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Consumers' attitude and perception of *Moringa oleifera* products in Nasarawa state, Nigeria

MASTER'S THESIS

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Declaration

I hereby declare that I have done this thesis entitled consumers' attitude and perception of *Moringa oleifera* in Nasarawa state Nigeria independently, all texts in this thesis are original, and all the sources have been quoted and acknowledged by means of complete references and according to Citation rules of the FTA.

In Prague 20th April 2023

.....

Ilesanmi Ayodeji Amoran

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This has always been a dream, and nothing excites me more than the fact that a dream is now a reality. I would like to return all glory and honour to God Almighty, who made this possible. Similarly, I would like to thank my parents, my siblings, most importantly Abiodun Ernest, Samuel Kayode, Ayomide Adebayo for their support and love all through the programme. I would like to specially thank my boss, Hon. Ajibaye Ekundayo and the wife, who beyond being a boss has become a father to me and family, thank you for everything and believe me, words would never be enough at any point to say my thanks to you sir.

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Abstract

Moringa is mostly used for medicinal, nutritional, culinary, pharmaceutical, and as vegetables for consumption in many parts of the world. It has been proven to be effective in combating food insecurity in the society, considering that it significantly contributes to the improvement of nutrition and health situation of people that consumes it. Therefore, seeing that there is a rising population growth with more demand for food and nutritional balance, the consumption of tree crop as moringa can be considered as an option for health and nutritional intake. In the case of Nigeria, particularly in the study area, there is an increasing rate of stunted growth which is mostly caused by inadequate/unhealthy diet at any time of life, limited access to food, nutrition knowledge deficiency and so on. Noteworthy is that moringa is planted by nearly every household in the area, therefore, the attitude and perception of consumers to moringa oleifera in the area then becomes important for study.

A total of 210 respondents were evaluated, where only 202 were fit for final analysis; and data collected were analysed using descriptive statistics, Mann Whitney U test, binary logistic and probit regression models. The study identified the form of use, the perceived health risk of the respondents, the factors influencing the decision to consume moringa products, and finally, the main reason why they consume moringa products from the perspective of health benefit. The study tested how socioeconomics and psychographic characteristics determines consumers' willingness to pay for moringa tea products, and how previous experience had a positive relationship on consumers' willingness to pay for *Moringa oleifera* products.

The result showed that boiled fresh leaf was the most consumed form, the respondents preferred synthetic drugs to moringa products because they are produced in the laboratory and prescribed by qualified doctors, age and education were factors influencing their decision to consume; immune boosting, energy intake and fever treatment were the top 3 reasons why they consume moringa. Level of education, affordability of moringa products, Perception of the price of close substitute were factors influencing their willingness to pay for moringa tea; fair price offered, and expectation met are factors that were significant based on the previous experience of the consumers. The study recommends the use of moringa as a functional food since they contain essential compounds of antiaging drugs which can inhibits cancerogenesis; Government and pharmaceutical body should give it needed support for wide publicity

at an affordable price; to bridge information gap, food dietary program/training should be organized to educate and sensitize the public on the use of moringa.

Key words: Willingness to pay, Willingness to consume, Medicinal and Nutritional purpose, Malnutrition.

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List of the abbreviations used in the thesis.

A

ANOVA: Analysis of Variance, 17

B

B.Sc: Bachelor of Science, 26

C

CENCOMDEV: Centre For Community Development, 11

F

FOXO: Forkhead Box Transcription Factors, 40

M

M.Sc: Master of Science, 26

mTOR: Mammalian Target of Rapamycin, 40

N

NCE: Nigeria Certificate In Education, 26

O

OND: Ordinary National Diploma, 26

P

PGCI-alpha: peroxisome proliferator-activated receptor- γ coactivator-1 α , 40

S

SD: Standard Deviation, 33

U

UNICEF: United Nations Children's Fund, 11

W

WHO: World Health Organization, 1

1. Introduction and Literature Review

1.1. Introduction

Moringa oleifera is native to Northwest India and is often referred to as the "drumstick" or "horseradish," but it is also found in South Africa, Southwest Asia, Northeast Africa, Tropical Asia, Madagascar, and Latin America. Similarly, the moringa genus contains 14 species in total which are *M. Concanensis*, *M. hildebrandtii*, *M. arborea*; *M. longituba*, *M. borziana*, *M. pygmaea*; *M. drouhardii*; *M. longituba*, *M. rivaie*, *M. peregrina*, *M. stenopetala*, *M. ruspoliana*, *M. Ovalifolia*, and *M. oleifera* (Rani et al. 2018). *Moringa oleifera* is the most studied and exploited moringa species for human and animal end use, out of the many species in the moringa family. (Anwar et al. 2005). It also differs from other crops in that its leaves can be consumed fresh, roasted, or stored as dried powder for many months without refrigeration and, according to reports, with no loss of nutritional content. Due to its potential to have significant positive effects on people's health and the environment, it has recently attracted the interest of dieticians, healthcare workers, health enthusiasts, and green organizations. According to Mishra et al. (2011), it is medicinally valuable, as a result, it is used to treat a variety of illnesses because it acts as a cardiac and circulatory stimulant, antioxidant, has anti-tumor, antihypertensive, antipyretic, antiepileptic, anti-inflammatory, antispasmodic, antiulcer, diuretic, cholesterol lowering, anti-diabetic, hepatoprotective, antibacterial, and antifungal properties. In the light of the world's growing population which according to FAO (2016) is expected to hit 9-10billion people by 2050, there is equally an expected increased demand in food and nutrients that levels up with population growth. However, they opined that with appropriate policy investment and food intervention programs, the tendency of food insecurity can be abated. Meanwhile, WHO (2018) said one-third of the world's population suffers from inadequate nutrients leading to some health deficiencies. This is further corroborated by the study of Global Nutrition Report of 2018 (Hawkes 2018) stated that poor feeding of infants and young children remains a key cause of infant malnutrition everywhere. The above is similar to the growth of children in Nigeria who are also recorded to have the third highest stunted growth in the world (Tolulope et al. 2013). The research evaluating the contribution of FAO contributions to *Sustainable Development Goal 2* clearly mentions the concept of 'nutrition', revealing that nutritional imbalances is mostly caused by an inadequate/unhealthy diet at any time of life (Grosso et al. 2020). These unhealthy diets, which can also be because of limited access to food, nutritional

knowledge, leading to lack of right attitudes and behaviours can be addressed by understanding consumer's perception and nutritional education.

To address these nutritional imbalances as in case of Nigeria, the consumption of some of the local foods and fruits that are native to Nigeria, including *moringa*, can be considered as a good source of nutrient that could avert diseases and poor nutritional intake among the population. Worthy of note is that the consumption of this plant is wholesomely determined by the consumers and all other underlying factors that could influence them; some which can be socio-economic, cultural, psychographic etc. Besides all the factors related to socio economic characteristics, cultural, mental and other social factors of the consumers, there could also be sensory tastes that is related to the level of satisfaction derived from the consumption of a product. It is also inclusive of the amount and supply of energy needed for physical activities by individuals. Satiety is obtained by consuming carbs and starchy meals such as bread, rice, and potatoes, could also be associated with local foods, fruits, and other nutritious food products such as *Moringa oleifera* depending on the perception of the consumers to such foods. Therefore, this research was focus on the investigation of consumers attitudes and perception of moringa products in Nigeria and how it can be used through consumer's preference to better nutritional intake and boost healthy living.

1.2. Literature review

1.2.1. Use of moringa products

The parts of *Moringa oleifera* just like every other plant include —leaves, flowers, seeds, pods, bark and roots and they all can be used for one purpose or the other ranging from consumption purpose to health care purpose and many others. The plant *M. oleifera* also gained the name "Miracle of trees" because of its diverse purpose and it has strong root system which makes it has capacity to survive well even in dry hot climates and poor soils (Anwar et al. 2005). It is also a nutritious plant which also serves the purpose of treating malnutrition or malnourished patients in developing countries (Debajyoti et al. 2017). In comparison to other plants such as orange, carrot, banana and spinach; moringa contributes more relative nutrients elements such as iron, vitamins, calcium among others (Oduro et al. 2008). As for the values attached to the consumption and use of these food products; there is

a challenge to observe on how acceptable or appealing it is to its consumers and of course how they react to it.

The plant is used for a variety of purposes, including domestic cleaning agent, fever treatment, nutrient supplement, water purification, blue dye, fencing, bio-pesticide, fertilizer, green manure, gum, foliar nutrient, honey- and sugar cane juice-clarifier, honey (flower nectar), medicine, ornamental plantings, pulp, rope, tanning, tea etc. (Emmanuel & Emmanuel 2011). It is essential to point out that food products and produce including *moringa* have varying levels of interest, attitude, acceptability and even perception with the consumers. All of these depends on several factors ranging from cultural, mental and social factors meant for such food to either be adopted as functional foods or dietary supplements; both of which are regarded as important products for the body system to reduce health risks and reduce chances of diseases infection into the system worldwide (Phillips & Rimmer 2013). Similarly, the consumption of the two classes of food above is not limited to eating three times a day or eating for the purpose of energy for the daily activities but also aimed at protecting the body from several hazards that might even be insignificant but also a basis for the physiological mindset which determines the consumption and perception of the consumers to the food (Rozin 2006).

1.2.2. Benefits of production of moringa tree crop

Moringa oleifera is one of the important tree crops contributing to the numbers of useful tree species in the world and it is a member of the family of Moringaceae. It is a fast growing and drought resistant tree, and its native is attached to India, although sometimes mistaken as Asian crops (Oyeyinka 2018). There are several names attached to this tree depending on the culture of people and the purpose it meant for and some of them are drumstick tree, *moringa*, horseradish tree, ben oil tree and many more (Hellsing et al. 2014). It is scientifically referred to as *Moringa oleifera* and the name is believed to be originate from its structure as a twisted pod and its purpose as a young pod seed which is commonly used as medicinal purpose at the traditional market and also as vegetables for consumption in many parts of the world. There are so many other basic uses of *Moringa oleifera* and some of which include malnutrition management, culinary uses, and traditional medicine. Generally, it is then paramount to know that this tree crops is not only useful in the above, but it also ensures rapid and sustainable level of food security in the society, contributes significantly to the improvement of nutrition and recommendation of health specific purposes, support plans and guides of sustaining land care while been used alongside as a forage crop for livestock,

and also serves as micronutrient liquid, a natural anthelmintic, and possible adjuvant (Leone, 2015).

Moringa oleifera is a highly demanded type of crop and it is widely accepted in larger parts of the world because of its fast growing and nutritional value for the years. *Moringa oleifera* has also emerged in larger parts of the world and it is accepted for been a reliable income not only for commercial farmers but also the small-scale farmers and because of this regularity as a source of revenue; it is called smart crops or super foods (Waterman 2021). Attached to this variety of purpose is why moringa is attached to several organizations in aim to keep meeting the lagging need of low-income consumers and serving as source of revenue for their livelihoods especially among the rural populace.

The moringa tree has a lot of advantages and unique characteristics. According to Omotesho et al. (2013), the moringa tree's ability to fight hunger and poverty is still unquestionable. Other than this, there are other research on the aim to affirm if the purpose moringa was used for satisfies the need of the consumers. A similar example of this is research by Animashaun et al. (2013), on the perceptions consumers on effectiveness of moringa for nutraceutical benefits, the research conducted shows that across each of the categories, the respondents strongly agreed to the claims stated on the purpose it was used for. In essence, moringa is not only a specific crop for one purpose but a multipurpose crop for several needs. If given adequate attention and meets the needs of people, it is obvious that the demand for this crop will be on the high side and the rural farmers can generate income from this and even other employment opportunities. Other than the financial perspective, the crop can also serve dietary purpose for the rural populace with organic health benefits as it can be cultivated without the use of chemicals. Table 1 shows an overview of some of the uses that have been identified for the purpose of this study.

Table 1: The list of uses of *Moringa oleifera*

Uses	Findings	Author(s)
Food and nutritional security	Consuming households that are producers and non-producers of moringa has more calories intake than non-consuming households	(Tafesse <i>et al.</i> 2020)
Pharmacological purposes	The seed and oil serve as Anticancer, antidiabetic, reduced nocturnal heart rate, attenuate for asthma and arthritis, antiaging, protein source etc. Modulate T cell calcium signaling, and work as antihypertensive	(Leone <i>et al.</i> 2016; Attakpa <i>et al.</i> 2017)
Supplementary and Functional purposes	Moringa extract is given to expectant mothers to stop their babies' growth from being stunted. The addition of moringa extract to a tigernut when assessed shows a high level of minerals and protein and consuming moringa cookies improves the protein content of breast milk.	(Oyetero <i>et al.</i> 2019; Sumarni <i>et al.</i> 2020; Basri <i>et al.</i> 2021)
Dietary purposes	Consumption as tea, fresh leaves that have been cooked, leaf powder used in various cuisines, immature pods and leaves as vegetables, consists of major micro and macro nutrients	(Kumssa <i>et al.</i> 2017)
Cosmetics	Soap, perfumes	(Kumssa <i>et al.</i> 2017)

1.2.3. World production and consumption

There is no accurate measure to account for the global production of *Moringa oleifera*, but it can be related to its widespread across continents over the years. According to (Sekhar *et al.* 2018), India produces 2.2 million tonnes annually from an area of 43,600ha, making them the prime producer of *Moringa oleifera*, followed by China. However, China is recorded to have highest export return on *Moringa oleifera* to a tone of 864.8 million dollars annually (Tridge 2021). The plant is best suited for tropics and sub-tropic regions where they have about 1,000-2,000mm annual rainfall to supports it growth; it however can adapt to different kind of soil because it is a well-drained plant (Dania *et al.* 2014). Notably, if the primary aim of every production is to meet the demand of the market, then it is regarded that a major conceptional theory of this is the theory of demand. However, there is a negative relationship between the quantity demanded and the price of the farm produce. Whenever the demand increases, the price will do the same. It literally connects the moringa to be

dependent on its demand and the number of farmers available to supply. However, when a farm produce is not highly demanded, farmers do not produce too as it is based on the level of adoption by the rural populace alone with a limited population of 20 % less compared to the population of the urban settlements (Al-Malki 2015). Therefore, to ensure any level of development on the quantity demanded and supplied, there is a need for common goal and mutual market interest among the producing farmers so to encourage them to increase production as there will be more markets potentially. Such a market will contribute to the level of intensification of the farmers for both the process of growing and selling *Moringa oleifera*. It is right that there is also several importance attached to the production of moringa, it is also good to know that most of the decisions that could influence multiple production is the encouragement of farmers to mutually participate in this production and this can be achieved by very limited costs of production. Efficient and limited costs add up to the profit margin which contributes to the massive production scale (Asante 2014). Moringa is now widely accepted and even stored in South Africa as it is contributing to their economic development. It is similarly a center of attraction for the same country which implies its values have been well researched and adopted for developed ideas. Therefore, there are many reasons why formalization and restructuring of policies that could influence market growth and contribute to the development of the market in terms of adequate production and standard marketing is important.

It is also usual for members of different household to produce products they are sure will meet demand of the market and they can earn from so to feed varying farm families. Therefore, if any farmer is not sure about the product, he or she will not produce because they fear the market will not know the value of such farm produce. Awareness is, therefore, very important as moringa is highly underutilized and demands more audience to meet up with the sparing audience and more efforts are needed to meet such tasks (Stevens et al. 2015).

Many studies have also contributed to the idea of growth for farmers producing moringa but larger percentage of them concludes that poor access to good and reliable market is a factor that discourage massive production. A similar study conducted by Mabapaet *al.* (2017), he researched and concluded that many of the farmers have interest and priority to adopt massive production, but they are faced with the challenge of having access to more reliable markets. However, if this is to be accessed, moringa must be dynamic and suited to several purposes such as the processing into value added produce and then always meeting the respective needs of the consumers. Additionally, Gandji et al. (2018) suggested the need to accurately gauge tenacity of how much the market can give back to the farmers if they

jointly expand and commercialize their farmers to meet up with high quantity and structured size, and to also meet the standard need of the consumers. Furthermore, it will become a plus for the growth of the farmers to develop chains as a linkage of value for the moringa production. *Moringa oleifera* is known generally as a versatile crop with a unique range of properties and this contributes to its versatility worldwide. The production of the crops is dominated largely by small scale farmers in African countries. The cultivation of the crops ranging from production, processing and marketing is inadequate globally as the crop is majorly used as border line crops and demarcation of farms (Matimisebi 2010).

The tree crop is economically classified into several disintegrates ranging from its value as a source of revenue to its producer and to the marketer of this tree crop. It can further be divided into government interventions for policy formulations and its comparison with other tree crops. The economics of this tree crop is wide as of the fact that it is a functional crop, and it is widely accepted without financial stratification to its use and purpose. Owing to this fact, it has acquired a higher level of socioeconomic importance among the producers and the consumers. In addition, the value attached to *moringa* economically is diverse and this is also because of the nature of the crop as its never dying and high level of adaptability of the crop (Bandaranagake 2006). The growing and limitless importance of this crop as resulted into higher demand of the crop and as also made more interest of research on the work. Similarly, it has attracted more audience from various countries by governmental and non-governmental organizations for the purpose of economic development and its contribution to the economic growth of the world at large (Foldi 2001). In lieu of this, more interest has been sought on ensuring that the economic value of *Moringa oleifera* is on the increase and its contribution perspective to the economic growth is on similar increase.

Table 2: Top 10 countries with the highest export value of moringa

S/N	Country	Export value (Million dollars)
1	China	864.8
2	India	414.5
3	Germany	232.6
4	Egypt	158.7
5	United States	127.0
6	Spain	108.1
7	Poland	103.8
8	Canada	85.5
9	France	60.71
10	Brazil	4.97

Source: (Tafesse et al. 2021)

1.2.4. Consumers' attitude and perception of moringa

The adequate nutrient of *moringa* products has prompted important research on customers' attitudes and perceptions toward the food product. These two variables inform the consumers' willingness to also pay or purchase the product (Aryal et al. 2009). There are several factors contributing to the attitude of the consumers towards moringa products ranging from the socioeconomic characteristics of the consumers to the economic condition of the country which affects the purchasing power of the consumers too. The consumers' attitude towards moringa products under the influence of economic condition is also different as the state of the country also determines the financial stands of the residence of such country which also in turn influence their attitude to food products. As a result, consumers in developing nations or those with low levels of money often behave differently when making food-related decisions than customers in developed nations or those with higher levels of income. Similarly, price is always considered when making choices on food to purchase by low-income consumers because of their financial strength. The financial strength of the consumers tends to determine the food products they consume, so when the financial resources are limited, the consumers' demand for more foods with high calories are also limited (Story et al. 2008). The similarity in financial strength is applicable to geographical

location or place where food products is accessible, this is because the residence outside the location of the consumers also demands a certain amount of transport fare to access the products which makes it more costly to get the desired food products for the nutrients that will contribute significantly to the body system.

In addition, studies have also revealed that the knowledge of the consumers contributes significantly to their perception towards moringa products. Therefore, increased consumers knowledge on the values attached to the product and possible health benefits increases the chance of purchasing such farm product. For instance, Aryal et al. (2009) stated that almost all respondents claimed they were aware of certified organic products in their study on consumers' readiness to pay for organic food items: a case study of Kathmandu valley. In addition to this, Phillip and Dipeolu (2010) investigated with more than 150 respondents, a study of consumers' willingness to pay for a few farm-produced goods was conducted in Abeokuta, Nigeria. It was known that more than 80% of the respondents were aware of the benefits of using such organic farm products. This is similar to the consumption of moringa as also conducted by John (2018) that the health benefits of the moringa is also known by over 80 % of the respondents with the same sample population as used by Philip in Abeokuta.

According to empirical research carried out by Owusu et al. (2013) in Ghana using perception indices to determine the perception of certain food products that is basically fruit crops such as vegetables, it was found that over half of the respondents believes that fruit crops are of health benefits and will also do more if they are organically grown. They also agree that they are healthier and tastes better than other food crops with no harmful effects. This explains the sensitivity of consumers to food that can pose risk to their health condition. There are however many studies that believes that consumers knows that foods with health risk free benefits and averting health diseases tends to cost more than the traditional ones (Radman, 2005). The above may account to be one of the reasons why consumers avoid the consumption of moringa products, despite their knowledge of its nutritional and health benefits. The present increase of its adoption in African countries for the fortification of foods is sporadic where both fresh and dried leaves are used, such as in several African nations like Ethiopia, Malawi, East Africa, and Ghana (Agbogidi OM & Ilondu EM 2012). Similarly, in some African countries, it has also been adopted as a medicinal plant, but the shift is gradually growing from just a medicinal plant being consumed as moringa powder in South Africa, to utilizing it as other food produce such as a source of basic meal in children. Some research projects, including the Lamangata, Moringa oleifera project, have detailed a

case study of how *Moringa oleifera* leaf powder was used in Limpopo to treat childhood malnutrition (Lekgau 2012). Another study by Agyepong (2009) revealed that in Limpopo, 4.5% of participants created *Moringa oleifera* fresh leaf dishes with chicken, while 9% did so with red meat. This shows that there is a promising level of acceptability towards this crop and the consumption attitude towards it becomes sustainably on the high side of the consumers. This is evidence that consumers have differing knowledge about the contribution of moringa to their health and nutritional improvement, especially, in developing countries.

Similarly, people's reasons and perceptions of this plant varies across countries. Although, the more seemingly reasons are endless, the most common ones are attached to food; its medicinal and nutritional value, demographic factors and some socio-economics factors; among a diversity of other factors. Even though, the use of the knowledge related to moringa products are vast enough that demands critical views, acceptance of knowledge from moringa products or use of such produce is now dependent on the possible positive or negative perceptions of the consumer to the use of the product (Mafimisebi et al. 2012). In a study to establish the food values applied to leafy vegetables like *Moringa oleifera*, Amadou & Mahamane Moctar (2020) discovered that food values include veganism, nutrition, aesthetics, and social virtues when applied to *Moringa oleifera* are among the most important to customers, whereas food, drink, and objects that satiate one's appetite and/or desire were among the least important. Therefore, for areas where vegans are dominant, the consumption of tree crop like moringa will be dominant: owing to their knowledge of its nutritional and health benefits. Mahomoodally & Ramalingum (2015) in their study to determine consumers attitude and perception to some medicinal food products, with moringa inclusive, they concluded that taste was a key element determining intake across age groups, and older subjects also shown lower perceived health benefit towards amaranth, bottle gourd and moringa, and that perceived risk of the MFP to health was also observed to influence preference. This explains again the paranoid attitude of consumers to safety of food, perception with respect to age and taste of the products. In similar manner, Obayelu et al. (2015) said factors such as nutrition, safety, price, convenience, and brand name of products such as *Moringa oleifera* are some of the elements that affects consumers' decisions to buy things. People tends to purchase more the goods that are closer and less stressful for them to get, therefore, convenience could be an important factor in product purchase. Likewise, people purchase products such as *Moringa oleifera* from brand they are familiar or used to than testing a new brand. This could be attributed to the trust they accrued to the brand over time either based on taste, quality, packaging, price or accessibility.

Moringa is a well-known tree by the indigenous in Nigeria agroforestry system and it is already attached to multiple uses on its diverse products. Therefore, the cultivation of this crop is a promising development towards food security and other purposes attached to its use unlike many other crops. More recently, Nigeria recorded a higher level of poverty and malnourishment which has been in existence for quite a while (CENCOMDEV 2006). There are several policies and growth ideas that has been innovated to solve this trending challenge, but it has become a national issue. Also, malnutrition brought on by poverty and its consequences is linked to other problems with poor health and low productivity. It is believed that interventions that will enhance nutrition status ought to be easily accessible and reasonably priced for the majority of the population in the area. This will bring about a drastic and significant solution to the problem of malnutrition.

Moringa oleifera has earlier stated, has the potential to mitigate the above stated challenges and even worse, since the plant provides amino acids necessary for new-born development, it may also reduce malnutrition-related morbidity and/or death in infants. This also holds true for pregnant and nursing women. According to UNICEF (2022), there is a record of under nutrition each year and it contributes imminently to the massive death of children under ages of 5. Additionally, UNICEF says that in the least developed nations, 42% of children are stunted and 36% are underweight as a result of poor nutrition or under nutrition. All these records are attached to the fact that the consumer's perceived believe in local foods are questionable as it is believed that they source for more modern and expensive foods even when they may not be able to afford it (CENCOMDEV, 2006). This has also explained why the perception of consumers about an important tree product as moringa is very important. To address the above, several non-governmental groups, including Volunteer Partnerships for West Africa, Church World Service, Educational Concerns for Hunger, and Trees for Life International, have sensitized and made their own contributions to change the awareness of stakeholders about nutrition that can be derived from moringa and influence its use as a largely acceptable medicinal product. Also, several research were done on the values of moringa including its chemistry, origin and importance but little results have been derived in gaining the perceptions of the audience to the use of moringa products: a means to addressing malnutrition problem.

Factors influencing consumption.

There are several theories and their applications that has impact on the economic trend, growth, and technical applications in the tree crop *Moringa oleifera*. Many of them have diversified relations but are basically functions and influences of demand and supply. However, both the existing literature reviews and past ones shows high level of connection between how members of households perceive moringa, awareness level and consumption attitude. Earlier, from the reviewed literatures, there has been an interwoven relationship between the production of moringa and its limited consumption rate by consumers who could use it to better their nutrition. The reviewed papers show that most of the factors that affects their consumption pattern can be socio-economical, demographical, psychographic, or marketing issues etc. There are several socioeconomic characteristics that influence decisions and most of them are related to demographic factors of the individual which includes age, gender, level of income, level of education and many more. According to Tolulope et al. (2016) consumers are more likely to be willing to pay for moringa if they are educated. This might be the case because consumers who are better educated are more likely to have access to a variety of resources for information on the health advantages of the vegetable. People with higher levels of education are also anticipated to have higher incomes, increasing their willingness to pay for moringa. Education has been proven to be an important factor in adoption of technology, societal development and choice of food consumed. Study by Higuchi et al. (2017) demonstrates that having a higher level of education increases the likelihood of being a traditional consumer. This is probably because of the knowledge of the nutritional and health benefits of some of the products; factored by knowledge/education. Ekepu & Tirivanhu (2016), argued that even though education might seem unconnected to the development, but reversibly, education determines the level of adoption of agricultural technology among rural farmers and this simultaneously affects the yield of the farmers as they are limited in application of agricultural technology. Level of education also determines how willing farmers are to adopt innovation in the society, especially on the farm. Study also shows that farmers with technical education no matter how small tends to learn more than farmers with no form of formal education (Tolulope et al. 2015). This shows that education does not end with just the production of moringa but also influences further into processing, marketing, industrialization, and other linkage phases/activities involved in moringa production till it is finally consumed. Farinola *et al.* (2014) showed that the majority of those willing to pay for the intake of moringa powder were women. It's likely that the majority of

respondents were housewives who decide what the family eats. This is not to say that male preferences are not dominant in some products, such as the research carried out by Kral et al. (2020) about branded products, he found that the gender of a consumer with respect to their demographic factors determines their consumption attitude and behaviour. Based on his results, he concluded that male consumers prefer branded products significantly than female. His result also shows that occupation plays a role in the willingness to consume moringa. This was corroborated by the research of Oke et al. (2020) where he concluded that locality where their basic occupation is farming has higher likelihood to cultivate and consume moringa more. Similarly, age is found to be a significant factor that determines consumption. Study by Tolulope et al. (2016) demonstrates that age was a crucial influence in the consumption of moringa, she concluded that as consumers' ages increase, they are more likely to pay for moringa. Study by Kral et al. (2020) also shows that consumers between ages 30-50 tends to have stronger preference for branded products, but consumers below and above this age group has lesser/weaker product preference. This could be because people in this age category are probably influenced by peer pressure, display of affluence and class, and other unnoticed factors. Aruppillai & Godwin Phillip (2015) found that consumers within the ages 15 and slightly above consumes fast food more than people in the middle age, while majority of consumers above 30years has a very low preference of consuming fast food. He concluded that youngsters have interest in consuming already made food, rather than preparing themselves. In research carried out by Mahomoodally & Ramalingum (2015) to evaluate consumers' behaviour to seven medicinal food plants, he found out that older people have a paranoid behaviour towards the consumption of some of the plants: putting the safety of those plants into consideration. Such behaviour could also be because they are used to some food species all their life and having trusted its health safety, they find it difficult to adjust. The above highlights that people at different ages of their lives have preferences, and these preferences are also determined by the kind of food in question, safety concerns etc. There is therefore a high probability that age would also be a high impact factor in the consumption of *Moringa oleifera*. Marital status and family type had little or no contributions to the consumption of *Moringa oleifera*. The results of a study by Neerghee-Bhujun et al. (2019) revealed that there was no significant correlation between family type, marital status and the consumption of *Moringa oleifera*. The concept of price and income is relatively correlated when it comes to consumer's consumption behaviour. It dictates how much a supplier is willing to sell and how much a customer is prepared to spend. It is sometimes regarded as most important factor in consumption; assuming that other influencing factors are

linked with it. For instance, the study by Berhanu & Acha (2020) indicated that the respondents' income was a significant factor in their willingness to pay for the new products of certified *Moringa oleifera*. As the price of *moringa* products increases, the more money one has, the more the purchasing power of such individual, this mitigates the challenge of price. On the other hand, income might be significant in consuming *moringa* products, if the need arises that the consumer is buying *moringa* products on health issues. This is in line with the study by Marvin et al. (2004), which found that customers were prepared to pay more for processed meals that had nutritional advantages comparable to those of *moringa* products. Also, getting the right information about *moringa* is very key to its consumption, in study conducted by Neerghee-Bhujun et al. (2019) showed that the major source of information about *moringa* was passed down by parents to the children, this is rather disturbing due to the volume of materials available online about the health benefit of *moringa* this also showed that younger generated are more interested in social media.

Other than nutritional preferences, taste and safety, convenience and brand-name, socio-economic factors which has discussed is branding and packaging. Branding and packaging is the face of any product; even before the content is inspected, the attractiveness of the product comes into place, most people buy commodity based on the appearance of the commodity even before checking out what the content might look like. To increase the size of the market for their products, many businesses have started employing various strategies, equally, to make their products competitive with those of competitors and draw in more customers, businesses have also innovated in a variety of ways. One of these strategies is to draw attention to the packaging form among consumers. Packaging really influences some people's purchasing behaviour, particularly young ones. Because consumers are exposed to packaging in the same way they are in other forms of promotion, it gives the manufacturer one last chance to convince potential customers before they choose a brand. An important form of this is label. Labels on food or brands tends to add up to the demand for the produce even though if they barely know about the product (Radam, 2010). This is because customers' health concerns have increased, important vegetables and fruits needed for the body to respond well for good health are equally their concerns (Gil et al. 2000). This has in turn also made consumers create more interest and respond well to products with a well branded and package farm produce, so far it is healthy and there is a positive response of the consumers to its consumption. In the same vein, the rate of *moringa* consumption and awareness in the Nasarawa metropolis were shown in a study by Patience et al. (2020). According to this

study, the participants knew that moringa can be used to treat a variety of ailments, including bronchitis, catarrh, chest congestion, diseases, blackheads, blood impurities, anaemia, nervousness, and asthma. This may be due to Northern Nigeria's strong fondness for the use of traditional medicine. These outcomes are consistent with those of Oluwadamilare (2017), who examined the level of knowledge among farmers in southwest Nigeria regarding the nutritional and therapeutic advantages of the *Moringa oleifera* plant. Even though *moringa* consumption is very uncommon, awareness of it is noticeably high. The details of factors influencing moringa consumption are summarized in Table 3.

Table 3: Factors influencing the perception and consumers' attitudes towards moringa.

Factors Categories	Factor(s)	Setting	Objective	Method	Key findings	Author
Socio-Economic Characteristics	Age	Shomolu Local Govt. Area Lagos State, Nigeria	Awareness and willingness to pay for moringa	A logit regression model	Age was found to be a significant determinant in the consumption of moringa, which suggests that as consumers age, their propensity to pay for moringa increases.	(Tolulope et al 2016)
	Gender	Oyo State, Nigeria	Perception, knowledge, and spending power of households toward Moringa oleifera Lam powders	Descriptive Statistics and Logistic Regression Model.	Most respondents who indicated that they would be prepared to pay for the use of moringa powder were women, according to the findings. It's likely that the majority of responders were homemakers who decide what the family eats.	(Farinola et al. 2014)
	Income	Ethiopia	Household Heads Willingness to Spend money on certified and labeled moringa products.	Ordered Logit Model (OLM)	The respondents' willingness to pay for new certified <i>Moringa oleifera</i> products increased in proportion to their respondents' greater incomes.	(Berhanu &Acha, 2020)
	Family Size/marital status	Mauritius	The purpose was to explore the consumption behavior of <i>Moringa oleifera</i> and pod in Mauritian adult	Descriptive Statistics and inferential statistical methods	No significant relationship between family type, marital status and the consumption of <i>Moringa oleifera</i>	(Neergheen-Bhujun et al. 2019)
	Education	Ibadan Nigeria	Awareness and willingness to pay for moringa	Cross tabulations and discriminant analysis	Educated people have access to information on the benefit of moringa,	(Tolulope <i>et al.</i> , 2015)
	Area of residence	China	How COVID-19 affects people's willingness to pay for and eat wild animals	Probit, tobit and mediating model	Location was important because urban residents' food consumption patterns are more sensible than those of rural residents.	(Si et al. 2021)
	Occupation	Oyo state Nigeria	Moringa perceptions,	Descriptive statistics	Occupation of the respondents have a	(Farinola et al.

			knowledge, and willingness to pay	and logistic regression model	significant effect on their willingness to pay for moringa	(2014)
	Disease prevalence	Ethiopia	Family Heads' Willingness to Pay for Moringa Products with Labels and Certification	Ordered Logit Model (OLM)	Disease prevalence significantly influenced their willingness to pay for the new products of certified <i>Moringa oleifera</i>	(Berhanu & Acha, 2020)
Knowledge	Information source	Mauritius	The goal was to investigate how Mauritian adults consumed Moringa oleifera and pods.	Descriptive Statistics and inferential statistics	Findings showed the major source of information as parents but consume <i>Moringa oleifera</i> as a vegetable rather than being medicinal	(Neergheen-Bhujun et al. 2019)
	Previous experience	Brazil	How prior purchasing experiences of consumers affect their environmental awareness and attitude toward aspirations to buy green products	Structural equation modeling technique and a covariance-based SEM	Influence of prior purchases and environmental awareness on the buying of green products. Individual purchase intent is influenced by the product's attributes and the buying environment.	(Costa et al. 2021)
	Awareness	Oyo state Nigeria	Perception, awareness and willingness to pay for moringa	Descriptive statistics and logistic regression model	Occupation of the respondents have a significant effect on their willingness to pay for moringa	(Farinola et al. 2014)
Trust	Taste, safety	Mauritius	To assess Mauritian's consumption habits, attitudes, and views of seven prevalent MFPs—amaranth, aloe vera, bitter melon, bottle gourd, moringa oleifera, breadfruit, and jackfruit—as well as their culinary and therapeutic uses—	Descriptive statistics and inferential tests (ANOVA, t-test and 2 test)	Among different age groups, taste was a crucial factor determining intake; older participants demonstrated reduced perceived health benefit towards amaranth, bottle gourd and moringa, older participants (≥ 60 years) perceived risk of the MFP to health was also observed to influence preference.	(Mahomoodally & Ramalingum 2015)
	Convenience, Brand name	Ogun State Nigeria	Discover factors impacting consumers' perceptions of and attitudes about labelled and certified moringa	Descriptive statistics and the logit regression model	Factors such as nutrition, safety, price, convenience, brand name are some of the factors that influence their decision to purchase. Majority also preferred labeled products to unlabeled products, The	(Obayelu et al. 2015)

			goods (tea, spice, and oil), as well as their perceptions of and attitudes toward those items overall.		results showed that attitude towards moringa products, perception of moringa product were positively related to WTP for labelled and certified moringa product	
Attitude	Nutrition preference	Tahoua city, Niger	Using current developments in best worst scaling, to establish food values as applicable to leafy plants like Moringa oleifera and more especially, to understand how climate change and food security information influence food values.	A Best Worst Scaling experiment was designed to determine the relative importance that consumers place on the policies selected	Food values related to veganism, nutrition, aesthetics, and social good when applied to Moringa oleifera were found to be among the more significant to consumers, whereas values related to medicine, culture, and objects of desire and hunger were found to be among the least significant.	(Amadou &Mahamane Moctar 2020)
Product Related	Price	Ohio, USA	Customer Acceptance of Processed, Organic Foods with Multiple Ingredients	Descriptive statistics.	When it comes to the nutritional advantages of processed meals, consumers are willing to spend higher costs than they would for moringa products.	(Marvin et al. 2004)
	Branding, Packaging	Nasarawa State, Nigeria	Packaging's Effect on Consumer Purchasing Patterns	Ordinary Least Square (OLS) Regression method	The way a product is packaged has a big impact on how consumers perceive it. Based on the study's findings, efforts should be taken to make products like moringa's packaging highly appealing in order to draw and hold consumers' attention.	(Oaya et al. 2017)
	Rate of awareness of health benefit of moringa	Nasarawa, Nigeria	To study the rate of awareness of the health benefit and consumption of moringa	Descriptive Statistics	The respondents were aware of the health benefit of the consumption of moringa, the study concluded that this might be due to the consumption of herbal medicine in that locality	(Patience et al. 2020)

2. Aims of the thesis

To address the nutritional imbalances as in case of Nigeria, the consumption of some of the local foods and fruits that are native to Nigeria, including moringa can be regarded as a reliable source of nutrients that could avert diseases and poor nutritional intake among the population. Therefore, this study was aimed to determine the perception and consumers' attitude to the consumption of *Moringa oleifera* products. This was done by investigating the consumers' willingness to pay and consume moringa products in the study area.

Specifically, the study identified the form of use of moringa products, ascertained the perceived health risk of the respondents on *Moringa oleifera*, examined the factors influencing the decision to consume moringa products, and finally, it investigated the main reason why they consume moringa products from the perspective of health benefit. The study also estimated the following hypothesis.

H1: There is a relationship between their social, psychographic characteristics and their willingness to pay for moringa tea (Berhanu & Acha 2020).

H2: There is a positive relationship between the previous experience of the consumers and their willingness to pay for moringa products (Costa et al. 2021).

3. Methods

3.1. Study area

The research was carried out in Nasarawa state Nigeria. It is located in the north central part of the country, bordered by the Federal Capital Territory, Taraba state, Benue state and Plateau state which accounts for most populated states in the north aside Kano. The state is made of 13 local governments with farming being their major occupation. On October 1st, 1996, the state was created from the western portion of Plateau State (Nasarawa, Nigeria).

Nasarawa is the second-least populated of Nigeria's 36 states, with an estimated population of roughly 2.5 million as of 2016. It is also the fifteenth largest in terms of size, covering 27,117 km² (10,470 m²), and fifteenth in terms of population. Geographically speaking, the majority of the state is located within the tropical Guinean forest-savanna mosaiceco-region. The River Benue, which forms a large portion of Nasarawa State's southern borders, and the state's remote northeast, which contains a small portion of the Jos Plateau, are both significant geographic features (Nasarawa, Nigeria).

Residence of the Koro and Yeskwa are situated in the farthest part of the northwest, with the Kofyar residing at the extreme northeast, while the Eggon, Gwandara, Mada, Ninzo, and Nungu are situated at the north, the Alago, Goemai, and Megili in the east, the Eloyi in the south, the Tiv in the southeast, the Idoma in the southwest, the Gade and Gbagyi in the west, and the Hausa and Fulani reside all over the state. Nasarawa is a diverse state in terms of religion, with around 60% of the population practicing Islam, followed by roughly 30% practicing Christianity, and the other 10% practicing traditional ethnic religions.

Agriculture dominates Nasarawa State's economy, with the primary crops being sesame, soybeans, groundnuts, millet, maize, and yams. Services, particularly in metropolitan areas, and the raising of cattle, goats, and sheep for livestock are other important sectors. Additionally, it includes a number of minerals, primarily extracted by artisanal miners, including salt, baryte, and bauxite. The Farin Ruwa Falls are located in the Wamba Local Government District of Nasarawa State. One of Africa's tallest waterfalls is Farin Ruwa Falls (Nasarawa, Nigeria).

The state is well populated, with evidentially high rate of malnutrition that could be as a result of improper nutritional intake. Unfortunately, majority of crops produced in the state are carbohydrate and fat based; limiting the intake of other essential nutrients needed for the body. Furthermore, moringa is common to houses in the region. All of these therefore, makes the state a perfect fit for this study.

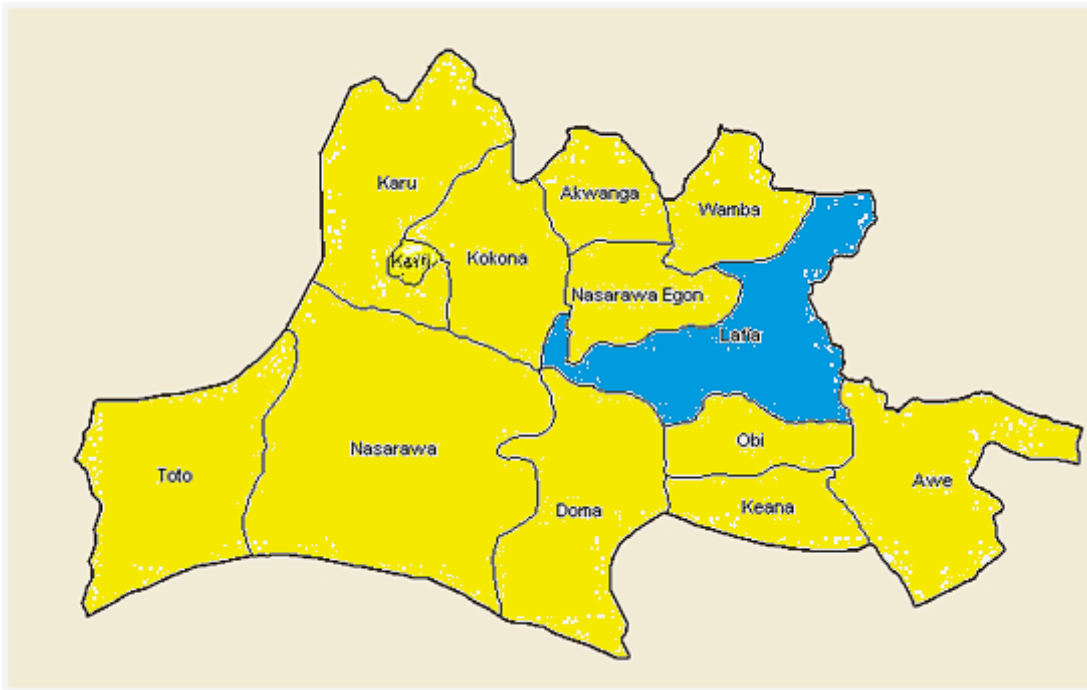


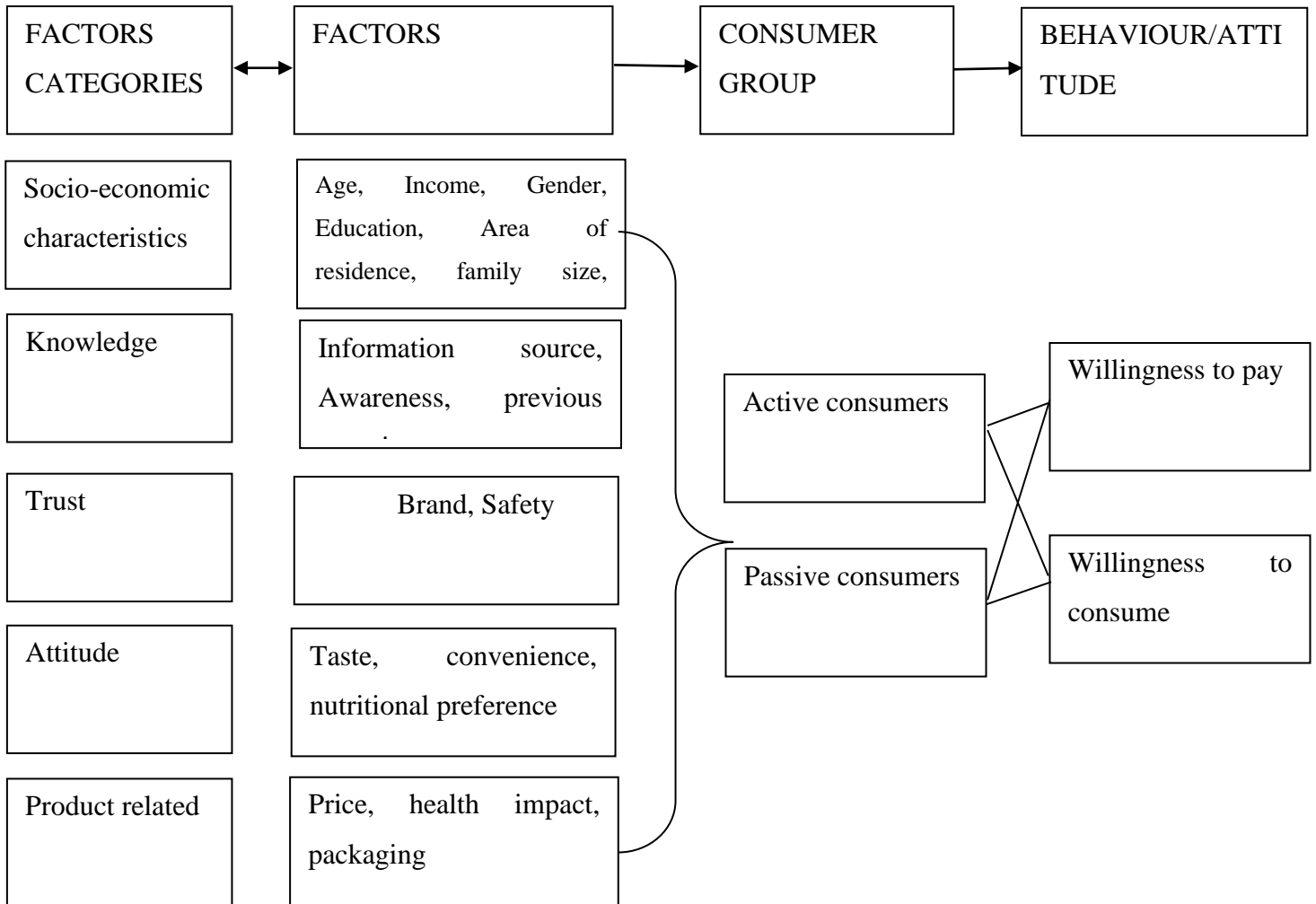
Figure 1: Map of the study area (Nasarawa State, Nigeria)

3.2. Sampling procedure and survey structure

The data was collected using a structured questionnaire, and multi-stage sampling procedure was used to elicit information from the respondents. The first stage was a purposive selection of 3 Local Government where the consumption of moringa is dominant, secondly, selection of 2 communities from each of the selected local governments, and the last stage was a random selection of 35 respondents from each city making a total of 210 respondents. The questionnaire was structured into seven sections which helped to get information on the attitude and perception of the consumers to moringa products. The section one contains information of the socio-economic and psychographic characteristics of the consumers such as gender, age, educational level, family size, marital status, area of residence, occupation/status, income, if they have attended training on food diet, their willingness to pay for moringa products, if they have previously purchased moringa products, their perception of moringa close substitute and finally if they have access to moringa

products. The following section focused on the form of use of moringa which was elucidated through a 5-scale Likert ranging from regular usage to non-usage, this form includes tea, leaf powder, boiled fresh leaf, soap and cosmetics, seed and pods, and finally capsule. The next section contained factors influencing their decision to consume such as price, taste, safety, social influence, branding and packaging, convenience, impact on health, nutritional preference, information source, area of residence and doctor's prescription (5-scale Likert of strongly agreed to strongly disagreed). The survey of the fourth section contained questions on the main reason why they consume moringa, which includes energy intake, immune boosting, antiaging, antidiabetic, antihypertensive, mineral and protein, quality protein in breastmilk, child nutrition during pregnancy, fever treatment (5-scale Likert of strongly agreed to strongly disagreed). The next section was their willingness to pay for moringa tea product, this was investigated using a binary response yes or no. The sixth section was on their previous experience and their willingness to pay for moringa products, it includes questions on whether the purchase was based on fair offer, if it was of high quality, if the product met their expectation, if they are willing to pay more for similar products (5-scale Likert of strongly agreed to strongly disagreed). The last section was on the perceived health risk of the respondents to the consumption of moringa products. It includes survey on their perception of pesticides for moringa growth, if synthetic drugs are safer, if moringa plant could be contaminated by bacteria, if moringa drugs are effective and if the action of moringa when consumed for health purpose are immediate (5-scale Likert of strongly agreed to strongly disagreed).

Figure 2: Conceptual framework



3.3. Data analysis

Mean, frequency, and percentages were employed as descriptive statistics to analyze the socio-economic characteristics of the respondents based on active and passive consumers, the forms of use and perceived health risk were elicited using a 5-scale Likert and the mode was visualized using chart. The factors influencing consumers' decision to consume was analyzed by checking the mean and standard deviation of both active and passive consumers, the mean was compared using a Mann Whitney U test of non-random distribution, and finally, the main reason why they use moringa was analyzed using a Pearson Chi square by testing it against their age and educational level (Chaloupková et al. 2020).

The first hypothesis was also analysed using a probit model by testing their willingness to pay for moringa tea against their social and psychographic factors (Berhanu & Acha, 2020). Moringa tea products is taken as the focus because it is the most prevalent in the region (Obayelu et al. 2015). Binary response yes or no on whether they are willing to pay for moringa products tea was the dependent variable, while the factors influencing their decision to consume was the independent variable. Therefore, inferences reached could also be applicable to other moringa products. The second hypothesis which was the relationship between their previous experience and their willingness to pay for moringa products was analysed using a probit model by testing if they had previously purchased moringa products (yes or no) as the dependent variable with their willingness to pay for moringa products based on their previous experience (Costa et al. 2021).

4. Results

4.1. Socio-economic and psychographic characteristics of the respondents

The results showed the distribution of respondents by gender where 53.5 % of the respondents were male and the remaining 46.5 % were female; 55.4 % of the respondents were less than or equal to 30 years, 18.3 % were between the age bracket of 31-40 years while 16.8 % and 9.4 % were between the ages of 41-50 years and >50 years; 13.4 % of the respondents had no formal education, 2 % of the respondents had primary education, 56.4 % of the respondents had secondary education, while the remaining 41.2 % of the respondents acquired either OND, NCE or B.Sc and 1.5 % accounts for M.Sc holders; 74.8 % of the respondents had between 1-5 persons as family size, while the remaining 23.8 % and 1.5 % reported between 6-10 and >10 persons respectively as their family size; 30.2 % of the respondents were single, 63.4 % were married and 6.4 % were divorced; 47.5 % of the

respondents resided in the rural area, while the remaining 52.5 % resided in the urban area; 30.7 % of the respondents were farmers, 21.4 % were civil servants, 1.9 % were on maternity leave, 2.4 % were pensioners, while 42.6 % of the respondents were reported to be unemployed; 53.5.6 % of the respondents earned less than or equal to ₦ 50,000 monthly while 32.7 % and 13.9 % of the respondent earned income between ₦ 50,001- ₦ 100,000 and greater than ₦ 100,000 monthly respectively;

The psychographic characteristics showed that 18.8 % of the respondents had attended a training on food dietary and consumption, while the remaining 81.2 % had never for once attended a training on food dietary and consumption; 98 % of the respondents had access to moringa products while 2 % had no access to moringa products; 98.5 % of the respondents indicated that moringa was affordable while 1.5 % of the respondents reported that moringa was not affordable; 42.6 % of the respondents perceived the price of moringa close substitute to be higher while 57.4 % of the respondents perceived the price of the close substitute to be lower; 98.5 % of the respondents were willing to pay for moringa tea products while 1.5 % of the respondents were not willing to pay for moringa tea products. Majority of the respondents indicated that they have previously purchased moringa product. The details of the socio-economic and psychographic characteristics of the respondents based on their consumer group are provided in Tables 4 and 5. Those who indicated that they consume moringa products were classified as active consumers while those who said they don't consume moringa but also indicated to have used it for one thing or the other were classified as passive consumers.

Table 4: Socio-economic characteristic of the respondents

	Total samples		Active consumers		Passive consumers	
	N=202	%	N=157	%	N= 45	%
Gender						
Male	108	53.5	73	46.5	24	53.5
Female	94	46.5	84	53.5	21	46.7
Age (years)						
≤30	112	55.4	82	52.2	30	66.7
31-40	37	18.3	32	20.4	5	11.1
41- 50	34	16.8	25	15.9	9	20.0
>50	19	9.4	18	11.5	1	2.2
Educational Level						
No formal Education	27	13.4	17	10.8	10	22.2
Primary Education	4	2.0	4	2.5	0	0.0
Secondary Education	83	56.4	62	39.5	21	46.7
NCE/OND/Bachelors	85	42.1	71	45.2	14	31.1
M.Sc	3	1.5	3	1.9	0	0.0
Family Size						
1-5	151	74.8	117	74.5	34	75.6
6-10	48	23.8	38	24.2	10	22.2
>10	3	1.5	2	1.3	1	2.2
Marital Status						
Single	61	30.2	47	29.9	14	31.1
Married	128	63.4	99	63.1	29	64.4
Divorced	13	6.4	11	7.0	2	4.4
Area of Residence						
Rural	96	47.5	76	48.4	20	44.4
Urban	106	52.5	81	51.6	25	55.6
Primary Occupation						
Farming	62	30.7	50	31.8	12	26.7
Civil service	45	21.4	37	23.6	8	17.8
Maternity leave	4	1.9	4	2.5	0	0.0
Pensioner	5	2.4	4	2.5	1	2.2
Unemployed	86	42.6	62	39.5	24	53.3
Monthly Income						
≤50,000	108	53.5	82	52.2	26	57.8
50,001-100,000	66	32.7	51	32.5	15	33.3
>100,000	28	13.9	24	15.3	4	8.9

Table 5: Psychographic characteristics of the respondents

	Total samples		Active consumers		Passive consumers	
	N=202	%	N=157	%	N=45	%
Attended food training?						
No	164	81.2	129	82.8	35	77.8
Yes	38	18.8	28	17.2	10	22.2
Do you have access to moringa?						
No	4	2	4	0	1	2.2
Yes	198	98	154	98	44	97.8
Substitute price						
Higher	86	42.6	65	41.4	21	46.7
Lower	116	57.4	92	58.6	24	53.3
Is price of MO products affordable?						
No	3	1.5	0	0	3	6.7
Yes	199	98.5	157	100	42	93.3
Are you willing to pay for MO tea?						
No	3	1.5	0	0	3	6.7
Yes	199	98.5	157	100	42	93.3
Have you previously purchased MO product?						
No	99	49	68	43.3	31	68.9
Yes	103	51	89	56.7	14	31.1

4.2. Forms of use of moringa products

The results from Figure 3 shows that 18.6 % of the respondents regularly consumed moringa in tea form, 21.9 % occasionally consumed moringa in tea form, 16.7 % of the respondent revealed that they knew moringa in tea form but they do not consume it, while 42.9 % of the respondents do not consume moringa in tea forms; 11.9 % of the respondents consumed moringa regularly in leaf powder form, 24.3 % of the respondent occasionally used moringa in leaf powder form, 24.8 % of the respondents indicated they knew moringa in leaf powder form but they do not use it, while 39.0 % of the respondent indicated that they do not use moringa leaf powder form; 41.0 % of the respondents regularly use moringa in form of boiled fresh leaf, 32.4 % of the respondent occasionally use moringa in form of boiled fresh leaf, 16.2 % of the respondent revealed that they knew moringa in boiled fresh leaf form but they do not consume it, while 10.5 % of the respondent did not use moringa in form of boiled

fresh leaf; 3.3 % of the respondent used moringa regularly in form of soap and perfume, 5.2 % of the respondents occasionally used moringa in form of soap and perfume, 26.2 % of the respondent knew soap and perfume form of moringa but do not use it, while 65.2% of the respondent indicated that they do not use moringa in form of soap and perfume; 2.4 % of the respondent used moringa regularly in form of cosmetics, 5.7 % of the respondents occasionally used moringa in form of cosmetics, 25.2 % of the respondent indicated that they knew moringa in form of cosmetics but do not use, while 66.7 % of the respondent indicated that they do not use moringa in form of cosmetics; 5.2 % of the respondents used moringa regularly in form of seeds and pods, 13.8 % of the respondents used moringa occasionally in form of seeds and pods, 34.3 % of respondent knew about moringa in form of seeds and pod, but they do not use, while 45.6 % of the respondent indicated they do not use moringa in form of seeds and pods; 3.8 % of the respondents indicated that they regularly use moringa in form of capsule, 3.8 % of the respondents indicated they occasionally use moringa in capsule form, 11.9 % of the respondent indicated that they knew moringa in form of capsule, but they do not use, while 80.5 % of the respondent indicated that they do not use moringa in capsule form.

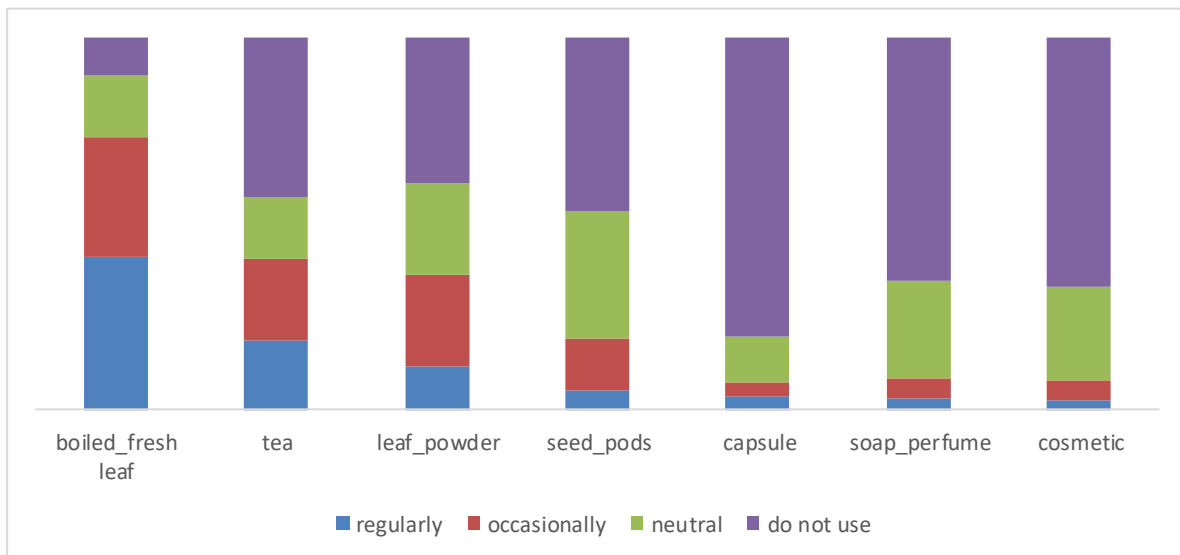


Figure 3: Forms of use of moringa products

4.3. Perceived health risk of the respondents

The results from Figure 4 showed that 8.1 % of the respondent strongly agreed that they do not trust moringa due to the extensive usage of pesticides during their growth, 1.0 %

of the respondents agreed to it, while 61.4 % of the respondents neither disagree nor agree, 25.2 % of the respondents disagreed on it, while 4.3 % of the respondents strongly disagreed; 8.1 % of the respondents strongly agreed that synthetic drugs were safer for use than moringa because they were designed in the laboratory, 36.7 % of the respondents agreed to it, while 32.9 % of the respondents were neutral, 19.5 % of the respondents disagreed on it and 2.9 % of the respondents strongly disagreed; 7.6 % of the respondents strongly agreed that the consumption of moringa maybe risky due to the possibility that bacteria or other microorganisms could contaminate them, 5.7 % of the respondent agreed on it, 27.6 % of the respondents were neutral about it, while 56.7 % of the respondents disagreed on it, while 2.4 % of the respondents strongly disagreed; 9.5 % of the respondents strongly agreed that dosage of synthetic drugs are safer than moringa because the former are recommended by licensed doctors, 35.7 % of the respondents agreed to it, 31.9 % of the respondents neither agree nor disagree, while 19.5 % of the respondents disagreed on it and 3.3 % of the respondents Strongly disagreed; 10.5 % of the respondents strongly agreed that moringa are not effective in severe treatments, 15.7 % of the respondents agreed to it, 34.3 % of the respondents were neutral about it, while 37.1 % of the respondents disagreed on it and 2.4 % of the respondents strongly disagreed; 8.1 % of the respondents strongly agreed that actions of moringa on health are not immediate, 5.7 % of the respondents agreed, 31.9 % of the respondents were neutral, 51.9 % of the respondents disagreed on it, while 2.4 % strongly disagreed.

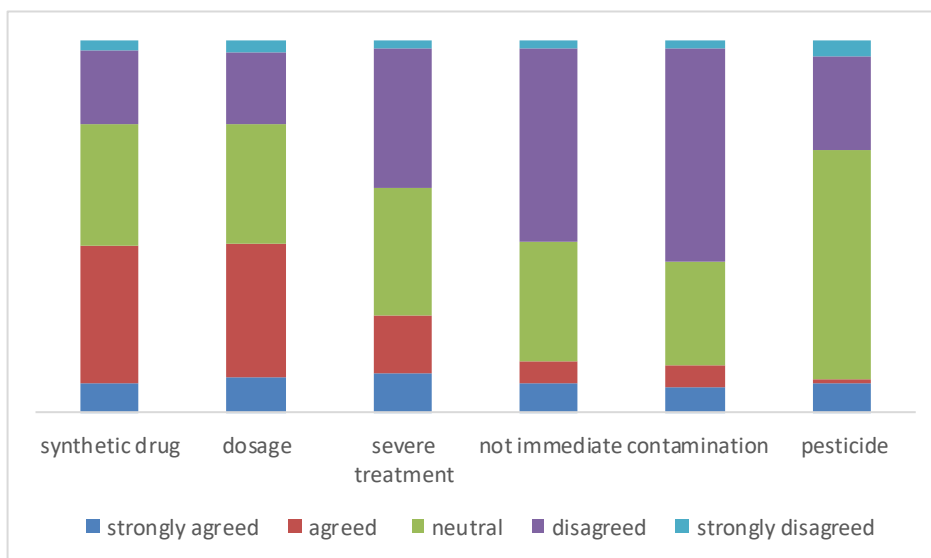


Figure 4: Distribution of the respondents by the perceived health risk of *Moringa oleifera*

4.4. Factors influencing the decisions to consume moringa products.

The findings revealed the average and standard deviation of the variables affecting consumers' decision to consume *Moringa oleifera*, these factors include both psychographic and socio-economic factors. The results also show the p-value of the consumers by comparing the mean of both active and passive consumers using Mann-Whitney test. Age and educational level which are both significant at 10 %, they have U value (2827 & 2769), Z (-2.043 & -2.313) and P-value (0.041 & 0.021) respectively. The result of the age indicates the mean difference between active and passive consumers where active consumers have mean of 33.9 years of age to standard deviation of 11.98, and passive consumers have mean of 30.13 years of age to standard deviation of 11.34 years. The result of the educational level of the respondents shows the mean difference between active and passive consumers where active consumers have mean of 12.17 years of age to standard deviation of 4.76, and passive consumers have mean of 10.29 years of age to standard deviation of 5.75 years. Factors such as gender, marital status, area of residence, income, price, taste, safety, social influence, branding & packaging, convenience, health impact, nutrition preference, and doctor's prescription have no difference that is significant between both consumer groups.

Table 6: Comparison of factors influencing the decisions to consume *Moringa oleifera*.

	Active consumers	Passive consumers	P-value
	Mean+SD	Mean+SD	
Gender	0.46 ± 0.50	0.47 ± 0.51	0.984
Age	33.90 ± 11.98	30.13 ± 11.34	0.041*
Educational level	12.17 ± 4.76	10.29 ± 5.75	0.021*
Family size	4.43 ± 3.25	3.93 ± 2.35	0.402
Marital status	1.77 ± 0.57	1.73 ± 0.54	0.728
Area of residence	1.52 ± 0.50	1.56 ± 0.50	0.640
Occupation	2.94 ± 1.77	3.38 ± 1.83	0.183
Income	64780.3 ± 51907.13	53422.2 ± 40315.51	0.261
Food training	0.18 ± 0.384	0.22 ± 0.420	0.508
Price	3.11 ± 1.14	3.11 ± 1.09	0.975
Taste	2.18 ± 1.10	2.31 ± 1.18	0.590
Safety	2.34 ± 0.83	2.38 ± 0.834	0.561
Social influence	2.74 ± 1.08	2.82 ± 1.15	0.664
Branding & packaging	3.81 ± 1.26	3.87 ± 1.29	0.712
Convenience	1.68 ± 0.81	1.60 ± 0.75	0.542
Health Impact	1.97 ± 0.55	2.00 ± 0.56	0.680
Nutrition preference	2.28 ± 0.69	2.29 ± 0.76	0.754
Information source	2.50 ± 1.12	2.82 ± 1.11	0.088
Doctor's prescription	4.13 ± 1.21	4.13 ± 1.10	0.666

*, represents significance at 10 %

4.5. Perceived health benefits of using *Moringa oleifera*.

The result showed that immune boosting, energy intake and fever treatment are the top 3 reasons why the respondent consume moringa. The relationship between the age and education of the respondents with the main reason why they consume moringa was also analyzed. The result based on the age of the respondents shows that antiaging was significant

at 10% as a factor why they consume moringa product. The result also shows that consumers between ages 41-50 have the highest percentage of moringa consumption for energy intake, immune boosting, arthritis, antiaging, minerals and protein supplement at 67.6 %, 73.5 %, 41.2 %, 51.8 % and 61.7 % respectively. Consumers between ages 31-40 have the highest percentage of moringa consumption for antidiabetic, antihypertensive, quality protein in breast milk, child nutrition during pregnancy, fever at 62.1 %, 62.1 %, 56.7 %, 51.3 %, 43.2 %, 70.3 % respectively. The result based on the education of the respondents shows that it does not have any significant influence on why they consume moringa. This could be explained by the low educational level of the respondents, even though education was found to be one of the factors that influences decision to consume moringa. The effect of this would be that as the education level of the respondents increases, their consumption of moringa would also increase, this is because education brings about knowledge and informed decision making. This is in consonant with the study carried out by Higuchi et al. (2017), the research shows the likelihood of becoming a traditional consumer is positively impacted by educational achievement.

Table 7: Perceived health benefits of using *Moringa oleifera*.

Reasons why they use <i>Moringa oleifera</i>	Total samples (%)	Level of Education (%)						Age (%)				
		No formal education	Primary	Secondary	Nce/ond/b sc	Masters	P value	≤ 30	31-40	41-50	50+	P value
Antiaging	43.6	22.2	0.00	31.3	37.6	33.3	0.862	40.2	45.9	51.8	26.3	0.022*
Antidiabetic	49.5	22.2	0.00	31.3	36.5	33.3	0.840	41.9	62.1	58.9	52.6	0.080
Antihypertensive	48.0	25.9	0.00	33.7	40.0	33.3	0.588	42.8	62.1	50.0	47.3	0.451
Arthritis	34.1	22.2	0.00	31.3	37.6	33.3	0.846	30.3	40.5	41.2	31.6	0.427
Child nutrition during pregnancy	41.5	22.2	25.0	36.1	40.0	33.3	0.114	39.3	43.2	42.1	41.5	0.606
Energy intake	60.9	22.2	0.00	32.6	37.7	33.3	0.467	59.8	62.1	67.6	52.6	0.538
Fever	56.0	22.2	0.00	27.7	36.5	33.3	0.906	52.7	70.3	55.9	47.4	0.737
Immune boosting	63.4	18.5	0.00	30.1	34.1	33.3	0.515	63.4	62.1	73.5	47.4	0.195
Minerals & protein supplement	52.5	22.2	0.00	31.3	40.0	33.3	0.445	50.0	56.7	61.7	42.1	0.912
Quality protein in breastmilk	41.5	22.2	25.0	36.1	44.7	33.3	0.508	50.2	51.3	50.0	36.8	0.687

4.6. Factors determining the willingness of the consumers to pay for moringa tea product.

The result of the probit model testing the willingness to pay for moringa tea against the social and psychographic characteristics of the respondents showed that the level of education was statistically significant at 5 %, Affordability of moringa products was statistically significant at 1 %, Perception of the price of the close substitute was statistically significant at 1 %. There is a positive relationship between gender and the willingness to pay for moringa products; there is a negative relationship between the age of the respondent and the willingness to pay for moringa tea products; there is a positive relationship between the level of education and the willingness to pay for moringa tea products; there is a positive relationship between the family size and the willingness to pay for moringa tea products; there is a positive relationship between the marital status of the respondent and the willingness to pay for moringa tea products; there is a positive relationship between the respondent area of residence and the willingness to pay for moringa tea products; there is a positive relationship between the occupation of the respondent and the willingness to pay for moringa tea products; there is a positive relationship between the income per month of the respondent and the willingness to pay for moringa tea products; there is a negative relationship between the respondent attendance of training on food dietary and consumption and the willingness to pay for moringa tea products; there is a positive relationship between the affordability of moringa and the willingness to pay for moringa tea products; there is a negative relationship between the perception of the price of moringa close substitute and the willingness to pay for moringa tea products.

Table 8: Factors determining the willingness of the consumers to pay for moringa tea Product.

Factors	Coefficient	Standard Error	P-value
Gender	0.0256	0.2951	0.931
Age	-0.0014	0.0138	0.908
Level of education	0.0772	0.0370	0.037**
Family size	0.0104	0.0141	0.459
Marital status	0.1189	0.2801	0.671
Area of residence	0.2031	0.2747	0.460
Occupation	0.1086	0.9136	0.234
Income per month	0.0000	0.0000	0.322
Attendance of food training	-0.4267	0.2959	0.149
Access to moringa product	0.7143	1.5342	0.642
Affordability of moringa	2.6908	0.8185	0.001***
Perception of price of close substitute	-1.2146	0.3832	0.002***
LR chi square(12)=38.53		Pseudo R2= 0.2513	

** ,*** represents 5 % and 1 % respectively

4.7. Previous experience and the willingness of the consumers to pay for moringa products.

The results showed that fair price was statistically significant at 1 % and expectation previously met by the moringa products was significant at 5 %. The table further shows that there is a positive relationship between the fair price offered and the willingness to pay for moringa products; The percentage discount offered had a positive relationship with the willingness of the consumers to pay for moringa products; The high quality of moringa products had a positive relationship with the willingness of the consumers to pay for moringa products; The expectation previously met by the moringa products had a positive relationship with the willingness of the consumers to pay for moringa products; There was a positive relationship between consumers' previous purchase of moringa products and willingness of the consumers to pay for moringa products.

Table 9: Previous experience and the willingness of the consumers to pay for moringa products.

Factors	Coefficient	Standard Error	P-value
Fair price offer	0.6186	0.1955	0.002***
Percentage discount	0.1991	0.2412	0.409
High quality	0.0079	0.2072	0.970
Meet expectations	0.4060	0.2057	0.048**
Pay more	0.1753	0.1657	0.290

LR chi square (6) = 48.80 Pseudo R2= 0.5928

,* represents 5 % and 1 % respectively

5. Discussion

Socio-economic and psychographic characteristics of the respondents

The result showed that majority of the respondents were men. It could be because consumption is mostly dependent on the preference of the man of the house who is regarded as the head of the family in the region. This result contradicts the study on the perception, knowledge, and readiness to pay of households for *Moringa oleifera* Lam powder carried out by Farionola et al. (2014) in Oyo State, Nigeria. The study showed that women were the major consumers of *Moringa oleifera* in the study area. The result also shows that the majority of the respondents were young and can still enjoy the numerous health benefits of moringa products. The findings of this study are consistent with those of Obayelu et al. (2014) on consumers' readiness to pay for labelled and certified moringa products in Ogun State, Nigeria. The study showed that majority of the moringa consumers were young people. Results based on education shows that most of the respondents were literate at varying levels of education. Educated people would possibly be aware of the health benefits, nutritional and economic values of moringa. The findings of this study are consistent with those of Ayinde et al. (2015) on consumer perceptions of risk related to moringa products. Ilorin Metropolis, Kwara State, Nigeria. The study revealed that the major consumers of moringa in the study area were educated people. The distribution of the respondents by their family size shows that most of the respondents had a family size ranging between 1-5 persons. An increased family size would likely influence the consumption of moringa. This study is in consonance with the study of Kassaliet al. (2020) which shows that the majority of the respondents had a family size of about 1-10 persons. The result also shows that a larger percentage of the respondents were married and would likely depend on the nutritional value of moringa products to sustain their family's health. This study is in tandem with the findings of Kola-Oladiji et al. (2014), whose study revealed a greater percentage of moringa consumers were married. The distribution of the respondents based on their area of residence shows that most of the respondents resides in the urban area. People residing in the urban area are more likely to be aware of the various health benefits of moringa, as they are open to getting more information on the numerous benefits of moringa, hence their reason for being the major consumers of moringa. Based on the result a fair percentage of the respondents were employed and therefore they would be able to take a part of their earnings to buy moringa products. This study supports the conclusions of Farionola et al. (2014), whose study showed most of the moringa consumers were employed. The monthly income of the respondents shows that most

of the respondents earned less than or equal to ₦ 50,000 monthly. This indicates that majority of the respondents in the study area were either farmers who earned little money as their monthly take home or businesspeople who operates on a small scale. Results also shows that most of the respondents had never attended a training on food dietary and consumption. This is an indication that their awareness on dietary and nutritional benefit of *Moringa oleifera* is poor. This contradicts the study by Patience et al. (2020) on the rate of intake and understanding of the health benefits of moringa. Access to moringa product shows that most of the respondents have access to moringa products. This is in consonance with the study of Farinola *et al.* (2014) on the household perception, awareness and willingness to pay for *Moringa oleifera* Lam powder in Oyo State, Nigeria. The study revealed that 81 % of the respondent had access to *Moringa oleifera*. The result on the distribution of the respondents by affordability of price most of the respondents could afford moringa. This might be because *Moringa oleifera* was accessible in the study area. The price of the close substitute shows that most of the respondents perceived moringa to be of higher price than its close substitute. This could be attributed to its numerous health benefit, economic value, and acceptability in the society. The result also shows that a larger percentage of the respondents were willing to pay for moringa products. Most of the respondents were educated and would possibly be aware of the nutritional and economic values of moringa hence their willingness to pay for the products. This study concurs with Nedombeloni's (2017) study regarding consumer awareness of and readiness to pay for moringa as a leafy vegetable in the province of Limpopo. the majority of the respondents to the study were unaware about moringa leaf vegetables but were still willing to pay for the item, this might be because of its numerous health benefits.

Forms of use of moringa products

Based on the results, majority of the respondents consumes moringa in boiled leaf form. This finding is consistent with the Popoola & Obembe (2013) study on the geographical distribution, local knowledge, and use patterns of *Moringa oleifera* Lam. (Moringaceae) in Nigeria that leaves, and seed are the most utilized part of moringa for food and nutritional purposes. This result could be because the utilizations come at no cost, and the most available and accessible form of moringa products in the study area. From this survey, it can be realized that an average household has moringa tree grown in from of the house, the simple meaning of this is that they are aware of the benefits of moringa, which is why it is been grown by them. Additionally, their limited income could be a factor why they prefer the less expensive means of utilizing this crop. The second most consumed form was in tea. This

result is in tandem with the study of Williams et al. (2013) that moringa is mostly consumed in tea form in Nigeria. Based on previous research we opined that tea form was the most consumed in the study area, however, the results show it to be second after boiled leaf form. The constraining factors could be occupation, education, and income. Their occupation affects income and this in turn affects how much they can spend, equally education will inform how much they can spend or not spend. The result also revealed that 65.2 % of the respondents indicated that they did not use moringa in the form of soap and perfume. This could be because of the smell, which sometimes may be considered unpleasant. It was also revealed that 66.7 % of the respondents indicated that they do not use moringa in form of cosmetics. This could be as a result of similar perception of soap and perfume, also, the consumers are probably used to a product which they may assumed affordable and good for their skin, thereby, having the fear of change. The result reveals that 39.0% of the respondents indicated that they do not use moringa leaf powder form. The result further revealed that 45.6 % of the respondents indicated they did not use moringa in the form of seeds and pods. Also 80.5 % of the respondents indicated that they did not use moringa in capsule form. This could be because of their perception that synthetic drugs are safer, and that the synthetic drugs are prescribed by doctors who are qualified.

Perceived health risk of the respondents to the use of moringa products.

The two most identified perceived risk based on the result is that synthetic drugs are safer, considering that they are made in the laboratory; and, that they are recommended by doctors who they take as licensed to correctly prescribed them drugs. The perception of majority of the respondents that synthetic drugs were safer for use than Moringa because they were designed in the laboratory agrees with the research of Mahomoodally & Ramalingum (2015) on the consumption habits, dietary practices, and medical beliefs of Mauritians, that trust, and safety were significant factors for consumption among different age group. Noteworthy is that there is production of moringa capsule in existence. These capsules are also made in the laboratory, it could only mean that there is dearth of information on them, which would require wide publicity at an affordable price. The results also showed that most of the respondents agreed that dosage of synthetic drugs was safer than Moringa because the former was prescribed by doctors who are qualified. This is similar to the above on knowledge, publicity and training on the use of moringa capsule. It would also be important to get support that is needed by pharmacological sectors on its acceptability and usage by the people. The results show that 61.4 % of the respondents neither disagreed nor agreed that they did not trust moringa due to the high amount of pesticide used for their growth. This

could be because little or no pesticide is employed in the growth of moringa in the study area. The result further revealed that 56.7 % of the respondents disagreed that the consumption of moringa may be risky because they might be contaminated by bacteria or other micro-organisms. This is because there is no prevalence of moringa plant infestation in the study area. The result further revealed that 37.1 % of the respondents disagreed that Moringa was not effective in severe treatments. This can be because most of them are yet to try it for situation that are seriously health-wisely. This can also be traced to their level of knowledge on the various usefulness of moringa. This can be addressed by public enlightenment and training on its benefits. Also, the result shows 51.9 % of the respondents disagreed that actions of Moringa on health are not immediate. This can be traced to the form in which they consume moringa, therefore if forms such as capsule can be introduced appropriately to the consumers, the effect will no doubt satisfies their expectation.

Factors influencing the decisions to consume moringa products.

The mean and standard deviation of the factors influencing consumer's decision to consume *Moringa oleifera*, these factors include both psychographic and socio-economic factors were analysed. The results show the p-value of the consumers by comparing the mean of both active and passive consumers using Mann-Whitney test. Age and educational level which are both significant at 10% and 5% have U value (2827 & 2769), Z (-2.043 & -2.313) and P-value (0.041 & 0.021) respectively. The result of the age indicates the mean difference between active and passive consumers where active consumers have mean of 33.9 years of age to standard deviation of 11.98, and passive consumers have mean of 30.13 years of age to standard deviation of 11.34 years. This difference would mean that older consumers have high likelihood of becoming active consumer of moringa products. The finding supports the research of Tolulope et al. (2016) that as the age of consumer increases their likelihood to consume moringa also increase. The result of the educational level of the respondents shows the mean difference between active and passive consumers where active consumers have mean of 12.17 years of age to standard deviation of 4.76, and passive consumers have mean of 10.29 years of age to standard deviation of 5.75 years. Worthy of note is that consumers whose mean falls within the confine of active consumers according to this result has a minimum of secondary education. Therefore, this difference would mean that consumers who are more educated have high likelihood of becoming active consumer of moringa products. This also support the research on how education makes individuals a conventional consumer of products that are of health and nutritional benefits such as moringa (Higuchi et al. 2017).

Factors such as gender, marital status, area of residence, income, price, taste, safety, social influence, branding & packaging, convenience, health impact, nutrition preference, and doctor's prescription have no difference that is significant between both active and passive consumers.

Reasons for using *Moringa oleifera*.

The top 3 reasons why the respondents consume moringa are immune boosting, energy intake and fever treatment. All the above explains the use of moringa by the respondents for health purposes. It could be because the respondents have medicinal knowledge of the plants owing to their local background where the consumption of plants that are medicinal are rampant for the treatment of health-related issues. This result is in alignment the study of Mishra et al. (2011) on the use of moringa for indigenous treatment of different ailments in South Asia. The result based on the age of the respondents showed that antiaging was significant factor why they consume moringa product. This becomes important, because as people grows the likelihood of having a weak immune system and susceptibility to health-related issues increases. Worthy of note is that antiaging drugs helps to inhibit cancerogenesis, besides, they also prevent inflammation and fragility, all of which are important for good health (Leone *et al.* 2016; Attakpaet *al.* 2017). Study shows that antiaging drugs targets aging regulator such as FOXO (forkhead box transcription factors), PGC1 α (peroxisome proliferator-activated receptor- γ coactivator-1 α) and mTOR (mammalian target of rapamycin) which when deregulated causes oxidative stress, affects autophagy, and permeates inflammation. Such drugs are said to contain rapamycin, aspirin, metformin, and resveratrol which aside the initial functions mentioned, also slow down functional decline in some organ of the body to (Piskovatska et al. 2017). The result also shows that consumers between ages 41-50 have the highest percentage of moringa consumption for energy intake, immune boosting, arthritis, antiaging, minerals and protein supplement. This age is a production stage and more energy are needed for fulfilling daily activity by people of this age category, they are more susceptible to stress, disease and infection owing to the activities they engage in, some at this stage works by standing on their feet for 8 hours every day of the week, which in turn can lead to leg disease. Similarly, they are afraid of transiting to a stage of fragility which could contribute to why they consume it more for antiaging purpose. Consumers between ages 31-40 have the highest percentage of moringa consumption for antidiabetic, antihypertensive, quality protein in breast milk, child nutrition during pregnancy, fever. People of this age consume foods that mostly contain sugar, snacks and that are easy to prepare many which are of carbohydrate source, also it is

reasonable that they consume for quality protein in breast milk and intake for child nutrition during pregnancy as the age is mostly regards as maternity age (Oyetero *et al.* 2019; Sumarni *et al.* 2020). This also supports the study of Basri *et al.* (2021) that eating moringa cookies raises the amount of high-quality protein in breast milk. The result based on the education of the respondents shows that it does not have any significant influence on why they consume moringa. This could be explained by the low educational level of the respondents, even though education was found to be one of the factors that influences decision to consume moringa. The effect of this would be that as the education level of the respondents increases, their consumption of moringa would also increase, this is because education brings about knowledge and informed decision making. This is in consonance with the study carried out by Higuchi *et al.* (2017), the research demonstrates that having a higher level of education increases the likelihood of being a traditional consumer.

Factors determining the willingness of the consumers to pay for moringa tea product.

The result showed that the most important element influencing willingness to pay for moringa tea were the level of education, affordability of moringa products and perception of the price of the close substitute. According to Tolulope *et al.* (2016) education enhances the possibility that buyers will be willing to pay for moringa products. The results showed that there was a positive relationship between gender and the willingness to pay for moringa products. This implies that the higher the number of male respondents the higher the willingness of the consumers to pay for moringa tea products. This contradicts the study conducted by Farinola *et al.* (2014) who reported that majority of the respondents who were willing to pay for the consumption of moringa powder were females. It could be because consumption is mostly dependent on the preference of the man of the house who is regarded as the head of the family in the region. There was a negative relationship between the age of the respondent and the willingness to pay for moringa products. This implies that the higher the number of young respondents the lower the willingness to pay for moringa tea products. A study conducted by Kral *et al.* (2020) shows that consumers between ages 30-50 tend to have stronger preference for branded products, but consumers below and above this age group have lesser/weaker product preference. There was a positive relationship between the level of education and the willingness to pay for moringa tea products. This implies that the higher the number of educated consumers the higher the willingness to pay for moringa tea products. Educated people would possibly be aware of the health benefits, nutritional and

economic values of moringa and they are also anticipated to increase their income, which will increase their willingness to pay for moringa. This is consistent with a study by Higuchi (2017) that demonstrates how education level influences one's propensity to be a traditional consumer. There was a positive relationship between the family size and the willingness to pay for moringa tea products. This implies that the higher the family size the higher the willingness to pay for moringa tea products. An increased family size would likely influence the consumption of moringa. This is in line with the findings of Zarma (2021) on the use of moringa tree products and reported health advantages in rural Nasarawa State, Nigerian households. The study revealed that an increased household size could increase the utilization of *Moringa oleifera* due to its numerous health benefits. Similarly, a family of 5 people with not so high income will need every means necessary to balance their nutritional intake which could make moringa an alternative to achieving this. There was a positive relationship between the marital status of the respondent and the willingness to pay for moringa tea products. This implies that the higher the number of married consumers the higher the willingness to pay for moringa tea products. Married people need *Moringa oleifera* to improve their family health status. There was a positive relationship between the respondent area of residence and the willingness to pay for moringa tea products. This implies that the higher the number of urban respondents the higher the willingness to pay for moringa tea products. There was a positive relationship between the occupation of the respondent and the willingness to pay for moringa tea products. This implies that the higher the number of employed consumers the higher the willingness to pay for moringa tea products. There was a positive relationship between the income per month of the respondent and the willingness to pay for moringa tea products. This implies that the higher the income of the consumers the higher the willingness to pay for moringa tea products. This agrees with the study of Berhanu & Acha (2020) which states that the higher the income of the respondents, the more their willingness to pay for the new products of certified *Moringa oleifera*. There was a negative relationship between the respondent attendance of training on food dietary and consumption and the willingness to pay for moringa tea products. This implies that the lower the number of consumers attendance of training on food dietary and consumption the lower the willingness to pay for moringa tea products. There was a positive relationship between the affordability of moringa and the willingness to pay for moringa tea products. This implies that the more affordable moringa is, the higher the willingness to pay for moringa tea products. There was a negative relationship between the perception of the price of moringa close substitute and the willingness to pay for moringa tea products. This implies that the

lower the price of moringa close substitute the lower the consumers' willingness to pay for moringa tea products.

Previous experience and consumers' willingness to pay for moringa products.

The result showed that fair price offered, and expectation previously met by the moringa products were the variables found to statistically influence consumers' willingness to pay for *Moringa oleifera* products. This explains the price range that consumers will accept goods that best meets their needs. Although, our result showed that close substitute has lower price compared to moringa product, yet purchase was made based on fair price. This implies that the health and nutritional benefit of moringa is known and authentic, equally, the re-purchase decision because of previous expectation met explains its efficacy. This aligns with the study of Costa et al. (2021) individual purchase intentions for green items are influenced by previous purchasing history and environmental awareness. Seeing therefore, that there was a positive relationship between the fair price offered and the willingness to pay for moringa products, this implies that an increase in the fair price offered will bring about an increase in the consumer's willingness to pay for moringa products. The percentage discount offered had a positive relationship with the willingness of the consumers to pay for moringa products. The implication of this is that the higher the percentage discount offered, the higher the consumers' willingness to pay for moringa products. Economically, people tend to purchase goods based on discount even when they do not necessarily have need for such goods, the resultant effect of such discount is a probable re-purchase, provided that the first experience meets or surpasses their expectation. The result also shows that high quality of moringa products had a positive relationship with the willingness of the consumers to pay for moringa products. This implies that the higher the quality of the moringa products, the higher the consumers' willingness to pay for moringa products.

The expectation previously met by the moringa products had a positive relationship with the willingness of the consumers to pay for moringa products. This implies that an increase in the level of expectations met by moringa products will bring about an increase in the consumers' willingness to pay for moringa products. There was a negative relationship between consumers' willingness to pay less for moringa products or rather not buy again and willingness of the consumers to pay for moringa products. This means that the consumers do not agree that the price of moringa products previously purchased by them was much more than the valued derived from them. There was a positive relationship between consumers' willingness to pay more for moringa products and willingness of the consumers to pay for

moringa products. This means that the consumers agrees that moringa product they have previously purchased are worth more than the price they are sold considering the valued derived from them.

Limitation of the study

1. The study could not cover the aspect of branding and packaging. Branding and packaging are the face of any product as most people buys commodity based on the appearance even before checking out what the content might look like. This could possibly increase the willingness of the consumers to consume moringa.

6. Conclusions

The study inferred that consumers of moringa in the study area were dominated by relatively young people, male, educated, married, and employed respondents. It was concluded that the major form of use of moringa products in the study area was boiled fresh leaf form. The majority of the respondents neither agreed nor disagreed that they do not trust moringa because a lot of pesticide was used to help them grow, the majority of the respondents agreed that synthetic drugs were safer for use than moringa because they are designed in the laboratory, while most of the respondents disagreed that the consumption of moringa may be risky because they may be contaminated by bacteria or other microorganisms. Also, a larger percentage of the respondents agreed that dosage of synthetic drugs is safer than moringa because the former is prescribed by doctors who are qualified, most of the respondents disagreed that moringa is not effective in severe treatments and most of the respondents disagreed that actions of moringa on health are not immediate. The Mann Whitney U test shows that age and education were major factors influencing decision to consume moringa across the two consumer groups. Immune boosting, energy intake and fever treatment were the top 3 reason why they consume moringa, and with respect to the age of the respondents, antiaging was significant as the main reason why they consume moringa. The probit regression model revealed that the level of education, affordability of moringa products and perception of the price of the close substitute were the variables found to significantly determine the willingness of the consumers to pay for moringa tea products and fair price offered and expectation previously met by the moringa products were the variables found to statistically influence consumers' willingness to pay for *Moringa oleifera* products.

Considering the above conclusions, antiaging drug having been medically proven to inhibit cancerogenesis, prevent inflammation, and fragility, moringa can be used as a functional food since they contain essential compounds of antiaging drugs. moringa capsule is already in existence, if therefore, respondents preferred synthetic drugs to moringa products, it could only mean that there is little or no knowledge of the drug. Therefore, the government and pharmaceutical body should give it needed support for wide publicity at an affordable price. Since education was a factor in the consumption of moringa, food dietary program/training should be organized to educate and sensitize the public on the use of

moringa. This will help to bridge the information gap that affects the illiterate group of the state which probably has little knowledge of the benefit of moringa.

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