



Exploring the awareness and value chain of *Moringa oleifera* for sustainable livelihoods: A case study of Sauyemwa West and Kaisosi East Areas in Rundu, Kavango East Region, Namibia

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ABSTRACT

The study explored the awareness and utilization of *Moringa oleifera* for sustainable livelihoods in Kaisosi East and Sauyemwa West areas in Rundu in Kavango East region of Namibia. Purposive sampling was used to select two regions, which are Kaisosi East and Sauyemwa West of Rundu in Kavango East region. Data on socio-demographics and uses of *Moringa oleifera* was collected using a structured interview questionnaire from 82 farmers that were randomly selected across the two selected areas of study. Majority of farmers in the study area were female (56.1%), whereas for employment status, 68.3% were unemployed, and for education, 51.2% had attained secondary school level of education. Results from the study revealed that most of the respondents (48.8%) fell within the age range of 20-39 years, and 67.1% were single. The results also showed that most of the respondents were aware of the *Moringa oleifera* plant, such that 34.7% use it for medicinal purposes and 19.5% as a source of income generation through the sales of *Moringa oleifera* products. The results showed that there is no significant difference ($P > 0.05$) in the use of *Moringa oleifera* between socio-demographic factors. The study further revealed that many of the farmers could identify the plant physically and by name. The study suggests that there is a large scope for increasing the cultivation and utilization of *Moringa oleifera* in the study area. To achieve the objective, efforts are needed to improve farmers' access to credit and markets, as well as training in production and processing.

Contribution/Originality: The research used a social science lens to study the awareness and *Moringa oleifera* value chain for sustainable livelihoods in Namibia. The study examined for any relationships between use of *Moringa oleifera* and selected demographic variables. To the best of our knowledge, no such study has been conducted in Namibia.

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1. INTRODUCTION

Moringa oleifera is the most widely cultivated of the 13 known species in the *Moringaceae* monogenetic family. The *Moringa* is a multipurpose tree since nearly every part of it has some nutritional, medicinal, and/or commercial benefits (Alhassan, Sanchi, Dorh, & Sunday, 2022; Fahey, 2005; Fuglie, 1999; Gopalakrishnan, Doriya, & Kumar, 2016; Paliwal, Veena Sharma, & Pracheta, 2011; Velázquez-Zavala, Peón-Escalante, Zepeda-Bautista, & Jiménez-Arellanes, 2016). Since the tree is adaptable to dry climates, it can not only combat malnutrition, desertification, climate change, and variability but is also used for income generation for the farmers. *Moringa* can easily be grown in tropical countries, including Namibia, since it has favorable climatic conditions. It is, therefore, an ideal plant to promote at the household level because of its resilience to harsh growing environments, including drought, poor soil quality, and resistance to many pests and diseases. *Moringa oleifera* is a leafy vegetable that, when dried, can be used as a food supplement that serves as rejuvenating nutrients for the body. Based on the importance of dietary diversification, *Moringa oleifera* is a vegetable crop that can be grown to generate income, reduce poverty, and improve the health of people through proper nutrition. Planting *Moringa oleifera* can help provide a more diversified farm economy and potentially stimulate the rural economy as a whole, encouraging the development of more stable commodities. Thus nutritional vegetable crop's acceptability necessitates sensory evaluation in various forms. Therefore, we can subject the plants products to sensory evaluation to ascertain their acceptability among various age groups. Many developing countries, including, Namibia are faced with the problem of food insecurity caused by a continuous decline in food production due to drought, post-harvest losses, and inadequate agricultural-related policies.

Food insecurity is a major cause of malnutrition, a condition that results from poor diet in which essential nutrients are either lacking or in the wrong proportions. *Moringa oleifera* can be a resource to developing countries by utilizing leaves, whether fresh or processed, not only to generate income and provide employment, but also to be a nutrition supplement for families and improve their health. The study's purpose is to investigate the current and potential role of *Moringa oleifera* can play in the development of sustainable livelihoods, particularly for small-scale, indigenously based agriculture. This study was to investigate the awareness and utilization of the *Moringa* socio-economic benefits available in two areas in Rundu, Namibia, known as Sauyemwa West and Kaisosi East. Residents commonly find *Moringa oleifera* trees in their backyards in the Kavango East and Zambezi regions of Namibia. The cultivation and use of *Moringa oleifera* can play a key role in the successful achievement of sustainable livelihoods in rural areas of Namibia. The Kavango East region, like others in Namibia, experiences climate change effects and variability that are commonly associated with food insecurity (famine), desertification, lack of safe drinking water, poverty, etc. The study looked at how the *Moringa oleifera* is used, can be used, or was being used as a sustainable solution by subsistence farmers and rural communities for socio-economic development with the aim of determining their perceptions and levels of utilization of the plant for sustainable livelihood. Most of the Namibian population lives in rural areas and is prone to the effects of climate change and variability. Climate change is making droughts more of a norm than an exception. This is a pattern that places some of the most vulnerable communities in an increasingly precarious position when it comes to meeting basic food needs. For subsistence and smallholder farmers in dry lands like Namibia, a failed harvest can mean months of hunger, lack of adequate food, and hardship. In addition, "conventional" crops such as cereals are often not native and suitable to the local environmental conditions and thus require expensive inputs, significant irrigation, and land preparation in order to produce a successful harvest. This means that these crops are more vulnerable to droughts, leading to poor or unsuccessful harvests. Trees, on the other hand, often survive when other crops fail. In order to determine which tree can effectively combat food shortages and contribute to climate change mitigation, it is crucial to examine the potential already present in developing countries, particularly Namibia. *Moringa oleifera*, being advocated for, is an ideal plant to promote at the household level because it is extremely resilient to harsh growing environments, including drought, poor soil quality, and many pests and diseases.

Lack of proper nutrition caused by not having enough to eat due to the prevalence of the drought is generally estimated to contribute to more than one-third of all child deaths, although it is rarely listed as the direct cause. Lack of access to highly nutritious foods, especially in the present context of rising food prices, is a common cause of poverty. Poor feeding practices, such as inadequate breastfeeding, offering the wrong foods, and not ensuring that the child gets enough nutritious food, contribute to malnutrition. Infection-particularly frequent or persistent diarrhea, pneumonia, measles, and malaria-also undermines a child's nutritional status. In the poorest countries, as many as one child in five dies during infancy (Atrash, 2013). According to a report by the United Nations World Food Programme, more than 42% of people in Namibia suffer from a lack of adequate food (World Food Programme (WFP) Report, 2015). Despite being classified by the World Bank as an upper middle-income country, Namibia is currently ranked among four African countries with the highest number of undernourished people in the world; Zambia, the Central African Republic, and Malawi are the others with levels of poverty and famine caused by not having enough to eat exceeding 35% of the population. Considerable investments continue to be made by governments and aid agencies in programmes designed to prevent poverty and lack of food through the introduction of sustainable solutions. However, the problem of poverty and lack of food continues because the programmes that address this problem are normally unsustainable, hence the need for new approaches. The *Moringa* tree, or "miracle tree," as it is sometimes called, could be the solution to the problems of development of sustainable livelihoods, especially for small-scale, indigenously based agriculture in the developing world, including Namibia. The tree has well-documented nutritional and medicinal properties that also provide excellent economic opportunities for agricultural producers, traders, and processors, thereby making it effective in tackling micronutrient insecurity while equally holding the promise of sustainable economic returns to the farmers (Ajayi, Williams, Famuyide, & Adebayo, 2013).

2. MATERIALS AND METHODS

2.1. Study Area

The study was conducted in the Kaisosi East and Sauyemwa West areas of Rundu (Figure 1(a)) in Kavango East region of northern Namibia. The region contains the western half of the Caprivi strip; in the north, it borders the Cuando Cubango Province of Angola; and in the south, it borders the North-West District of Botswana (Figure 1(b)). Rundu is the capital and largest city of the Kavango-East Region, with a population of 136,823 inhabitants according to the Namibia 2011 Census provisional report. It lies on the border with Angola on the banks of the Kavango River, covering an area of 25,586 km². The major occupation in the study area is farming, although some of the respondents engage in some other minor activities, such as trading. The majority of the rural population in the study areas are subsistence farmers who cultivate crops.

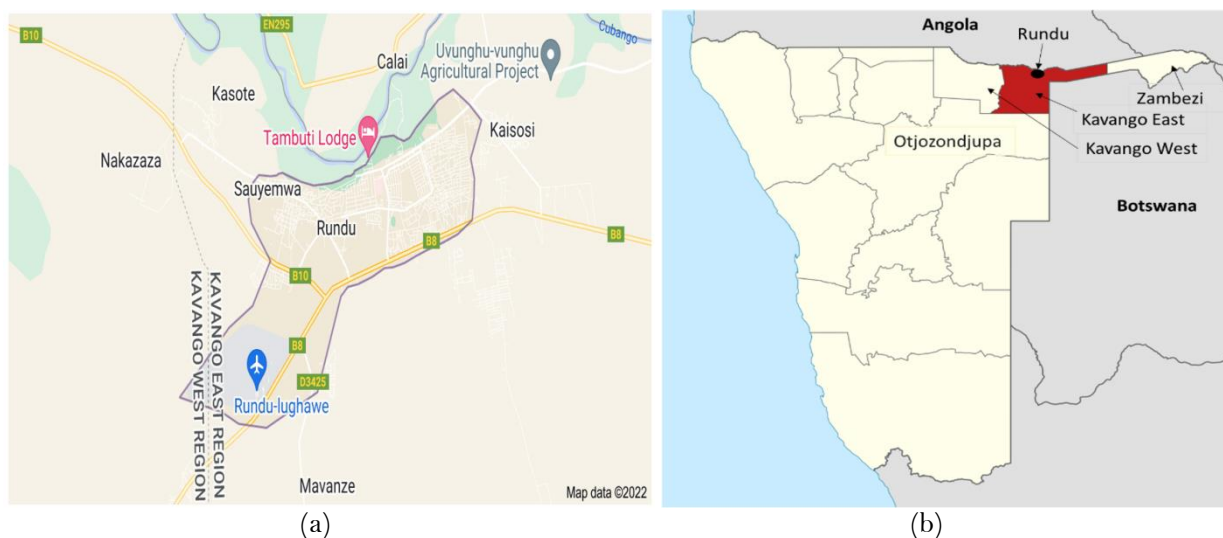


Figure 1. (a) Map of Rundu showing the locations of Kaisosi and Sauyemwa areas, and; (b) Map of Namibia showing the location of the Kavango East region.

2.2. Study Design

The study assessed the extent of cultivation and utilisation of *Moringa oleifera* in Rundu, in particular Kaisosi East and Sauyemwa West, which were both qualitative and quantitative in nature. The data collection was conducted through face-to-face interviews and questionnaires to collect information on awareness, utilization, and perception of *Moringa oleifera*. The data collection was done from September 2022-October 2022. To recruit participants for this study, the researcher used purposive sampling because random sampling was not possible due to the study design. Purposive sampling involved the researcher making a conscious decision about which individuals would best provide the desired information. For instance, 100 farmers (50 female and 50 male) were targeted as a representative of the population. In the study, such individuals in a population were selected as the samples and the results were generalized to the entire population. This helped the researcher achieve the objectives of the study in the shortest possible time.

2.3. Questionnaire and Interviews Administration

The primary data collection tool used was a structured questionnaire, which was first face-validated, pretested, and tested for reliability before administration (Roopa & Rani, 2012). It was administered through face-to-face interviews with the help of a translator/interpreter from English to local language, RuKwangali. The translator/interpreter clarified in the local language the survey objectives and procedures, and provided an assurance of the ethical principles, guaranteeing participants' anonymity and data confidentiality through a participant's information sheet prior to answering the survey questionnaire. The respondents were assured that the information collected was to be used for academic research purposes only, and participation in the survey was voluntary. Before participating in the survey, we asked the interviewees to sign the pre-prepared form to give their consent.

The translator/interpreter would then translate each question for the interviewee and provide the answer to the researcher. Both the researchers and translator/ interpreter participated in recording the responses.

The questionnaire was divided into two sections, comprising both open- and closed-ended questions. The first section dealt primarily with socio-demographic data, i.e., gender, marital status, age range, education level, employment status, and family size. The second section was for years of farming experience, farm size, and the knowledge, uses, and market of *Moringa oleifera*.

2.4. Data Analysis

The demographics and characteristics were described and analysed using descriptive statistics (frequencies and percentages of qualitative and quantitative *Moringa oleifera* producers' data) in the questionnaire. The quantitative data collected was managed and arranged to make it easier for interpretation and computer software. We used the Statistical Package for Social Sciences (SPSS) version 22 for data analysis to generate descriptive statistics of the questionnaire

responses. The quantitative data obtained was summarized and presented in tables. All information related to the study was kept on the encrypted personal hard drive, accessible only to the researcher.

3. RESULTS

A total of 82 respondents were interviewed in the two areas. Table 1 displays the age of the growers and gender characteristics of the the growers. The modal age of the interviewees was the 30-39 years and more females participated in the study.

In addition to information on household characteristics such as family size, educational status, farm size and experience of the farmers, the farmers have very small holdings and use traditional technology (hoes and cattle ploughs) for cultivation. Farming experience can be said to measure the number of years of participation in *Moringa oleifera* cultivation with a view to determining how such an experience has impacted the farmer's productivity in terms of the yield and input use. In the project that was developed by Komeho Namibia Development Agency, a national non-profit organization in Namibia that was formed in 2001/2002 to contribute to Namibia's national development objectives, the communities in both Kaisosi East and Sauyemwa West were introduced to *Moringa oleifera* cultivation and utilization. The study areas were, therefore, ideal for studying the socio-economic benefits of *Moringa* to rural communities. The study areas were, therefore, ideal for studying the socio-economic benefits of *Moringa* to rural communities.

To garner cooperation of smallholder farmers and communities in Moringa programmes, it is important to understand the factors that influence behavior. Socio-demographic factors such as gender, age, income, and education have been found to be influential in community-based programmes. Hence, the inclusion in the study of the socio-economic distribution of the respondents with respect to gender, marital status, age, education attainment, farmers' experience, and market of *Moringa*, farm size, family size, and uses of *Moringa oleifera*.

3.1. Socio-Demographics of the Respondents

Table 1 provides the socio-demographics in terms of gender, marital status, family size, employment status, age, and educational level.

3.1.1. Gender

Gender of respondents was 56.1% female and 43.9% male, as shown in Table 1. Namibia 2011 population and housing Census provisional report showed that female population was (51%), slightly higher than males (49%). The same trend is observed in this study in the growth of *Moringa oleifera* based on gender, i.e., there are more female respondents than males. This categorization was used to establish the growing of *Moringa oleifera* on gender basis, that is, which gender is more interested in growing the plant. The chi-square test on the uses of *Moringa* and gender of respondents revealed that there was no significant difference ($P > 0.05$) between the uses of *Moringa oleifera* and gender. This means that both males and females in the study areas use *Moringa oleifera* equally.

3.1.2. Marital Status

The marital status of respondents is such that 55 (67.1%) were married, 21 (25.6%) single, and 6 (7.3%) widow/widower. It is common in many societies that single people are always in the majority compared to married and widows/widowers, but in this study, this was not the case because of the purposive sampling used.

3.1.3. Family Size

Every respondent is a member of a family; therefore, the determination of the family size is crucial. In this study, family size was organized into three categories, namely, 1-4, 5-8 and >8 members/persons. The result shows that 1-4 members were 9 (11.0%) whereas 5-8 and >8 member families were 31 (37.8%) and 42 (51.2%), respectively.

3.1.4. Employment Status

The employment status shows that employed persons were 13 (15.9%), self-employed persons were 12 (14.6%), unemployed persons were 56 (68.3%), and only 1 was 1 (1.2%) retired. This means that there is a high unemployment rate among the respondents, although the employed were second highest, followed by self-employed. A chi-square test of employment status and use of *Moringa* was carried out to find out if there were statistical differences in the use of *Moringa* among respondents based on their employment status. The results indicated that there were no significant differences ($P > 0.05$) in the use of *Moringa oleifera* and employment status of respondents. This clearly reveals that all respondents used *Moringa oleifera* for different purposes equally, despite their employment status.

3.1.5. Age Ranges

The age ranges of respondents were arranged in the order of <20, 20-39, 40-49, 50-59 and ≥ 60 . The highest number of respondents were between ages 20 and 39 (48.8%), followed by <20 (17.1%), 50-59 (13.4%), 40-49 (12.2%), and the least was >60 (8.5%). To examine the uses of *Moringa oleifera* based on age range, the chi-square test was conducted, in which the result shows no significant difference ($P > 0.05$) in the use of *Moringa oleifera* between age ranges. Every age range of respondents consistently uses *Moringa oleifera*, which accounts for this.

3.1.6. Education Levels

Table 1 presents the respondents' education levels. Among the respondents, secondary education had the highest with 42 (51.2%), followed by informal education 19 (23.2%), primary education 12 (14.6%), tertiary education 4 (4.9%),

vocational education 3 (3.7%), and others had least with 2 (2.4%). A chi-square test of education levels and use of *Moringa* reveals that there was no significant difference ($P > 0.05$) between education levels of respondents in their use of *Moringa oleifera*. This demonstrates that every respondent uses *Moringa oleifera* regardless of their educational level.

Table 1. Socio-demographic data of the participants.

Variable	n (82)	%		n (82)	%
Gender			Family size		
Female	46	56.1	1 - 4	9	11.0
Male	36	43.9	5 - 8	31	37.8
Total	82	100	>8	42	51.2
Marital status			Total	82	100
Married	55	67.1	Employment status		
Single	21	25.6	Employed	13	15.9
Widow/Widower	6	7.3	Unemployed	56	68.3
Total	82	100	Self-employed	12	14.6
Age range			Retired	1	1.2
<20	14	17.1	Total	82	100
20-39	40	48.8	Education level		
40-49	10	12.2	Secondary education	42	51.2
50-59	11	13.4	Primary education	12	14.6
≥60	7	8.5	Informal education	19	23.2
Total	82	100	Vocational education	3	3.7
Tertiary education				4	4.9
Other				2	2.4
Total				82	100

3.2. Cultivation and Utilization of *Moringa oleifera*

Table 2 provides information on the cultivation and utilization of *Moringa oleifera* in terms of years of farming experience, farm size, and uses and marketing data.

3.2.1. Years of Experience as a Farmer

Respondents' years of experience in farming given in Table 2 are not based on farming of *Moringa oleifera* but rather farming in general.

The highest number of respondents had ≥5 years farming experience, with 53 (64.6%). The second largest respondents had 3-4 years farming experience 23 (28.1%), and the third had 1-2 years of farming experience 6 (7.3%), while < 1 year of farming experience was zero. The fact that farming is their primary source of livelihood accounts for the large percentage of respondents with farming experience.

3.2.2. Farm Size

The farm size of the respondents was 41 (52.4%), which had >0.8 hectares of farmland, followed by 27 (32.9%), which was 0.51-0.8 hectares, 9 (11.0%) had 0.31-0.5 hectares, and 3 (3.7%) had 0.1-0.3 hectares as the least. This indicates that many communal farmers have land to cultivate for their livelihoods.

3.2.3. Uses of *Moringa oleifera*

In this study, the respondents were asked to choose any three uses of *Moringa oleifera* from the following list: animal fodder, water treatment, food supplements, cosmetics, intercropping, vegetables, source of oil, tea, ornamental, fuel wood, medicinal, source of income, and others. All on the list received scores except water treatment, cosmetics, and intercropping.

The ones chosen are animal fodder, food supplements, vegetables, sources of oil, tea, ornamental, fuel wood, medicinal, sources of income, and others. Out of 82 respondents, the highest use was for medicine 56.1% followed by source of income (29.3%), tea (24.4%), food supplement (19.5%), source of oil (17.1%), vegetable (9.8%), and ornamental (9.8%), whereas fuel wood, animal fodder and others were all less than 9%.

3.2.4. Marketing of *Moringa oleifera*

We also asked the respondents if they were actively marketing *Moringa oleifera*. Out of the 82 participants, 66 (80.5%) of respondents sell *Moringa oleifera* and 16 (19.5%) do not. Respondents' intention when selling *Moringa oleifera* was to generate income for their livelihood. In terms of where the participants sell their *Moringa* produce, all 66 (80.5%) out of 82 do sell within Namibia, and only 3 (3.7%) are engaged in the export market. The latter's involvement in the export market is through Komeho Namibia Development Agency, which has an established export to Germany of dry *Moringa oleifera* leaves.

In other words, these *Moringa oleifera* farmers supply to Komeho Namibia Development Agency, who then export on their behalf. The indicated category "other" refers to respondents' who do not sell *Moringa* products, but instead use them for their own consumption.

Table 2. Cultivation and utilization of *Moringa oleifera*.

Variable	n (82)	%		n (82)	%
Years as a farmer			Uses of Moringa		
<1	0	0	Animal fodder	2	2.4
1-2	6	7.3	Food supplement	16	19.5
3-4	23	28.1	Vegetable	8	9.8
≥5	53	64.6	Source of oil	14	17.1
<i>Total</i>	82	100	Tea	20	24.4
Size of farm (Hectares)			Ornamental	8	9.8
<0.1	2	2.4	Fuel wood	6	7.3
0.1-0.3	3	3.7	Medicine	46	56.1
0.31-0.5	9	11.0	Source of income	24	29.3
0.51-0.8	27	32.9	Other	2	2.4
>0.8	41	50.0			
<i>Total</i>	82	100	Moringa market		
Moringa selling			Namibian market	66	80.5
Yes	66	80.5	International market	3	3.7
No	16	19.5	Other - consumption	16	19.5
<i>Total</i>	82	100			

3.2.5. Value Chain of Moringa

The uses of Moringa in the study areas are based on the leaves, although every part of the tree is known to have socioeconomic benefits. According to the findings articulated above, Figure 2 captures the most important features in the value chain. The value chain is considered to be short, fragile, and dominated by few actors. In general, the smallholder farmers or families collect Moringa leaves for either home consumption or further processing for sale. Whenever household needs arise, the farmers harvest the leaves needed and spend neither time nor the financial resources in pruning, fertilizing, or irrigating Moringa trees. Locally, consumers purchase the Moringa products mostly in informal outlets such as small shops, local agricultural markets, or individual farmers homes. On the production side, the farmers often harvest Moringa leaves and seeds from their own garden or neighborhood.

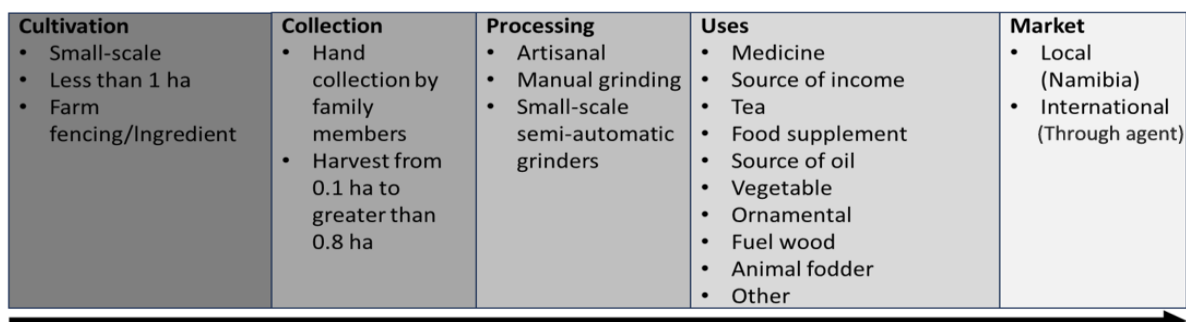


Figure 2. Moringa value chain in Saueyemwa West and Kaisosi East areas in Rundu, Kavango East region, Namibia.

4. DISCUSSION

Kwaambwa, Chimuka, Kandawa-Schulz, Munkombwe, and Thwala (2012) assessed and promoted the cultivation and utilisation of the *Moringa oleifera* in 5 Southern African Development Community (SADC) countries, namely Botswana, Namibia, South Africa, Swaziland, and Zambia. They conducted the study from September 2010 and March 2011. It was found that the tree is generally used for nutritional and medicinal purposes except in Namibia, where another species (i.e., *M. ovalifolia*), is found that is not yet being cultivated by all the respondents. The prices of the products varied from country to country. The information about the benefits of the *Moringa oleifera* was well received, although a lot still needs to be done to benefit from this sustainable resource.

The total 2,104,900 persons enumerated in the Namibian 2011 Census were 1,083,600 (51%) females and 1,021,300 (49%) males. This pattern varies slightly across regions and constituencies, which is not uncommon. Overall, however, there are more females than males in most populations, as stipulated in the Namibia 2011 Census report. The results of the gender of respondents indicated in Table 1 clearly show that the female respondents had a higher percentage than those of males, because there are more females in the population of Namibia.

In the study done by Odeyinka, Torimiro, Oyedele, and Asaolu (2007), the average age of respondents was about 50 years. The study further found that the respondents were aware of and willing to pay for *Moringa*. Most respondents were housewives, which could be attributed to the fact that they make decisions on what the family consumes. These findings seem to agree with the current study.

We expect education to improve access to information. Respondents were average income earners, which could influence their willingness to pay for *Moringa* or any other product. Most respondents were familiar with *Moringa*, implying that the plant is becoming known among consumers. Many respondents were aware of the nutritive benefits of *Moringa*. Age, educational status, and preference for other vegetables may determine consumer likelihood to pay for

Moringa. Older people seem to know the benefits of medicinal or herbal plants, such as *Moringa*. Educated consumers are more likely to be willing to pay for *Moringa*. This could be because the more educated a consumer is, the more likely he or she will have access to various sources of information on the benefits of the vegetable. We expect educated individuals to earn higher incomes, thereby increasing their willingness to purchase *Moringa*. The study findings indicate that the sex and family of the respondents positively influence their acceptance of diversified *Moringa oleifera* products. The results also revealed that *Moringa* products are highly acceptable to the respondents. In the study of educational levels, most of the respondents had secondary level and could read and write; therefore, they were aware of the benefits of *Moringa* and should ideally be willing to pay. The plant is in most of the households' backyards and is of importance to the families, who indicated that they used the plant products for different purposes in addition to selling them. Odeyinka et al. (2007) study supports this.

Moringa is becoming increasingly important as a source of income for several people in rural areas. For instance, several villagers in parts of Matebeleland in Zimbabwe have started nurseries to grow *Moringa* in large quantities for sale to other villagers and other provinces (Maroyi, 2007). In many instances, group members share the seedlings for planting on their farms and sell some to other farmers. Of late, the small town of Binga in Zimbabwe has become a hive of activity, hosting people from all over the country who buy the *Moringa* products in bulk. The products range from fresh leaves and pods to powdered leaves. Most farmers also give seedlings to relatives and neighbours. The price of a single seedling ranges from 10-30 South African rands (US\$0.5-US\$1.7). The relatively high prices for seedlings in Namibia are indicative of their high demand. Demand generally outstrips supply.

Farmers' reasons for planting and perceptions of benefits varied across the country. Four of the most common and important reasons are the need for food, an important medicine for home consumption, a cash-making enterprise, and the diversity of uses. Cultivation of the multiple-use species is an economic proposition, and unlike many slower-growing and more habitat-specific medicinal plant species, *Moringa* is already a popular tree for indigenous agroforestry in Africa (Maroyi, 2007). The selling of *Moringa* by the respondents was mainly to generate income for sustainable livelihoods, and those who were not selling it used it for consumption. Maroyi (2007) observed a similar trend.

The sociodemographic distribution of the respondents was with respect to gender, marital status, age, annual farm income, educational attainment, and experience. Distribution of respondents on the consumption of *M. oleifera* according to the study that was done in Nigeria by Odeyinka et al. (2007) showed that more than half (52.5%) of the respondents fell into the category of people that have favorable perception of the benefits of *Moringa oleifera*, while (47.5%) fell into the category of people that have an unfavorable perception of the benefits of it. This implies that the majority of the respondents somehow benefit from using *Moringa oleifera*. This is consistent with the finding that *Moringa oleifera* is beneficial to human nutrition. Based on the findings of this study, the respondents' sex and family size enhance the acceptability of diversified *Moringa* products. The results also revealed that *Moringa* products are highly acceptable to the respondents. The null hypothesis is therefore accepted. This implies that age, marital status, level of education, and monthly income had no effect on the level of acceptability of the products. The result showed that respondents' perceptions on the benefits of using *Moringa oleifera* are not significant ($r = 0.171$, $P = 0.292$) because $P > 0.05$, therefore the null hypothesis is accepted. This suggests that the respondents' perceived benefits from using *Moringa* do not influence the level of acceptability of the products. It also meant that the location of the respondents does not affect the level of acceptability.

Opportunities for establishing communal plantations are almost nonexistent, so there is no doubt that any efforts to introduce a programme with the aim of providing a self-sustainable supply of *Moringa* must concentrate on the promotion of tree planting on individual farms. In Table 2, the uses were identified, and the ones that were the most used were for medicinal purposes, as a source of income, as a food supplement, and for a tea, which indicated the high percentage, therefore in agreement with the study done in Zimbabwe. In the districts of Matebeleland in Zimbabwe, *Moringa* was found to be used for the following purposes: vegetables, medicine, ornamental, and as source of oil and other uses, which include firewood, coagulate, fencing, in construction, making ropes, and as animal fodder (Maroyi, 2007).

5. CONCLUSION

The study demonstrates that *Moringa oleifera* is valuable, cost-effective plant resource with a diverse array of applications. The major uses (>8%) were found to be the following: medicine (34.7%), source of income (19.5%), tea (12.2%), and food supplement (9.8%). However, many people remain unaware of the tree's full potential, including its socioeconomic value and multipurpose nature. This is evident from the fact that not all the people that claimed to be aware of the plant knew the various benefits that could be derived from the tree. Therefore, there is need to promote the cultivation and socioeconomic benefits of this natural resource as a sustainable livelihood approach in the rural areas of the country. The Chi-Test results showed that there were no significant differences ($P > 0.05$) in the use of *Moringa* by respondents versus gender, employment status, age, or education level. Based on the findings, we suggest tackling the specific characteristics and needs of *Moringa oleifera* producers would more adequately help to improve cultivation, yields, and utilization of *Moringa*. Interventions to enhance yields include training on best *Moringa* production, preservation, processing, and packaging practices, provision of input subsidies; and access to irrigation tailored to the specific constraints and needs of each *Moringa oleifera* grower type. The promotion of the cultivation and utilization could be done through various media that are accessible and affordable to the community, such as radio, roadshows or demonstrations, workshops, etc. Finally, enabling access to credit will improve the productivity of *Moringa oleifera* farmers.

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REFERENCES

- Ajayi, C. A., Williams, O. A., Famuyide, O. O., & Adebayo, O. (2013). Economic potential of *Moringa oleifera* as a commercial tree species and its suitability for forest management intervention in Taungya farming system. *Agrosearch*, 13(3), 242-255. <https://doi.org/10.4314/agrosh.v13i3.7s>
- Alhassan, Y., Sanchi, I. D., Dorh, L. E., & Sunday, J. A. (2022). Review of the nutritive, medicinal and general economic potentials of *Moringa oleifera*. *Cross Current International Journal of Agriculture and Veterinary Sciences*, 4(1), 1-8. <https://doi.org/10.36344/ccjavs.2022.v04i01.001>
- Atrash, H. K. (2013). Childhood mortality: Still a global priority. *Journal of Human Growth and Development*, 23(3), 257-260. <https://doi.org/10.7322/jhgd.69513>
- Fahey, J. W. (2005). *Moringa oleifera*: A review of the medical evidence for its nutritional, therapeutic, and prophylactic properties. Part 1. *Trees for Life Journal*, 1(5), 1-15.
- Fuglie, L. J. (1999). *The miracle tree: Moringa oleifera, natural nutrition for the tropics*. Dakar, Senegal: Church World Service.
- Gopalakrishnan, L., Doriya, K., & Kumar, D. S. (2016). *Moringa oleifera*: A review on nutritive importance and its medicinal application. *Food Science and Human Wellness*, 5(2), 49-56. <https://doi.org/10.1016/j.fshw.2016.04.001>
- Kwaambwa, H. M., Chimuka, L., Kandawa-Schulz, M., Munkombwe, N., & Thwala, J. (2012). Situational analysis and promotion of the cultivation and utilisation of the *Moringa oleifera* tree in selected Sub-Saharan Africa countries. *Progress Multi-Disciplinary Research Journal*, 2(1), 9-40.
- Maroyi, A. (2007). The utilisation of *Moringa oleifera* in Zimbabwe. *Asian Journal of Plant Sciences*, 6(2), 320-325.
- Odeyinka, S., Torimiro, D., Oyedele, J., & Asaolu, V. (2007). Farmer's awareness and knowledge of *Moringa oleifera* in Southwestern Nigeria: A perceptual analysis. *Asian Journal of Plant Science*, 6, 320-325. <https://doi.org/10.3923/ajps.2007.320.325>
- Paliwal, R. R. P., Veena Sharma, V. S., & Pracheta, P. (2011). A review on horse radish tree (*Moringa oleifera*): A multipurpose tree with high economic and commercial importance. *Asian Journal of Biotechnology*, 3(4), 317-328. <https://doi.org/10.3923/ajbkr.2011.317.328>
- Roopa, S., & Rani, M. S. (2012). Questionnaire designing for a survey. *Journal of Indian Orthodontic Society*, 46(4_suppl1), 273-277. <https://doi.org/10.5005/jp-journals-10021-1104>
- Velázquez-Zavala, M., Peón-Escalante, I. E., Zepeda-Bautista, R., & Jiménez-Arellanes, M. A. (2016). *Moringa* (*Moringa oleifera* Lam.): Potential uses in agriculture, industry and medicine. *Revista Chapingo. Serie Horticultura*, 22(2), 95-116.
- World Food Programme (WFP) Report. (2015). *The state of food insecurity in the world; 2015*. Retrieved from <https://www.wfp.org/publications/wfp-year-review-2015>

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