Additionally,

Moringa exhibits high productivity of fresh material per unit area, making it advantageous for livestock forage. The press cake obtained from the oil extraction process, rich in protein, can also be utilized as supplementary livestock feed. Moringa leaves can be employed as foliar sprays to promote plant growth and as green manure to enhance soil fertility (Hussain et al., 2013). These leaves contain natural plant growth hormones called cytokinins, which stimulate cell division in both shoots and roots. Plants treated with Moringa leaf extract foliar sprays have shown increased firmness, resistance to pests and diseases, and higher yields of larger fruits (Ashfaq et al., 2012). Yield improvements have been observed in various crops, including onions, bell peppers, soybeans, sorghum, coffee, chili, and melons.

2.2 The Diffusion of Innovation Theory

The Diffusion of Innovation theory, developed by Rogers (1962) offers valuable insights into the process by which new ideas, products, or practices are adopted and spread within a social system. This theory explores how innovations are communicated, accepted, and integrated into society, shedding light on the factors influencing their diffusion (Zanello et al., 2016; Vargo et al., 2020). At its core, Rogers (1962) espouses that the Diffusion of Innovation theory emphasizes the role of individuals and social networks in the adoption process, categorizing adopters based on their readiness to embrace innovation. This theory seeks to understand the dynamics of innovation adoption and the factors that shape its trajectory within a given context through the examination of key concepts such as innovations, adoption, diffusion, and adopter categories. In the context of this study on the awareness and use of Moringa products in Lilongwe, Malawi, the Diffusion of Innovation theory provides a framework to explore how and why individuals in this community adopt and incorporate Moringa products into their daily lives.

Innovations serve as a central concept within the Diffusion of Innovation theory (Robertson, 1967). Innovation refers to a new idea, product, or practice that is perceived as new by individuals or groups. It can be a tangible object, a technology, a behavior, or even a belief system. Innovations are the driving force behind the diffusion process, as they represent the catalyst for change within a social system (Cain and Mittman, 2002). They hold the potential to address needs, solve problems, or offer improvements over existing alternatives. Innovations can vary in their complexity, relative advantage, compatibility with existing practices, and observability of their benefits. The Diffusion of Innovation theory posits that understanding how and why some innovations are widely adopted, while others may struggle to gain acceptance aids in developing strategies to promote their successful adoption and integration within a given context (Denis et al., 2002). In the case of the awareness and use of Moringa products in Lilongwe, Malawi, understanding the innovative aspects of these Moringa products, such as their health benefits, nutritional value, and cultural relevance, can shed light on their potential for adoption and the strategies to facilitate their diffusion among the target population.

Adoption is a crucial concept within the Diffusion of Innovation theory, focusing on the individual decision and process of accepting and using an innovation (Greenhalgh et al., 2004). Adoption represents the point at which an individual or a group decides to integrate innovation into their regular practices or routines. It involves a deliberate and conscious choice to embrace innovation and incorporate it into one's daily life (Katz et al., 1963). Adoption encompasses not only the behavioral aspect of using the innovation but also the cognitive and psychological aspects related to the individual's perception and evaluation of the innovation. This provides insight into the factors that facilitate or hinder the acceptance of an innovation. In the context of this study, the concept of adoption helps to examine the motivations, barriers, and drivers behind

individuals' decisions to embrace Moringa products and how these products become integrated into their daily lives.

Rogers (1962) identified five distinct adopter categories within the theory: innovators, early adopters, early majority, late majority, and laggards. Innovators are the first individuals to adopt an innovation. They are characterized by their adventurous and risk-taking nature, displaying a high tolerance for uncertainty. Innovators are typically well-informed, have access to diverse information sources, and are willing to experiment with new ideas or products. Early adopters are the second category to adopt an innovation, following the innovators. They hold significant influence within their social networks and are seen as opinion leaders. Early adopters tend to possess a higher social status and exhibit a keen ability to recognize the value and potential benefits of innovation. They often play a crucial role in influencing the adoption decisions of others.

The early majority represents the larger segment of the population that adopts an innovation after it has been embraced by the innovators and early adopters. This group tends to be more deliberate in its decision-making process and relies on interpersonal networks and recommendations from early adopters. They observe the experiences and outcomes of others before making their own adoption choices. The late majority comprises individuals who adopt an innovation after the majority has already adopted it. They may display some skepticism or resistance to change, often adopting an innovation due to social pressures or necessity rather than a strong personal desire. The Late majority adopters tend to have lower socioeconomic status and are influenced by normative behavior and conformity. Laggards are the final category of adopters, being the last to adopt an innovation. They typically exhibit a high degree of resistance to change and adhere strongly to traditional practices. Laggards may have limited access to

information or face various barriers to adoption, such as lack of resources, skepticism, or cultural and social factors that discourage change.

Diffusion is the final concept within the Diffusion of Innovation theory, which focuses on the process by which an innovation spreads and is adopted within a social system (Haider and Kreps, 2004; Vargo et al., 2020). It refers to the communication and dissemination of information about innovation among individuals or groups. Diffusion involves the transmission of knowledge, ideas, and practices related to innovation through various channels, including interpersonal communication, mass media, social networks, and formal institutions (Oldenburg and Glanz, 2008). The rate and extent of diffusion are influenced by factors such as the characteristics of the innovation itself (e.g., its relative advantage, compatibility, complexity), the characteristics of potential adopters (e.g., their innovativeness, social networks, socioeconomic status), and the communication channels through which information about the innovation is shared. Diffusion patterns can vary, ranging from rapid and widespread adoption to slower and more selective diffusion. In the context of this study, the diffusion process helps to identify the channels through which information about Moringa products can be effectively disseminated, the influential individuals or groups that can facilitate adoption, and the factors that may hinder or accelerate the spread of awareness and usage within the population.

According to the Diffusion of Innovation theory, several factors influence the process of diffusion, determining the rate and extent to which an innovation spreads within a social system. These factors include relative advantage, compatibility, complexity, observability and trialability (Dibra, 2015). Relative advantage refers to the perceived superiority of the innovation over existing alternatives (Junglas et al., 2019). If individuals perceive innovation as offering substantial benefits, such as improved outcomes, cost-effectiveness, or time-saving advantages,

they are more likely to adopt it. Compatibility refers to the degree to which an innovation aligns with the existing values, needs, and practices of potential adopters affects its diffusion (Nor et al., 2010). Innovations that are compatible with established norms, beliefs, and behaviors are more likely to be adopted, as they require fewer adjustments or disruptions to existing routines. Sahin (2006) explained the complexity of innovation refers to its perceived difficulty in understanding and using it. Innovations that are relatively simple, easy to comprehend, and convenient to use have a higher likelihood of diffusion. Complex innovations may face resistance or slower adoption rates due to perceived effort, skill requirements, or potential risks associated with their implementation.

Observability is the extent to which the benefits and results of using an innovation are visible or observable to others influencing its diffusion (Cain and Mittman, 2002). If the positive outcomes of adopting an innovation can be easily observed or demonstrated, it creates social proof and encourages others to adopt as well. Lee et al. (2011) explain trialability as the degree to which individuals can experiment with or test an innovation before deciding to adopt it. It involves the opportunity for potential adopters to have a hands-on experience with the innovation, which can reduce uncertainty and facilitate the decision-making process. When an innovation is highly trialable, individuals can explore its features, benefits, and functionality firsthand. In the context of this study, the position is that the awareness and use of Moringa products are affected by the relative advantage of their high nutritional value, health benefits, and affordability; compatibility with the cultural context, dietary habits, and traditional practices in Lilongwe; the simplified use and preparation of the Moringa product to address the issue of complexity; observability: showcasing the observable benefits of Moringa and trialability: providing product samples or conducting taste tests.

The Diffusion of Innovation theory is highly suitable for this research as it explains the mechanisms by which new products and practices spread through a society (Dearing, 2009). Since moringa can be considered an innovation, this theory sheds light on the factors that can accelerate or hinder its adoption. For example, it suggests that enhancing the observability and trialability of moringa products can facilitate diffusion among the Lilongwe community. The theory's emphasis on communication channels also provides guidance for promotional initiatives to increase moringa awareness. Extensive use in prior food and nutrition studies further supports the application of this theory (Thurber and Fahey, 2009).

2.3 Popularity of the Moringa products

Moringa products have gained popularity in recent years due to their health benefits. The growing awareness of the health benefits of Moringa products is one of the prime reasons driving Moringa products market growth. In Nigeria, Williams et al. (2013) revealed that a significant portion of the respondents, specifically 48%, reported using Moringa products for their nutraceutical benefits. This finding suggests a notable level of awareness regarding the potential advantages associated with Moringa products within the surveyed area. The high percentage of respondents who had utilized Moringa products reflects a growing interest in alternative health and wellness practices in the community. The findings indicate that the awareness of Moringa's nutraceutical benefits has permeated the community, prompting a considerable number of individuals to incorporate Moringa products into their dietary routines.

Equally, Ikwuakam et al. (2013) examined the perceived nutritional and medicinal values of Moringa oleifera (locally known as zogale) among rural dwellers. The findings revealed a high level of awareness among the majority of respondents regarding the nutritional and medicinal benefits of Moringa. The study found that a majority of rural dwellers had consumed

Moringa within the past 20 years. This indicated that Moringa has been a part of their dietary practices and that they have actively incorporated it into their food consumption habits. The study also identified religion, exposure to information, and awareness as significant factors influencing the perceived benefits of Moringa. This implies that individuals who belong to some religious grouping, have greater exposure to information, and possess higher awareness levels are more likely to recognize and appreciate the nutritional and medicinal value of Moringa.

Also, Uke et al. (2020) examined the economics of Moringa marketing in the Enugu Metropolis. The findings indicated that Moringa products were popular among consumers, with a relatively high demand and profitable market. This indicates that businesses involved in the production and sale of Moringa products can generate favorable returns on their investments. The major forms in which Moringa products were marketed include Moringa powder, seeds, oil, and herbal tea. Interestingly, the study found that the majority of Moringa marketers in Enugu were females. This suggests that women play a significant role in the marketing and distribution of Moringa products in the area. However, the study also identified difficulties in convincing people to buy Moringa products, which could serve as barriers to the consumption of Moringa products. This suggests that there may be challenges in promoting and educating consumers about the benefits of Moringa and its potential uses.

In addition, Oyewole et al. (2015) focused on the level of acceptability of Moringa oleifera diversified products among rural and urban dwellers in Oyo State, Nigeria. The study revealed that 85% of the respondents were aware of the Moringa plant, indicating a significant level of knowledge about its existence. The results also identified a significant relationship between sex and the acceptability of Moringa products. This suggests that gender plays a role in influencing individuals' perceptions and preferences regarding the acceptability of Moringa.

Equally, the majority of respondents in the study fell within the age range of 20 to 49 years old, indicating that this demographic group may be particularly receptive to Moringa products. This implies that there may be potential opportunities for marketing and promoting Moringa products to this specific age group. Similarly, in Indonesia, Irawan and Patricio (2015) revealed that an overwhelming majority (99.8%) of Indonesian consumers were aware of daun kelor (Moringa). However, only 20% of the respondents knew that daun kelor is known worldwide as Moringa.

Furthermore, Kola-Oladiji et al. (2014) investigated the indigenous knowledge and consumption pattern of Moringa oleifera among dwellers in rural enclaves around the Ibadan metropolis. The findings revealed that the majority of respondents in the rural settlements were aware of Moringa and primarily used it for cooking purposes. The results indicated that education and household size had a positive and significant influence on Moringa consumption. This suggests that individuals with higher levels of education and larger households were more likely to incorporate Moringa into their diets. The study also found that the majority of respondents used Moringa primarily for cooking. This indicates that Moringa is commonly utilized as a culinary ingredient in the rural enclaves surrounding the Ibadan metropolis. The results confirmed that females were found to be more involved in the use of Moringa. This aligns with the broader pattern observed in many cultural contexts, where women often play a significant role in household food preparation and dietary choices.

2.4 Factors influencing consumption of Moringa products

Kavoi and Kimambo (2021) explored the attitudes of farmers, traders, and urban consumers towards the consumption of Traditional African Vegetables (TAVs) in Tanzania. The study showed that consumers with a better understanding of the nutritional benefits of TAVs tend to have more positive attitudes toward their consumption. Furthermore, the frequency of TAV

intake is positively correlated with positive attitudes, suggesting that promoting regular consumption is important for improving overall attitudes and nutrition. However, the study advanced that barriers to TAV consumption included limited availability, lack of awareness, and cultural preferences for other types of vegetables.

Similarly, Gido et al. (2017) examined the factors that influence the consumption intensity of leafy African indigenous vegetables (AIVs) in Kenya. The authors showed that demographic factors, including age, gender, education level, and household size, play a significant role in AIV consumption. Younger individuals and those with higher education tend to have higher consumption intensity. Also, the study advanced that socio-psychological factors, such as attitudes, perceptions, and cultural beliefs, strongly influence AIV consumption. Positive attitudes towards AIVs and their perceived health benefits were associated with higher consumption intensity, emphasizing the role of individual perceptions and beliefs in influencing dietary preferences. Consumers were more likely to consume AIVs that are easily accessible, affordable, and have desirable taste and texture, highlighting the importance of these factors influencing food choices. The findings also show that limited availability and accessibility can hinder consumption, particularly in urban areas where AIVs may be less accessible compared to other vegetables.

Neergheen-Bhujun et al. (2020) explored the factors that influenced the consumption of Moringa oleifera among Mauritian adults. The study established that age, ethnicity, employment status, marital status, and geographical location played a role in shaping individuals' likelihood of consuming Moringa. Familiarity and cultural practices were found to have an impact on Moringa consumption. Participants who were more familiar with Moringa and had cultural practices that incorporated its use were more likely to consume it regularly. This highlights the

influence of cultural norms and traditions on dietary choices. One barrier to the widespread utilization of Moringa as food was the belief among some individuals that its consumption could raise blood pressure. The study highlighted that some respondents avoided consuming Moringa due to concerns about family members having hypertension. This misconception hindered the acceptance and consumption of Moringa as a dietary option in Mauritius.

Fadoyin et al. (2014) investigated the factors influencing the adoption of Moringa oleifera as a water purifier by farmers in Kaduna State, Nigeria. The findings emphasize the importance of awareness, knowledge, perceived benefits, resource accessibility, economic considerations, social influences, and government support in facilitating the adoption process. The authors established that farmers who possess knowledge and awareness about the perceived benefits of using Moringa oleifera, such as improved water quality and reduced health risks, strongly influenced their decision to adopt Moringa as a water purifier. Also, economic factors such as the cost-effectiveness of Moringa oleifera water purification, financial incentives, and potential income generation from selling Moringa products influenced the decision for the adoption of this method. Finally, the authors advance that farmers who receive support and encouragement from their social networks as well as government support including training programs, subsidies, and awareness campaigns, are more likely to use Moringa oleifera water purification systems.

Paleti et al. (2022) investigate the factors that influence consumer preferences for Moringa value-added products in Coimbatore City. The authors advanced that nutritional benefits were a major factor influencing consumer preferences. Consumers are attracted to Moringa value-added products due to their perceived health benefits and nutritional value. These products are seen as a source of enhanced well-being and contribute to consumers' desire for

healthier food choices. Also, the authors advance that consumers who have previously consumed Moringa products are more likely to continue doing so in the future, indicating the influence of habit and familiarity on consumer preferences. In addition, Gandji et al. (2018) investigated the key factors that drive the use, cultivation, and cultivation systems of Moringa oleifera. The authors established that individuals who are aware of the various beneficial properties and uses of Moringa oleifera are more likely to utilize it for its medicinal, nutritional, or other purposes.

2.5 Consumers' perception of consuming Moringa products.

Başaran (2016) explored the attitudes and perceptions of consumers toward traditional foods. The results showed that consumers perceive traditional foods as not only healthier but also tastier when compared to modern alternatives. This perception likely stemmed from the use of fresh and locally sourced ingredients in traditional recipes, which are valued for their natural and authentic flavors. Moreover, the study highlighted that consumers associate traditional foods with the historical and cultural identity of Trabzon. These foods are seen as integral to the region's heritage, representing a culinary tradition passed down through generations. The cultural significance contributes to the appeal of traditional foods among the local population.

Additionally, Başaran (2016) established that consumers in Trabzon believe that traditional foods are more convenient to prepare than modern foods. This perception might be related to the familiarity and simplicity of traditional cooking methods, which often involve locally available ingredients and straightforward recipes. Furthermore, the study revealed interesting differences in attitudes toward traditional foods among various consumer groups. Older consumers demonstrated a more positive attitude towards traditional foods than their younger counterparts, suggesting that traditional culinary practices and preferences may be more deeply ingrained among the older generation. Gender differences also played a role, with women

showing a more positive attitude towards traditional foods compared to men. This could be attributed to cultural and social factors, as women in many societies are often associated with traditional cooking and preserving culinary heritage.

Park (2017) delved into the perceptions, attitudes, and usage of Ginseng and Red Ginseng products among food consumers. The findings revealed that Indonesian consumers exhibited a positive perception of Ginseng and Red Ginseng products, considering them to be healthier, tastier, and more beneficial than other herbal products available in the market. Indonesian consumers attributed various health benefits to Ginseng and Red Ginseng products, including improved energy levels, enhanced immune system function, and stress reduction. These perceived advantages contribute to the popularity and appeal of these herbal products among the Indonesian population. A significant aspect highlighted in the study was the consumers' belief that Ginseng and Red Ginseng products are Halal. This is of paramount importance to Muslim consumers in Indonesia, as Halal certification ensures that products adhere to Islamic dietary guidelines, making them permissible for consumption.

Park (2017) also advanced that convenience was also noted as a key factor influencing consumer perception and usage. Consumers found Ginseng and Red Ginseng products easy to incorporate into their daily routines, with options such as taking capsules or drinking tea, offering hassle-free ways to consume these herbal supplements. Furthermore, the study revealed interesting differences in consumer perceptions of Ginseng and Red Ginseng products across various demographic groups. Women displayed a more positive perception of these products compared to men, suggesting potential gender-related preferences or health-related beliefs. Additionally, consumers with higher incomes tended to hold a more favorable perception of Ginseng and Red Ginseng products than those with lower incomes. This finding indicates that

consumers with higher disposable incomes are more willing to invest in health-enhancing products or have greater exposure to health and wellness trends.

Animashaun et al. (2013) evaluated consumers' perceptions of Moringa oleifera and their willingness to pay for the nutraceutical benefits of this plant. The study revealed that consumers displayed a significant level of awareness and knowledge about the various advantages associated with Moringa consumption. Among the benefits that consumers attributed to Moringa, the plant was regarded as an excellent source of essential vitamins and minerals, such as vitamin A, vitamin C, potassium, and calcium. Additionally, Moringa was believed to possess potent antioxidant properties, which can aid in neutralizing harmful free radicals in the body, thus potentially reducing the risk of oxidative stress and inflammation.

Furthermore, according to Animashaun et al. (2013), participants in the study reported consuming Moringa for both preventive and curative purposes. The plant was perceived as a natural means to boost the immune system, offering potential support in warding off illnesses and infections. Moreover, some consumers believed that Moringa could play a role in regulating blood sugar levels, which could be beneficial for individuals managing diabetes or those looking to maintain stable glucose levels. Another interesting finding was that some participants viewed Moringa as a helpful aid for weight loss. Although it's important to note that individual responses to dietary supplements can vary, the perception of Moringa as a potential support for weight management added to its appeal among health-conscious consumers.

Irawan and Patricio (2015) focused on examining Indonesian consumers' perceptions of daun kelor (Moringa oleifera) and its potential health benefits. The results indicated that nearly all respondents (99.8%) were aware of daun kelor, although only a minority (20%) recognized its global name, Moringa. The findings revealed that Indonesian consumers hold a positive view of

daun kelor and associate it with various health advantages. Daun kelor is predominantly consumed as a vegetable or used in soups, indicating its widespread culinary use in Indonesia. Consumers generally believe that daun kelor is safe for consumption and do not perceive any adverse side effects associated with its use. Notably, the authors of the study advocate for popularizing daun kelor consumption as a vegetable to address the high prevalence (37.2%) of stunted children in Indonesia. Stunting is a serious concern in the country, and the researchers believe that incorporating daun kelor into the diet could offer a potential solution due to its reported nutritional content and health benefits.

Ayinde et al. (2015) focused on exploring how consumers managed the perceived risks associated with Moringa products. The study revealed that consumers possessed a considerable level of awareness regarding the potential risks linked to the use of Moringa products. The most common perceived risks reported by consumers were related to possible adverse side effects. Concerns were raised about the potential for Moringa products to cause discomfort, such as nausea, vomiting, and diarrhea. These apprehensions highlight the importance of understanding the appropriate dosage and usage guidelines for Moringa products and consulting healthcare professionals when necessary.

Additionally, Ayinde et al. (2015) showed that some consumers expressed anxieties about the quality of Moringa products available in the market. The worries centered around potential contamination issues and questions about whether the products contained the right potency of active ingredients. This underscores the significance of obtaining Moringa products from reputable sources and ensuring proper quality control measures are in place during manufacturing and distribution. Furthermore, misinformation about Moringa products was identified as a notable concern among consumers. There were instances where false claims were

made, suggesting that Moringa could cure certain diseases or provide unrealistic health benefits. This misinformation can mislead consumers and lead to inappropriate use of the products, potentially putting their health at risk. It highlights the need for reliable and evidence-based information about Moringa's benefits and limitations.

2.6 Consumers' willingness to pay for Moringa products.

The study conducted by Ali and Ali (2020) sought to examine the factors impacting consumers' willingness to pay for health and wellness food products in Karachi, Pakistan. The study revealed that a range of factors significantly influenced consumers' willingness to pay for health and wellness food products. The factors encompassed age, gender, education level, income, health consciousness, perception of health benefits, trust in the product, product packaging, and brand reputation. Regarding consumers' willingness to pay a premium, the study observed that individuals were indeed open to paying more for health and wellness food products perceived to be healthy, beneficial, and trustworthy. This suggests that perceived quality, health advantages, and reliability play pivotal roles in influencing consumers' decisions to invest in such products.

The study conducted by Tsakiridou et al. (2011) aimed to explore the factors that influence consumers' purchasing behavior of fresh produce with food safety, origin, and traceability labels. The study indicated that several factors significantly influenced consumers' purchasing behavior of fresh produce with food safety, origin, and traceability labels. These factors included food safety concerns, perception of quality, trust in the label, and willingness to pay a premium. Consumers were more likely to purchase fresh produce with these labels if they had concerns about food safety, perceived the produce's quality to be high, trusted the label's information, and were willing to pay a premium for the labeled products. The study's results

emphasize the significance of food safety concerns and perceived product quality as crucial determinants of consumer behavior when choosing to produce with specific labels. Additionally, the level of trust placed in the label's authenticity and information played a vital role in influencing consumers' decisions. Interestingly, the study found that sociodemographic factors such as age, gender, and education level were not significantly associated with consumers' purchasing behavior of fresh produce with food safety, origin, and traceability labels.

Villano et al. (2016) sought to investigate the factors influencing consumers' willingness to pay for good quality sweet potato in Papua New Guinea. The study established consumers were more willing to pay a premium for sweet potatoes that exhibited desirable physical characteristics, such as being fresh, clean, and having a good shape and size. Additionally, the maturity of the roots and their sweetness played a crucial role in influencing consumers' willingness to pay more for good quality sweet potatoes. The place of origin also emerged as a significant factor, with sweet potatoes from the Highlands regions being more likely to command a higher premium from consumers. This suggests that regional reputation and preferences play a role in consumers' perceptions of sweet potato quality. Moreover, the study found that consumers with higher education levels were more inclined to be willing to pay a premium for good quality sweet potatoes. This implies that educated consumers may place greater value on the quality and nutritional attributes of the produce.

Obayelu et al. (2015) explored consumers' willingness to pay for labeled and certified Moringa products in Ogun State, Nigeria. The authors established that respondents' attitude towards Moringa products, as well as their attitudes towards labeling and certification, emerged as crucial determinants influencing their willingness to pay more. Positive perceptions of Moringa products, coupled with a favorable view of labeling and certification practices, appeared

to increase the likelihood of consumers being willing to pay a premium for products with these attributes. Moreover, the study observed that the current purchasing and consumption patterns of respondents also influenced their willingness to pay more for labeled and certified Moringa products. Consumers who were already familiar with and regularly purchased Moringa products were more inclined to pay a premium for products that came with proper labeling and certification, indicating a preference for transparency and quality assurance. In terms of the actual premium amount that respondents were willing to pay, the average figure stood at N100 (approximately US$0.25). This suggests that consumers in the study area perceived value in having Moringa products labeled and certified, and they were willing to invest an additional amount to gain this assurance.

Oyekale et al. (2015) focused on examining awareness and willingness to pay for Moringa in Ibadan, Nigeria. The study showed that respondents were generally open to paying for Moringa, with an average amount of N314.89/kg (approximately US$0.85/kg). The authors established a myriad of factors explaining the willingness to pay. The willingness to pay was expressed by consumers who were more aware of the plant and its potential benefits were more likely to express a willingness to pay for Moringa products. Equally, higher levels of education appeared to positively influence respondents' willingness to pay for Moringa. Education could be linked to greater awareness of health and nutrition benefits, which could make consumers more receptive to investing in nutritious foods like Moringa. Also, respondents with higher income levels were more inclined to be willing to pay for Moringa, indicating that the affordability of Moringa products influenced purchasing decisions. Finally, consumers who perceived Moringa as a healthy food option were more willing to pay for it, underlining the importance of health-related perceptions in shaping purchasing behavior.

Farinola et al. (2014) aimed to assess households' perception, awareness, and willingness to pay for Moringa oleifera Lam powder in Oyo State, Nigeria. The findings indicated a high level of awareness of Moringa among the respondents, with 80.67% of them being familiar with the plant. The authors established that the average amount that the majority respondents were prepared to pay for 50g of Moringa powder was N350 (approximately US$2.10), while a minority were willing to pay N450 (approximately US$2.69). This willingness to pay highlights the perceived value of Moringa powder as a health-promoting and nutritious product. The results also showed that consumers who were more aware of Moringa and its potential health benefits, highly educated and have access to higher income were more likely to express a higher willingness to pay for the product.

2.7 Conceptual Framework of the Study

This section describes the conceptual framework of the study aptly detailed in the figure below. In this conceptual model, it is advanced that the willingness to purchase and use Moringa products can be explained by three main categories: demographic characteristics, factors influencing consumption, and perceptions about Moringa.

Demographic Characteristics: This category includes factors like age, gender, educational level, income, employment status, and marital status. These characteristics play a role in shaping individuals' preferences and behavior toward Moringa products. In explaining the use of Moringa products, the following positions can be conceptualized. Younger individuals might be more open to trying new health trends and superfoods like Moringa. Older individuals might be interested in Moringa for its potential health benefits due to age-related concerns.

Equally, there might be differences in product usage between genders. Also, individuals with higher education might be more informed about the health benefits of Moringa, leading to

increased usage among this group. Moreover, with regards to income, the affordability of Moringa products' can influence usage. Higher-income individuals may be more willing to try premium Moringa products, while lower-income individuals might be drawn to more budget-friendly options. Busy professionals might find Moringa products convenient as a quick and healthy supplement to their diets. Finally, family-oriented individuals might consider the health benefits of Moringa for their loved ones, leading to higher household consumption.

Figure3: Conceptual framework on the use of Moringa products
(Source: Author's own conceptualization)

Factors Influencing Consumption: This category covers various factors that can influence individuals' decisions to consume Moringa products. These factors include awareness of the products, price, availability, taste preferences, influence from family and friends, perceived health benefits, cultural reasons, marketing and advertisement efforts, and certifications that

provide additional credibility. In explaining the use of Moringa lack of awareness can limit Moringa's adoption. On the other hand, affordable Moringa products are more likely to be embraced by a broader audience, while expensive options might cater to a niche market.

Also, readily available Moringa products in local stores or online would prompt more people to try them. Equally, Moringa products that align with popular taste preferences will be more appealing to consumers. The influence from family and friends is expressed by the word-of-mouth recommendations, sourced from the positive experiences with the products that can significantly impact the adoption of the product. Similarly, strong claims about the health benefits of Moringa may attract health-conscious individuals. In certain cultures, Moringa might have traditional significance, leading to higher usage within those communities. Effective marketing campaigns can create a positive image of Moringa products and encourage consumption. Finally, third-party certifications can enhance the credibility of Moringa products, leading to increased trust and usage.

Perceptions about Moringa: This category encompasses individuals' perceptions and beliefs about Moringa products. Factors such as limited availability, limited variety, high price, uncertainty about quality, unpleasant taste, and lack of information can influence how people perceive and approach these products. For instance, if Moringa products are not widely accessible, it may deter potential users from trying them. Also, a limited range of Moringa product options might limit consumer choices and preferences. Meanwhile, the perception of high prices may discourage price-sensitive consumers. Equally, concerns about the quality of Moringa products might lead to hesitancy in trying them. Furthermore, if individuals perceive Moringa products to have an unpleasant taste, it could deter regular consumption. Finally, insufficient knowledge about Moringa's benefits and usage might hinder its adoption.

2.8 Summary

In summary, the review of the existing literature reveals that numerous studies have examined the awareness, use, and perception of moringa products, primarily concentrated in countries like Nigeria, Kenya and India. However, there appears to be limited research exploring moringa utilization in Malawi, representing a significant knowledge gap. The findings from Nigeria, India or other contexts may not directly translate to Malawi given potential differences in local culture, agricultural practices, market systems, policy environments, and consumer behavior. This highlights the need for research focused distinctly within Malawi to understand if and how consumers engage with Moringa products.

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CHAPTER THREE

METHODOLOGY

3.0 Introduction

This section highlights the research methods employed for this study, the overall research design, sampling, data collection, data preparation, and analysis.

3.1 Research design

The research design refers to the overall approach or design chosen to address the research questions or objectives. According to Creswell (2014), a research design is a strategy or plan that contains the key judgments and guidelines that specify the data-gathering and analysis steps of a scientific investigation intended to address a problem. On the other hand, Kothari (2004) defined a research design as the theoretically conceived framework for conducting a study. It essentially describes the process of gathering, measuring, and analyzing data. Common research strategies in social sciences include quantitative, qualitative, and mixed methods approaches.

This study employed a quantitative research approach to investigate the factors influencing consumer preferences and purchasing behavior towards Moringa products. The quantitative research approach is a systematic and structured approach used to investigate research questions or hypotheses by collecting and analyzing numerical data. It focuses on measuring and quantifying variables and their relationships to derive objective and statistically valid conclusions. This research approach typically involves the collection of data from a representative sample, utilizing standardized data collection instruments and employing statistical analysis techniques to draw generalizable conclusions about a population.

Specifically, this study employs the cross-sectional approach. A cross-sectional approach is a form of quantitative research that involves collecting data from a sample of participants at a specific point in time, providing a snapshot of their characteristics, preferences, or behaviors. In the context of studying consumer preferences and behaviors towards Moringa products, a cross-sectional design allows researchers to gather data from a diverse group of consumers within a defined timeframe. Thus, using the cross-sectional approach allowed me the opportunity to assess variables such as customers' demographic characteristics, product attributes, purchase motivations, and the willingness to pay within the same survey. This provided the basis for analyzing associations between variables to establish the existing relationships and patterns.

3.2 Sampling

According to Bryman (2012), sampling denotes the procedure of selecting a representative set of cases from the population. This study employed a non-probability sampling technique, specifically convenience sampling, to address the issues of practical considerations and time constraints. Convenience sampling involves selecting participants based on their accessibility and convenience rather than random selection (Graue, 2015). This approach allows the researcher to gather data more conveniently and efficiently, as participants are chosen based on their availability and willingness to participate. The participants of the study were individuals residing in the capital city, Lilongwe. Lilongwe was selected because it is the melting pot of variation as individuals from different parts of Malawi are resident in the city and this diversity would provide a more comprehensive understanding of the target population's perspectives.

The survey included adults aged 18 years and above who are current residents of Lilongwe and have lived in the city for at least one year. This inclusion criterion ensures participants have adequate exposure to and familiarity with local food options, including

potential knowledge of moringa products. Individuals younger than 18 or who have recently moved to Lilongwe were excluded. A target sample size of 300 was determined to allow for a more confident generalization of results to the population of Lilongwe. The respondents participating in the study were engaged at easily accessible public locations, including markets, supermarkets, and pharmacies where Moringa products were available for purchase. These sites were deliberately chosen due to their frequent patronage by the intended study population, ensuring a suitable sample for the research. The recruitment of respondents for the survey was made in diverse parts of Lilongwe rather than one geographic area in order to improve representativeness. The survey was pre-tested with a sample of 20 participants and subsequently revised for clarity based on their feedback.

3.3 Data Collection

The study relied solely on primary data. A structured questionnaire was developed to serve as the primary data collection instrument for this study. The survey instrument was developed based on a review of similar published studies on consumer awareness, perceptions, and behavior related to novel foods or nutritional products (Khaled et al., 2022). The initial draft underwent review by two faculty members with expertise in food science and nutrition to assess content validity. A small pilot study with 20 participants was conducted to help identify ambiguity in survey items prior to finalization. The questionnaire was carefully designed to gather quantitative data from the participants. It consisted of a combination of closed-ended and Likert scale questions, offering respondents a range of pre-defined response options. The questionnaire aimed to capture comprehensive information regarding consumer preferences, factors influencing purchasing decisions, perceptions about Moringa products, and willingness to pay for the Moringa products. Initially, the study intended to explore differences in the

willingness to pay for the organic and inorganic variants, but the initial survey showed that in Malawi, there is no established distinction between organic and inorganic Moringa as such all the products are considered organic.

The inclusion of closed-ended questions provided specific response choices for participants to select from, allowing for easy quantification and analysis of the data. These questions covered various aspects, such as demographic information (e.g., age, gender, education level), product attributes (e.g., taste, packaging, price), purchase motivations (e.g., health benefits, environmental concerns), and overall satisfaction with Moringa products. Equally, Likert scale questions were utilized to assess respondents' opinions and perceptions on a range of factors. These types of questions (Likert scale) present a statement or series of statements series and ask participants to rate their level of agreement or disagreement using a pre-determined scale (ranging from 1 to 4). Likert scale questions were utilized to measure the strength of opinions or attitudes towards Moringa products, such as perceptions of quality, and perceived health benefits. To ensure the clarity, relevance, and reliability of the measures, the questionnaire underwent a pre-testing phase. A small sample of participants, similar to the target population, was selected to evaluate the questionnaire's effectiveness. During pre-testing, participants were asked to provide feedback on the questionnaire's clarity, understandability, and relevance of the questions. This feedback helped identify any ambiguous or confusing items that require revision or clarification.

The data collection procedure involved conducting surveys through face-to-face interactions with participants. The selected locations were supermarkets, health food stores, and community centers due to their convenience as venues for engaging with potential participants. A team of five trained individuals was involved in the data collection process to ensure the smooth administration of the surveys. These trained personnel were responsible for approaching

potential participants, explaining the purpose of the study, and administering the structured questionnaire. The training provided to the personnel ensured consistency in the data collection process, minimize biases, and maximize the quality and reliability of the collected data. The training sessions included guidance on appropriate communication skills, ethical considerations, and the standardized administration of the questionnaire to maintain consistency across survey sessions.

3.4 Data Analysis

The survey data was analyzed using R programming software and Excel. Descriptive statistics were conducted to identify the demographic profiles of the respondents (results presented in Table 1).

Table 1: Demographic profiles of the respondents

Socio-demographics	**Frequency**	**Percentage**
Gender		
Female	146	49
Male	154	51
Age		
Less than 20 years	14	5
20 to 40 years	205	68
41 to 60 years	68	23
+ 61years	13	4
Education		
None	7	2
Primary	66	22
Secondary	117	39

Socio-demographics	Frequency	Percentage
Tertiary	110	37
Occupation		
Unemployed	62	21
Employed	238	79
Marital Status		
Single	*141*	*47*
Married	*158*	*53*
Earnings		
Less than 25,000	27	9
25,001 to 55,000	62	22
55,001 to 105,000	72	25
105,001 to 350,000	76	26
+ 350,000	50	17

(Source: Author's fieldwork, 2023)

The details of the statistical analysis techniques for each specific objective are provided below and summarized in Table 2.

Table 2: Summary of the statistical analysis techniques

Objective	***Statistical analysis techniques***
Popularity of Moringa products among consumers	*Descriptive and chi-square*
Factors explaining consumption of Moringa products	*Relative importance index (RII)*
The perception about consuming Moringa products.	*Relative importance index (RII)*
Customeers' willingness to pay for Moringa products	*Multiple Linear Regression*

The first research objective: the popularity of Moringa products among consumers was analyzed using a blend of descriptive statistics and inferential statistics. The distribution of the popularity of the Moringa products was presented in a graph and these were further cross-tabulated with the demographic characteristics of the respondents. Chi-square tests were conducted to establish the relationship between the variable: the popularity of the Moringa products and the demographic characteristics.

The relative importance index (RII) technique was used to analyze the data in answering the second and third research objectives. The Relative Importance Index (RII) is a statistical measure used to determine the importance or contribution of individual independent variables. The RII formula was introduced into Microsoft Excel 2016 to determine the importance of each variable in each specific research objective. The formula adapted from the studies of Sakhare and Chougule(2019) and Tholibon et al. (2021)is summarized as follows:

$$\mathbf{RII} = \frac{1s1+2s2+3s3+4s4}{A*N}$$

Where ***s1*** represents the number of respondents for the first scale, ***s2*** represents the number of respondents for the second scale, ***s3*** represents the number of respondents for the third scale and ***s4*** represents the number of respondents for the fourth scale. A is the highest scale or weight, and the total number of people labeled as N. The Relative Importance Index ranges from 0 to 1.

For the second objective, the RII of the following variables: awareness, price, availability, taste preferences, family and friends, health benefits, cultural reasons, marketing and advertisement, and certification of Moringa products were calculated and ranked to establish the factors the respondents considered influential in determining their consumption of the Moringa products. Equally, for the third objective, the RII of the variables: limited availability; limited variety; high price; uncertainty about quality; unpleasant taste; and lack of information were

calculated and ranked to establish the perception that was of major concern for the respondents and the perception that was of no or little concern for them.

The final research objective: consumers' willingness to pay for Moringa products was analyzed using multiple linear regressions. The final model is specified as:

$$Log(Amount\ willing\ to\ pay\ for\ Moringa\ Product) = \beta_0 + \beta_1 * Certification\_Moringa + \beta_2 * Sex + \beta_3 * Age + \beta_4 * Education + \beta_5 * MaritalStatus + \beta_6 * EmploymentStatus + \beta_7 * Earnings + \varepsilon$$

Where:

- $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ are the coefficients for each respective independent variable.
- **Certification of Moringa, sex, age, education, maritalstatus, employmentstatus, earnings** are the independent variables.
- **Log(Amount willing to pay for Moringa Product)** is the dependent variable.
- ε represents the error term, which captures the variability in the log amount paid for Moringa products that is not explained by the independent variables.

The key assumptions of regression analysis including normality, homoscedasticity, and absence of multicollinearity were tested.

3.5 Ethical Considerations

This study strictly adhered to ethical protocols in conducting research. First and foremost, respondents' participation in the study was entirely voluntary. They were not coerced or pressured into participating and had the freedom to decline or withdraw from the study at any stage without facing any negative consequences. Informed consent was obtained from each participant, and this involved clearly explaining the purpose of the study, the nature of their involvement, and any potential risks or benefits.

Similarly, the anonymity and confidentiality of the participants were adhered to in this study. All information provided by the respondents was treated as strictly anonymous, meaning that no personally identifying information was collected or reported. During the data analysis process, personal identifiers such as names, email addresses, or specific details that could potentially reveal participants' identities were excluded. Instead, each participant was assigned a unique identifier to maintain confidentiality.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This chapter highlights the results and discussion of the findings of the study. The analysis and interpretation were limited to the objectives of the study and discussed within the context of existing literature.

4.1 The popularity of Moringa products among consumers

The study aimed to assess the popularity of Moringa products among customers, with a particular focus on the city of Lilongwe. The popularity of these products was evaluated based on the frequency of purchase and usage reported by the respondents. The results obtained from the study revealed that Moringa products enjoy a high level of popularity among customers in Lilongwe.

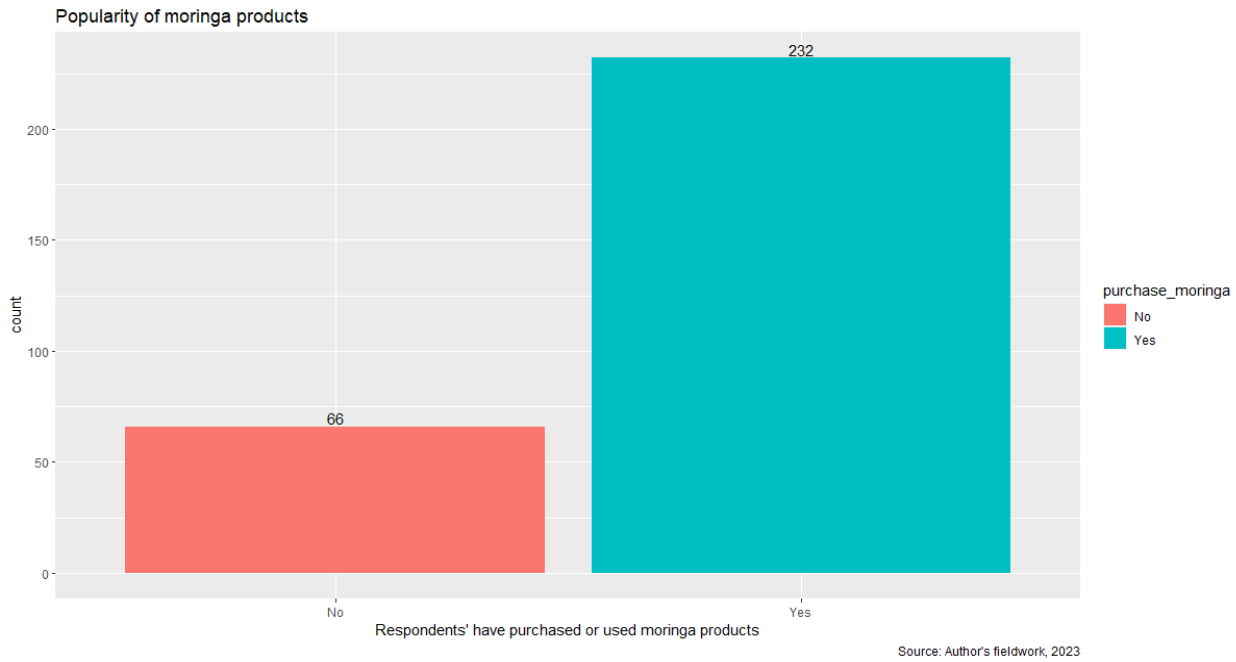

Figure 4: Popularity of Moringa products among customers in Lilongwe

In Figure 4, it is evident that a significant majority of the respondents (232 respondents representing 78% of the sample) reported that they have purchased or used a Moringa product within the past year. This finding suggests that there is a substantial demand for Moringa products in the local market. The high number of consumers who have engaged with these products reflects their popularity and possible awareness of the benefits and value of the Moringa products to customers in Lilongwe. The study's results imply that Moringa products have successfully captured the attention and interest of customers in Lilongwe. This finding resonates with existing literature that emphasizes the growing interest in and utilization of Moringa products in African countries (Ikwuakam et al., 2013; Williams et al., 2013; Kola-Oladiji et al., 2014; Oyewole et al., 2015; Uke et al., 2020). The prevalence of consumers who have actively sought out and incorporated Moringa products aligns with the notion that such products are gaining traction within health-conscious communities and the Lilongwe community could not be any different.

The study sought to establish how the socio-demographic characteristics: gender; age; level of education; employment status; marital status and monthly earnings are associated with the popularity of the Moringa products.

4.1.1 Gender and popularity of Moringa products

The result of Figure 5 shows that out of the female respondents, only 27 respondents (18.6%) reported that they have not purchased or used Moringa products, while 118 females accounting for approximately 81.4% of the female respondents stated that they have purchased or used Moringa products. Among the male respondents, 39 respondents (24.5%) indicated that they have not purchased or used Moringa products, while 114 representing around 74.5% of the male respondents that they have purchased or used Moringa products. The result of the chi-

square test reports a p-value of 0.1978 which suggests that there is no statistically significant association between the purchase of Moringa products and gender. In other words, the data does not provide strong evidence to suggest that the purchase of Moringa products significantly differs between males and females.

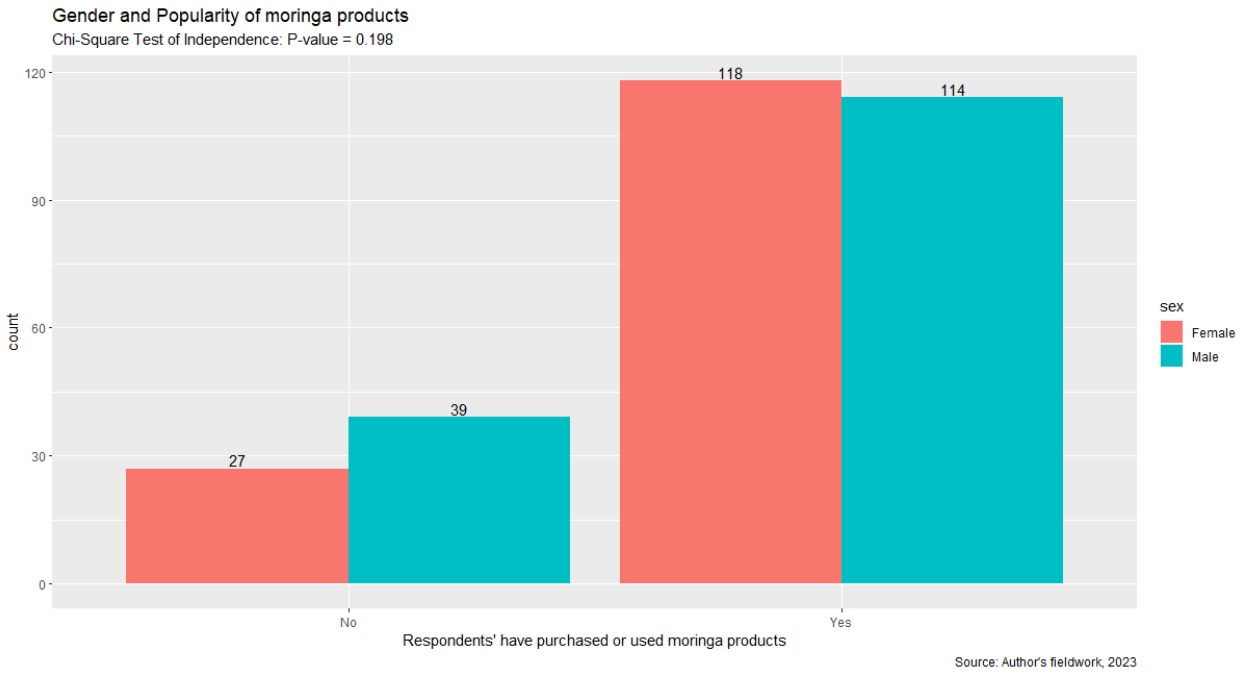

Figure 5: Gender and popularity of Moringa products.

4.1.2 Age and popularity of Moringa products

From Figure 6, it is observed that among the age groups of less than 20 years, 4 individuals reported not purchasing or using Moringa products, while 10 individuals stated that they have purchased or used Moringa products. Out of the respondents aged between 20 and 40 years, 52 individuals reported not purchasing or using Moringa products, while 151 individuals indicated that they have purchased or used Moringa products. Within the age group of 41 to 60 years, 9 individuals stated that they have not purchased or used Moringa products, while 59 individuals reported purchasing or using Moringa products. Among respondents aged 61 years and above, 1 individual reported not purchasing or using Moringa products, while 12 individuals

indicated that they have purchased or used Moringa products. It can be seen that the age group of 20 to 40 years has the highest number of respondents who have purchased or used Moringa products (151 individuals) whilst the age groups of less than 20 and 61 years and above have the lowest number of respondents who have purchased or used Moringa products. At a 10% significance level, the p-value of 0.08453 from the Fisher's exact test suggests that within a specific age bracket, there is a significant difference between Moringa-product users and non-users.

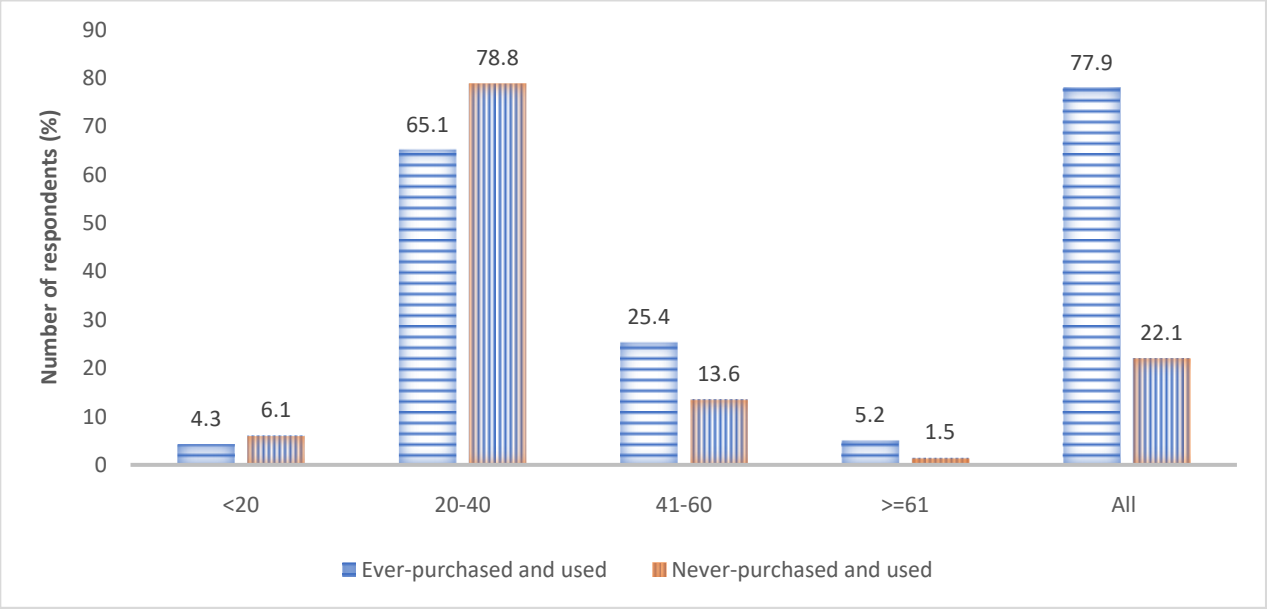

Figure 6: Age and popularity of Moringa products

Table 3: Demographic characteristics and the popularity of Moringa products

Respondent characteristics	***Ever-purchased and used***	***Never-purchased and used***	***Chi-square value***
Marital status			
Single	*103 (35)*	*37 (12)*	***0.125***
Married	*129 (43)*	*29 (10)*	

Respondent characteristics	*Ever-purchased and used*	*Never-purchased and used*	*Chi-square value*
Education level			
None	*6 (2)*	*1*	***0.362***
Primary	*55 (18)*	*11 (4)*	
Secondary	*86 (29)*	*29 (10)*	
Tertiary	*85 (29)*	*25 (8)*	
Employment status			
Unemployed	*53 (18)*	*9 (3)*	***0.146***
Employed	*179 (60)*	*57 (19)*	
Monthly income (Malawi Kwacha)			
Can't disclose	*9 (3)*	*4 (1)*	***0.329***
<25,000	*24 (8)*	*3 (1)*	
30,000-55,000	*49 (16)*	*11 (4)*	
60,000-105,000	*56 (19)*	*16 (5)*	
120,000-350,000	*54 (18)*	*22 (7)*	
>=400,000	*40 (14)*	*10 (3)*	
All	***232 (77.9)***	***66 (22.1)***	

4.1.3 Marital status

From Table 3, it is observed that among single respondents, 37 individuals (12%) reported not purchasing or using Moringa products, while 103 (35%) individuals stated that they have purchased or used Moringa products. Among married respondents, 29 (10%) individuals reported not purchasing or using Moringa products, while 129 (43%) individuals indicated that they have purchased or used Moringa products. The chi-squared p-value of 0.125 suggests that there is no statistically significant association between marital status and the purchase of Moringa products. Therefore, there is insufficient evidence to conclude that the purchase of Moringa products significantly differs between single and married individuals.

4.1.4 Level of education

Table 3 also shows that among respondents with no formal education, 1 respondent reported not purchasing or using Moringa products, whilst 6 individuals stated that they have purchased or used Moringa products. Equally, among respondents with primary education, 11 individuals (4%) reported not purchasing or using Moringa products, while 55 individuals (18%) indicated that they have purchased or used Moringa products. Similarly, among respondents with secondary education, 29 individuals (10%) reported not purchasing or using Moringa products, while 86 individuals (29%) indicated that they have purchased or used Moringa products. Whilst, among respondents with tertiary education (higher education or advanced degrees), 25 individuals (8%) reported not purchasing or using Moringa products, while 85 (29%) individuals reported purchasing or using Moringa products. The chi-square test resulted in a p-value of 0.362 which suggests that there is no statistically significant association between education and the purchase of Moringa. Therefore, there is insufficient evidence to conclude that the purchase of Moringa products significantly differs across different educational levels.

4.1.5 Employment status

For employment status, it is observed that among the unemployed respondents, 9 individuals (3%) reported not purchasing or using Moringa products, while 53 individuals (18%) stated that they have purchased or used Moringa products. Equally, among the employed respondents, 57 individuals (19%) reported not purchasing or using Moringa products, while 179 individuals (60%) indicated that they have purchased or used Moringa products. The results of the chi-squared test suggest that there is no statistically significant association between employment status and the purchase of Moringa products. Therefore, there is insufficient evidence to conclude that the purchase of Moringa products significantly differs between employed and unemployed individuals.

4.1.6 Income level

From Table 3, it is observed that among respondents earning less than 25,000, 3 individuals (1%) reported not purchasing or using Moringa products, while 24 individuals (8%) stated that they have purchased or used Moringa products. Among respondents earning between 30,000 and 55,000, 11 individuals (4%) reported not purchasing or using Moringa products, while 49 individuals (16%) indicated that they have purchased or used Moringa products. Among respondents earning between 60,000 and 105,000, 16 individuals (5%) reported not purchasing or using Moringa products, while 56 individuals (19%) stated that they have purchased or used Moringa products. Among respondents earning between 120,000 and 350,000, 22 individuals (7%) reported not purchasing or using Moringa products, while 54 individuals (18%) indicated that they have purchased or used Moringa products. Among respondents earning 400,000 and above, 10 (3%) individuals reported not purchasing or using Moringa products, while 40 individuals (13%) stated that they have purchased or used Moringa products. The

results of the chi square test suggest that there is no statistically significant association between earnings and the purchase of Moringa. Therefore, there is insufficient evidence to conclude that the purchase of Moringa products significantly differs across different income brackets.

Overall, the findings suggest that Moringa products are popular among customers in Lilongwe, Malawi. While most of the demographic factors show some interesting trends, the statistical tests did not establish significant associations between these factors and the purchase of Moringa products. This finding is in concert with Neergheen-Bhujun et al. (2020) which established that a similar chi square test failed to establish significant association between factors such as gender, family type, marital status, education level, and household monthly income level. However, it must be reiterated that at a 10% significance level, their results indicate that there are reported significant differences between Moringa-product users and non-users within a specific age bracket.

4.2 The factors influencing the consumption of Moringa products among consumers

This study sought to investigate the factors influencing the consumption of Moringa products among consumers. These factors would shed light on the driving force behind individuals' decision to incorporate Moringa products into their daily diet. This section presents the results of the relative importance index and the corresponding rank for each factor.

Table 4: Relative Importance Index of the factors influencing the use of Moringa products

Factors influencing consumption of Moringa products	**Percentage of Respondents Scoring**				**RII**	**Rank**
	1	***2***	***3***	***4***		
Health benefits	7	5	11	77	**0.89**	**1**
Awareness	11	8	21	60	**0.83**	**2**

Factors influencing consumption of Moringa products	Percentage of Respondents Scoring				RII	Rank
	1	*2*	*3*	*4*		
Availability	15	15	20	50	**0.76**	**3**
Family and friends	28	11	21	40	**0.68**	**4**
Price	32	20	18	30	**0.61**	**5**
Cultural reasons	45	13	15	27	**0.56**	**6**
Marketing and advertisement	40	19	18	23	**0.56**	**7**
Taste preferences	45	24	12	19	**0.51**	**8**

4.2.1 Health benefits

Health benefits emerged as the most influential factor, with a high RII of 0.89. Approximately 77% of respondents considered the health benefits of Moringa products as a significant influence on consumption, assigning it the highest rank. This result confirms the study of Paleti et al. (2022) which established that nutritional benefits were a major factor influencing consumer preferences for Moringa products in Coimbatore City, India. The perceived health benefits can encompass various aspects, including the nutritional content, potential medicinal properties, or positive effects on overall well-being that are associated with Moringa products. Consumers' growing interest in health and wellness can lead to an increased emphasis on incorporating functional foods and ingredients into their diets. Moringa products, known for their high nutritional value and potential health benefits, have gained attention in this context. Similarly, the high influence of the health benefits on consumption suggests that consumers are actively seeking out products that align with their health and wellness goals. Thus,

it can be advanced that in Lilongwe, individuals believe that consuming Moringa products can provide specific health advantages, such as boosting immunity, providing essential nutrients, or supporting energy levels, as such they are more inclined to incorporate them into their dietary choices.

4.2.2 Awareness

Equally, the level of awareness about Moringa products holds substantial influence, with an RII of 0.83. About 60% of respondents recognized awareness as an important factor driving their consumption, positioning it as the second most influential factor. Awareness plays a crucial role in shaping consumer behavior and choices. When people become aware of a specific product, its benefits, and its availability, they are better equipped to make informed decisions about whether or not to consume it. In the context of Moringa products, awareness can encompass various aspects, such as understanding the nutritional value, potential health benefits, and possible culinary uses of Moringa. Increased awareness can be attributed to various factors, including effective marketing campaigns, educational programs, word-of-mouth recommendations, and media coverage. These channels help disseminate information about Moringa products and raise awareness among the target audience. The influence of awareness in consumption is highlighted by Fadoyin et al. (2014) as the authors advance that farmers were strongly influenced in using Moring because they were aware of the benefits of using Moringa oleifera as a water purifier and also for personal use to reduce potential health risks.

4.2.3 Availability

It is also observed that the easy availability of Moringa products garnered attention, yielding an RII of 0.76. This factor, with a score of 50%, was perceived as a key determinant for consumption and was ranked third. The acknowledgment of easy availability as a key

determinant of consumption underscores the practicality and convenience associated with accessing Moringa products within the local market. The fact that half of the respondents recognized this factor highlights the essential role it plays in shaping consumer choices. The accessibility of these products is likely to have a direct impact on the decision-making process of individuals, as it facilitates their ability to obtain and incorporate Moringa products into their daily routines. In a dynamic and fast-paced world, where convenience is often a paramount consideration for consumers, the ready availability of Moringa products aligns with this trend. Respondents' recognition of this factor suggests that the proximity and ease of obtaining Moringa products from various points of sale, such as markets, supermarkets, and pharmacies, substantially contribute to their desirability and uptake.

4.2.4 Family and friends

In addition, influence from family and friends played a role in respondents' decision to consume Moringa products, achieving an RII of 0.68. Approximately 40% of respondents acknowledged this social factor as a very influencing factor in their consumption decisions, placing it in the fourth rank. Family and friends are often considered influential reference groups when making decisions, including those related to product choices and consumption patterns (Thurber and Fahey, 2009; Liu, 2021; Hedhili et al., 2022) The opinions, recommendations, and experiences of family and friends can shape individuals' perceptions, attitudes, and preferences towards certain products, including Moringa products. This influence can manifest in various ways, such as direct recommendations, shared experiences, or observing the consumption behaviors of family and friends. Positive recommendations and endorsements from trusted individuals within one's social circle can create a sense of trust, credibility, and social validation for Moringa products. Individuals may perceive that if their family and friends find value in

consuming Moringa products, they are more likely to experience similar benefits and be motivated to incorporate them into their own consumption habits. Additionally, if Moringa products are seen as popular or valued within a person's social network, there may be a higher inclination to align with the consumption patterns of family and friends.

4.2.5 Price

Finally, affordability was noted as a factor, with an RII of 0.61. Around 30% of respondents indicated that price influenced their consumption choices, ranking it fifth. Price is a fundamental factor influencing consumer behavior and purchase decisions. When considering Moringa products, individuals evaluate the price in relation to the perceived value they expect to receive (Quaye et al., 2009; Hedhili et al., 2022). If the price of Moringa products is perceived as high or not commensurate with the benefits or quality offered, it can potentially impact consumption patterns. This implies that consumers may weigh the perceived benefits and value derived from Moringa products against their prices. If consumers perceive the health benefits, taste preferences, or other desirable attributes of Moringa products to be significant, they may be more willing to pay a higher price. On the other hand, if the perceived benefits do not outweigh the cost, consumers may be more price-sensitive and less likely to consume Moringa products.

4.3 The perception of consuming Moringa products.

The study sought to analyze the perception of consumers regarding consuming Moringa products. Table 5 shows the percentage of respondents scoring different factors related to Moringa products, as well as the Relative Importance Index (RII) and the corresponding rank for each factor.

Table 5: Relative Importance Index of Consumer's perception of Moringa products

Perception about consuming Moringa products	Percentage of Respondents Scoring				RII	Rank
	1	*2*	*3*	*4*		
Unpleasant taste	50	16	17	17	**0.75**	**1**
High Price	42	22	17	19	**0.72**	**2**
Limited variety	37	15	22	26	**0.66**	**3**
Limited availability	37	14	21	28	**0.65**	**4**
Uncertainty about quality	35	17	22	26	**0.65**	**5**
Lack of Information	26	8	21	45	**0.54**	**6**

4.3.1 Unpleasant taste

It can be observed that taste is a significant concern as it received the highest RII (0.75) and was ranked as the most important issue suggesting that taste plays a crucial role in consumer perception. The majority of respondents, 50%, considered the taste of Moringa products to be unpleasant. This role of taste in affecting consumer perception aligns with previous studies (Frewer et al., 2007; Chodur et al., 2018; Khaled et al., 2022). These studies have identified taste as a crucial determinant of consumer acceptance and willingness to consume health-oriented products. Khaled et al. (2022) suggest that the taste of Moringa products greatly influences Lebanese consumer preferences and purchase decisions. The results highlight the similar importance of taste and suggest that improving the taste or finding ways to mask or enhance it could significantly impact consumer acceptance and willingness to consume Moringa products.

4.3.2 High price

It can also be observed that price is a prominent factor as the high RII (0.72) and ranking (2indicate that cost is a significant consideration for consumers. 42% of respondents expressed that Moringa products were perceived as expensive. This suggests that price point and affordability are crucial factors that need to be addressed to attract a wider consumer base. This finding that consumers perceive Moringa products as expensive is consistent with research on consumer behavior toward functional foods and dietary supplements (Verbeke et al., 2000; Grunert et al., 2007; Van Doorn and Verhoef, 2015). These studies have shown that price sensitivity is a significant factor influencing consumer purchasing decisions, particularly for products positioned as health-enhancing or premium. Affordability and value for money play a crucial role in attracting and retaining consumers. Therefore, pricing strategies, such as competitive pricing, promotional offers, or bundle deals, should be considered to address consumer concerns about the high price of Moringa products.

4.3.3 Limited variety and availability

It can be observed that the factors "limited variety" and "limited availability" both received moderate RII scores that is 0.66 and 0.65 respectively. This suggests that consumers may feel restricted in their choices when it comes to Moringa products. The findings regarding the limited variety and availability of Moringa products resonate with consumer behavior studies highlighting the importance of product assortment and accessibility. Consumers value choice and convenience when selecting functional food products. Literature suggests that a diverse range of product options and wider availability across different channels positively influences consumer satisfaction and likelihood of purchase (Steptoe et al., 1995; Grunertand Wills, 2007; Verbeke et al., 2012). Thus, there is a more calculated effort to expand the range of Moringa products and

making them more accessible through online platforms, local stores, or collaborations with retailers to cater to diverse consumer preferences.

4.3.4 Uncertainty about quality

Equally, the results suggest that quality concerns about Moringa products exist. The factor "uncertainty about quality" received a relatively high RII (0.65), indicating that respondents had concerns regarding the quality of Moringa products. This suggests that consumers may require more information or reassurance about the quality, sourcing, and production processes of Moringa products. This finding about consumers' concerns about uncertainty about the quality of Moringa products illuminates the importance of quality assurance and transparency in the functional food market. Consumers are increasingly concerned about the safety, authenticity, and efficacy of health products. Existing literature emphasizes the significance of providing clear information on product sourcing, manufacturing practices, certifications, and quality control measures to build consumer trust (Steptoe et al., 1995; Silayoi and Speece, 2007). This implies that ensuring adherence to regulatory standards and third-party testing can help address consumer concerns about the quality of Moringa products.

4.4 Consumers' willingness to pay for Moringa products.

The final objective sought to explore the factors explaining consumers' willingness to pay (WTP) for Moringa products. The final objective sought to explore the factors explaining consumers' willingness to pay (WTP) for Moringa products. Respondents were asked to state their maximum willingness to pay for 250g of Moringa powder. To control hypothetical bias, cheap talk and certainty follow-up questions were used before and after eliciting WTP (Blumenschein et al., 2008; Morrison and Brown, 2009). The general consensus is that

consumers are willing to pay for the Moringa products. The results are presented in the table below.

Table 6: Customer Willingness to Pay

Variable	***Freq***	***Percent***
The Maximum amount you would be willing to pay		
Less than 1000	*86*	*29*
1001 to 3000	*139*	*47*
3001 to 6000	*49*	*17*
6001 +	*22*	*7*
Are you sure you will pay		
Not Sure	*7*	*2*
Sure	*71*	*24*
Very Sure	*219*	*74*
What premium price are you willing to pay		
0%	*80*	*27*
5%	*102*	*34*
10%	*82*	*28*
20%	*33*	*11*
Are you sure you will pay?		
Not Sure	*8*	*3*
Sure	*78*	*27*
Very Sure	*206*	*70*

Multiple linear regressions were conducted with the dependent variable sourced from the question: *What is the maximum amount you would be willing to pay for 250g of Moringa powder?* The results are presented in Table 6. The table contains six models with dependent variable regressed on explanatory variables: certification, gender, age, marital status, employment status, monthly income, and level of education. The R-squared values range from 0.14 to 0.21. Models 1 to 3 have R-squared of 0.20, indicating that the independent variables explain between 20% of the variation in the models. Models 4 and 6 have R-squared of 0.21, whilst model 5 has R-squared of 0.14 indicating that the independent variables explain between 21% and 14% of the variation in the models respectively. Finally, the regression diagnostics were performed to assess assumption compliance. The results of the heteroskedasticity and multicollinearity tests confirm model fit (See appendix B)

Table 7: Factors influencing the willingness to pay for Moringa products

	Dependent variable:					
	Willingness to pay for Moringa Products					
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	6.16***	6.17***	6.15***	6.13***	6.70***	6.14***
	(0.28)	(0.28)	(0.29)	(0.28)	(0.28)	(0.29)
Certification	0.18	0.18	0.18	0.19	0.27**	0.19
	(0.12)	(0.12)	(0.12)	(0.12)	(0.13)	(0.12)
Male	0.20*	0.20*	0.20*	0.15	0.14	0.15
	(0.11)	(0.11)	(0.11)	(0.11)	(0.12)	(0.11)
Age	0.16*	0.16*	0.16*	0.12	0.05	0.12

	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Married		-0.01	-0.01	-0.04	-0.16	-0.04
		(0.11)	(0.11)	(0.12)	(0.12)	(0.12)
Employed			0.03		-0.02	-0.02
			(0.13)		(0.15)	(0.14)
Monthly earnings				0.12**	0.26***	0.12**
				(0.06)	(0.05)	(0.06)
Level of Education	0.50***	0.49***	0.49***	0.39***		0.39***
	(0.07)	(0.07)	(0.07)	(0.09)		(0.09)
Observations	232	232	232	223	223	223
R^2	0.22	0.22	0.22	0.24	0.16	0.24
Adjusted R^2	0.20	0.20	0.20	0.21	0.14	0.21
Residual Std. Error	0.82 (df = 227)	0.83 (df = 226)	0.83 (df = 225)	0.83 (df = 216)	0.87 (df = 216)	0.83 (df = 215)
F Statistic	15.84*** (df = 4; 227)	12.62*** (df = 5; 226)	10.48*** (df = 6; 225)	11.06*** (df = 6; 216)	6.98*** (df = 6; 216)	9.44*** (df = 7; 215)
Note:	*p<0.1; **p<0.05; ***p<0.01					

The results show that certification is positively related to the willingness to for Moringa products, but it is only significant in model 5. In model 5, it is observed that an individual who

considers certification to be important is 27% more likely to be willing to pay for Moringa products in comparison with an individual who does not acknowledge the importance of certification. With regards to gender, it is observed that in models 1 to 3, men are 20% more willing to pay for Moringa products in comparison with women. Equally, age has a significant effect on the willingness to pay for Moringa products as it is observed that in models 1 to 3, older individuals were 16% more likely to have a higher willingness to pay for Moringa products.

Similarly, the variable 'monthly earnings' was seen to have a significant effect on the dependent variable as it is observed, in models 4 to 6, that individuals with higher earnings are 12%, 26% and 12% more willing to pay for Moringa products. Furthermore, is observed that levels of education is significantly associated with the willingness to pay in all the models it was introduced into, that is models 1, 2, 3, 4 and 6. It is observed that individuals with higher levels of education are associated with a 50%, 49%, 49%, 39% and 39% willingness to pay for Moringa products in each model respectively. Finally, it can be observed that marital status and employment status are not associated with the willingness to pay for Moringa products across the models.

The result suggests that having a certification may have a positive influence on willingness to pay for Moringa products. Certifications often serve as indicators of product quality and safety. Consumers may perceive certified Moringa products as meeting specific standards and undergoing rigorous testing or inspection processes (Pratt et al., 2002; Liu et al., 2022). This assurance of quality can enhance consumers' trust and confidence in the product, thereby increasing their willingness to pay a higher price. Equally, certifications can provide consumers with clear and reliable information about the product's attributes, production methods, and sourcing. This increased transparency enables consumers to make more informed choices,

and they may be willing to pay a premium for products that meet their specific requirements or align with their values. Finally, certifications can enhance the perceived value of Moringa products (Obayelu et al., 2015). Consumers may believe that certified products offer unique benefits or differentiation compared to non-certified alternatives. This perceived value can justify a higher price point and increase consumers' willingness to pay. It is observed that the influence of certification is limited that is observed in only one model which ideally does not include the education variable. This can be attributed to the expected pay-off of higher levels of education informing customers about the expected value of the products.

The results indicate that gender is influential in individual's willingness to pay for the Moringa products. This result confirms the study by Ali and Ali (2020) which established the role of gender in explaining the willingness of consumers to pay for health and wellness food products. The result presents an interesting position as it is observed that on average, men tend to exhibit a higher willingness to pay for Moringa products compared to women.This observed difference can be explained by the role of societal norms and gender roles in shaping consumer behavior. The present cultural expectations or gender-specific marketing messages may have influenced men to perceive Moringa products as aligning with their dietary or health-related needs. This socialization process might contribute to the observed difference in willingness to pay between genders. It is possible that men and women have different preferences or attitudes toward Moringa products. This could be influenced by factors such as taste preferences, nutritional needs, or perceived health benefits associated with Moringa. Men may have a higher willingness to pay due to specific preferences or perceived value they associate with these products.

Furthermore, the results indicate that older individuals tend to have a higher willingness to pay for Moringa products. The established association between age and willingness to pay has been extensively highlighted in existing studies (Farinola et al., 2014; Obayelu et al., 2015; Oyekale et al., 2015). This could be explained in a myriad of ways. First, as individual ages, they may become more conscious of their health and well-being. Older individuals often have more stable financial situations and higher disposable incomes compared to younger age groups. With greater financial resources, they may be more willing and able to allocate a larger portion of their income towards products that they perceive as beneficial for their health and well-being, such as Moringa products. Also, older individuals often prioritize their health and may be more willing to invest in products that offer perceived health benefits, such as Moringa products known for their nutritional value. This heightened health awareness may contribute to a higher willingness to pay. Equally, older individuals are more likely to adopt health-conscious behaviors and prioritize their overall well-being. This may include engaging in healthier diets, consuming natural or organic products, or seeking out specific nutrients. The alignment between Moringa products and a health-conscious lifestyle could lead to a higher willingness to pay among older individuals.

In addition, the results suggest that higher earnings are associated with a higher willingness to pay for Moringa products. Obayelu et al. (2015) opine that this can be attributed to the possibility that individuals with higher monthly earnings have greater financial resources and the disposable income available. This increased financial capacity allows them to allocate a larger portion of their budget toward purchasing Moringa products, even at higher price points. Equally, higher-earning individuals may have different expectations and perceptions regarding the quality, value, and benefits of products. They may be more willing to pay a premium for

Moringa products due to a perceived higher quality, better nutritional content, or superior health benefits associated with these products. The perception of higher value can justify the willingness to pay more among individuals with higher earnings. Finally, individuals with higher earnings may place a greater emphasis on their health and well-being. They may have a greater awareness of the potential benefits of Moringa products and prioritize their consumption as part of a health-conscious lifestyle. As a result, they are more willing to invest in products that support their wellness goals, leading to a higher willingness to pay for Moringa products.

Finally, the results indicate that higher levels of education are associated with a higher willingness to pay for Moringa products. In an earlier study, Oyekale et al. (2015) advance that higher level of education positively influenced consumers' willingness to pay for Moringa. The authors opined that higher levels of education often correspond with greater health consciousness and awareness. Individuals with higher education levels may be more knowledgeable about nutrition, health benefits, and the potential value of Moringa products. This increased awareness and understanding of the product's benefits can lead to a higher willingness to pay. Also, education can shape individuals' perceptions of quality and value. Those with higher education levels may have higher standards and expectations when it comes to the products they consume. They may perceive Moringa products as being of higher quality, having superior nutritional content, or being produced through sustainable and ethical practices. This perception of higher value and quality can drive a higher willingness to pay. Finally, higher-educated individuals often prioritize their health and well-being. They may value products that align with their health-conscious lifestyles and wellness goals. Moringa products, known for their nutritional benefits, may be perceived as contributing to overall health and well-being, which can result in a higher willingness to pay among those with higher levels of education.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.0 Introduction

This section provides a summary of the study's findings and conclusions. Specifically, this section summarizes the findings on the popularity of Moringa products among customers. The chapter also summarizes the results of the factors influencing the consumption of Moringa products among consumers. Additionally, the chapter summarizes the findings on the perception of consuming Moringa products as well as the consumers' willingness to pay for Moringa products. The recommendations for policy and future research are also proffered.

5.1 Conclusion

This study employed a quantitative research approach to investigate the factors influencing consumer preferences and purchasing behavior towards Moringa products. This study specifically employed the cross-sectional approach. The study employed convenience sampling, to address the issues of practical considerations and time constraints, to select participants based on their accessibility and convenience rather than random selection. The determined sample size for the study was 300 respondents. The study relied solely on primary data. A structured questionnaire was developed to serve as the primary data collection instrument for this study. The survey data was analyzed using R programming software and Excel. The study conducted both descriptive and inferential statistics. This included frequency distributions, chi-square tests, relative importance index and multiple linear regressions. The results were presented in tables and charts.

The study assessed the popularity of Moringa products among customers in Lilongwe, focusing on the frequency of purchase and usage reported by respondents. The results indicated

that Moringa products enjoy a high level of popularity in the city. A significant majority of respondents (232 individuals) reported purchasing or using Moringa products, reflecting a substantial demand in the local market and indicating a positive perception of their benefits and value. The results indicated that approximately 81% of female respondents and 75% of male respondents reported purchasing or using Moringa products. In terms of age groups, the highest number of respondents who purchased or used Moringa products fell within the age range of 20 to 40 years, while the age groups of less than 20 and 61 years and above had the lowest number of respondents engaging with these products. There were no significant differences in the purchase of Moringa products based on gender, education level, marital status, employment status, or income brackets, however, there were reported significant differences for age groups.

The findings from the study offer valuable insights into the intricate web of factors that collectively influence the consumption patterns of Moringa products. The first cluster of influential factors centers on health-conscious choices. The prominence of health benefits as a primary driver of consumption underscores a growing awareness of the role that nutrition plays in overall well-being. Respondents' recognition of the potential advantages that Moringa products offer, in terms of their nutritional content and associated health benefits, emphasizes a heightened consciousness among consumers regarding the positive impact of their dietary choices. Closely intertwined with health benefits is the factor of awareness which explains customers' aforementioned knowledge of the benefits of Moringa products.

Moreover, the ease with which individuals can access Moringa products directly influences their ability to incorporate these items into their routines. The readily availability of Moringa products, whether through local markets or commercial outlets like supermarkets and pharmacies, simplifies the process of acquisition, thus contributing to their attractiveness to

consumers seeking convenient and accessible dietary options. Equally, the sway of family and friends and the impact of pricing on purchasing decisions collectively underscore the role that broader societal contexts play in shaping individual choices. While cultural influences, marketing efforts and taste preferences hold a place in influencing consumption, their relatively lower perceived impact suggests that, in the context of Moringa products, consumers may be more motivated by health and practical considerations than by these particular factors.

The study sought to examine consumer perception of consuming Moringa products. The findings highlight the importance of addressing taste preferences, price affordability, quality assurance, product variety, and availability, as well as providing comprehensive information to enhance consumer perception and acceptance of Moringa products. The study showed that taste is the most important factor affecting consumer perception, with 50% of respondents finding the taste of Moringa products unpleasant. Equally, price sensitivity and affordability play a crucial role in attracting and retaining consumers, suggesting the need for pricing strategies to address consumer concerns about the high price of Moringa products. Similarly, the findings show that individuals had concerns regarding the quality of Moringa products. Also, the findings show that consumers feel restricted in their choices due to the limited variety and availability of Moringa products. Finally, while lack of information is a relatively minor concern, some respondents expressed a need for more information about Moringa products. This involves providing comprehensive and accurate product information that can educate consumers about the health benefits, usage instructions, and potential side effects of Moringa products.

Finally, the study explored the factors influencing consumers' willingness to pay for Moringa products. The results indicate that factors such as certification, gender, age, monthly earnings, and level of education were found to influence consumers' willingness to pay for

Moringa products. It is observed that having certification for Moringa products was positively related to willingness to pay in one model. Also, men exhibited a higher willingness to pay for Moringa products compared to women and this was attributed to societal norms, gender roles, and potential differences in preferences and perceived value of Moringa. Equally, older individuals had a higher willingness to pay for Moringa products due to increased health consciousness, stable financial situations, and prioritization of health and well-being among older age groups. Similarly, higher earnings were associated with a higher willingness to pay for Moringa products in three models due to greater financial resources and perceived value, as well as a higher priority on health and well-being. Finally, higher levels of education were significantly associated with a higher willingness to pay for Moringa products. This association can be attributed to greater health consciousness, knowledge about nutrition and product benefits, and higher standards and expectations regarding quality and value.

5.2 Recommendations

Based on the findings of the study, the following recommendations are put forth.

1. Stakeholders such as the government, Moringa Industry players as well as policymakers can play a crucial role in promoting consumer education and awareness about Moringa products. This can be done through public health campaigns, educational programs, and partnerships with relevant stakeholders such as health organizations or educational institutions. By providing accurate and science-based information about the nutritional benefits, preparation methods, and safe usage of Moringa products, policymakers can empower consumers to make informed choices.
2. Stakeholders can encourage, and support research and development activities related to Moringa products. This can involve funding research projects, providing incentives for

innovation in product formulation and taste enhancement, and facilitating collaboration between research institutions and industry players. By investing in research and development, policymakers can promote product innovation, improve taste profiles, and enhance the overall quality and appeal of Moringa products.

3. Moringa Industry players can establish regulations and standards for the quality assurance of Moringa products. This can include setting criteria for certifications, promoting adherence to good manufacturing practices, and conducting regular inspections and testing to ensure product safety and quality. By establishing clear guidelines and enforcing compliance, producers of Moringa products can build consumer trust and confidence in the market.
4. The government or the government machinery responsible for agriculture can facilitate collaboration between different stakeholders in the Moringa industry, including producers, processors, distributors, and retailers. This can involve creating platforms for knowledge exchange, fostering partnerships between industry players, and organizing industry events or trade fairs. By promoting collaboration and market development, the government can create a conducive environment for the growth and competitiveness of the Moringa sector.
5. Furthermore, future studies can focus on elucidating the specific health benefits and nutritional profiles of different Moringa products. Research can investigate the bioactive compounds, micronutrient content, and potential therapeutic applications of Moringa products. This can help in establishing evidence-based health claims and expanding the understanding of the nutritional value of Moringa as a functional food ingredient.

6. The research's predominantly quantitative methodology provided generalized insights into consumer perspectives regarding moringa products in Lilongwe. However, future studies could employ qualitative techniques like interviews or focus groups to gain an in-depth understanding of the cultural, sensory, and experiential factors affecting moringa consumption from the consumer viewpoint.
7. While this study focused exclusively on Lilongwe, comparative research could examine if consumer interactions with moringa differ across urban and rural areas of Malawi, particularly given disparities in accessibility, incomes, education levels, and farming practices. Investigating regional variations could reveal opportunities to promote moringa utilization nationwide.

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Appendices

Appendix A: Questionnaire

This questionnaire has been designed to form part of research that seeks to examine the use of Moringa products in Lilongwe. Could you answer the questions that are in this questionnaire? The questionnaire is an essential aspect of the study, and responders are encouraged to fill it out and provide any additional information they believe is necessary. The researcher will maintain the highest level of integrity and ethics by ensuring that the information gathered is used solely for academic purposes and is treated with strict confidentiality.

Demographics

1. Gender. **A**. Male **B.** Female
2. Age of respondent. **A**. Less than 20 years **B**. 20-40 years **C**. 41-60 years **C**.61 and above years
3. Marital Status. **A**. Single **B**. Married **C**. Divorced **D**. Widow/Widower **E**. Separated
4. Highest level of education. **A**. None**B**. Primary **C**. Secondary **D**. Tertiary
5. Occupation. **A**. Farming **B**. Civil servant **C**. Trading/Business **D**. Student
6. On average, how much do you earn in a month?.....

Popularity of Moringa products

7. Are you aware of the existence of Moringa products? **A**. Yes **B**. No
8. Have you ever purchased or used Moringa products? **A**. Yes **B**. No
9. How frequently do you purchase Moringa products?

   A. Rarely or never **B.** Once a month **C**. A few times a month D. Once a week **E**. Multiple times a week
10. Which type of Moringa products have you purchased or used?

A. Moringa capsules **B**. Moringa powder **C**. Moringa Oil **D**. Moringa seed E. Other……..

11. Are you more likely to purchase general Moringa products or organic Moringa products? Why? .....……

12. How important is the organic certification of Moringa products to you?

    A. Not important at all **B**. Slightly important **C**. Very important **D**. Extremely important

13. Where do you typically purchase Moringa products?

    A. Online (e-commerce) **B**. Health food stores **C**. Supermarkets/grocery stores **D**. Farmers' markets **E**. Pharmacies **F**. Other (please specify)……

14. Would you recommend Moringa products to your friends and family?

    A. Yes, definitely **B**. Maybe, if they're interested in such products **C**. No, I would not recommend them.

Factors influencing the use of Moringa products.

15. Using a scale of 1=Not influential; 2=somewhat influential; 3= moderately influential and 4= highly influential, indicate how influential the following factors are in your decision in using Moringa products.

Factor	1	2	3	4
Awareness				
Price				
Availability				
Taste and preferences				
Family and friends				
Health benefits				
Cultural and Traditional reasons				
Marketing and advertisement				
Other…….				
Other…….				

Perception about the consumption of Moringa products

16. On a scale of 1 to 4, with 1 being "extremely dissatisfied" and 4 being "extremely satisfied," please rate your overall satisfaction with consumption of the following

Product	1	2	3	4
Moringa powder				
Moringa Seed				
Moringa Oil				
Moringa capsules				
Other				

17. What improvements or changes would you like to see in Moringa products to enhance your satisfaction as a consumer? .....

18. On a scale of 1= Not at all challenging; 2 =Slightly challenging; 3=Moderately challenging; 4= Very challenging, indicate your experience regarding the following challenges have affected your use of Moringa products

Factor	1	2	3	4
Limited availability in local stores				
Limited variety of Moringa products				
High price compared to other alternatives				
Uncertainty about the quality or authenticity of products				
Unpleasant taste or flavor				
Lack of information or education about Moringa products				
Other (specify)				

Consumers' willingness to pay.

Please you are about to answer questions on willingness to pay for Moringa products, answer the questions as if you are buying the products in a real-life situation.

19. What is the maximum amount you would be willing to pay for a specific certified organic Moringa product? Please enter the amount in Kwacha: _____

20. How sure are you that you would pay? **A**. Very sure **B**. Sure **C**. Not sure

21. What is the maximum amount you would be willing to pay for a specific inorganic (non-organic) Moringa product? Please enter the amount in Kwacha: _____

22. How sure are you that you would pay? **A**. Very sure **B**. Sure **C**. Not sure

23. What premium price are you willing to pay for certified organic Moringa products?

A. 0% **B**. 5% **C**. 10% D. 20%+

24. How sure are you? **A**. Very sure **B**. Sure **C**. Not sure

25. What premium price are you willing to pay for organic Moringa products compared to general Moringa products?

A. 0% **B**. 5% **C**. 10% D. 20%+

26. How sure are you? **A**. Very sure **B**. Sure **C**. Not sure

Name of respondent……

TelephoneNumber……

Thank you!

Appendix B: Model diagnostics

Model	Heteroskedasticity	Multicolinearity
Model 1	+	+
Model 2	+	+
Model 3	+	+
Model 4	+	+
Model 5	+	+
Model 6	+	+
Decision: + **= success, - = fail**	+ = p value > 0.05	+ = vif< 4

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