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Socio-Economic contribution of *Schinziophyton rautanenii* to rural livelihoods of Hwange District, Zimbabwe

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ABSTRACT

This study investigated the socio-economic contribution of *Schinziophyton rautanenii* in Hwange District, Zimbabwe. Purposive sampling was conducted, and *Schinziophyton rautanenii* harvesters were interviewed. The assessment focused on knowledge about the species' role in the environment, willingness to conserve Manketti, and the impact of distance on the amount of nuts harvested per season. Additionally, the economic contribution was evaluated using Plant Part Value (PPV) and Use Value Index (UV_k). Data analysis was done in PAST and R Studio statistical package. Chi-squared test was used to test for associations, T-test was used to analyze uses among different categories and ANOVA among different age groups. Chi-squared test results showed that the knowledge on species' role in the environment was dependent on age and gender. Willingness to conserve was dependent ($p<0.001$) on the knowledge of species' role in the environment, whereas proximity to protected areas influenced the amount of nuts harvested ($p<0.001$). Among the plant parts used, fruits were the most used, with 36%, and among the Use Value Index, food was the most valued. Scientifically, all the categories valued the species equally. In conclusion, there is a need to address these knowledge gaps, educate, and promote the social and cultural use of the species.

Contribution/Originality: This research on the socio-economic contribution of Schinziophyton rautanenii is original and was the first to be conducted in the district and nationally. This study expands knowledge on the species' importance, highlighting its socio-economic implications for income and food security, supporting conservation and sustainable development.

1. INTRODUCTION

From the early periods of humanity, people around the world have used trees native to particular regions for centuries. In many cases, trees have played a crucial role in the livelihoods of local communities, providing food, medicine, fuel, and building materials, among other uses [1]. Various studies have revealed that plants provide important benefits to individuals in Africa and around the world [1-3]. Challenges related to the management of diseases and health problems, plant-based therapies have emerged as an option to address such situations [4]. Scientists have discovered and adopted plant extracts, combining them with scientific research to produce medicines

[4]. The majority of the population residing in rural areas relies heavily on plant-based medicines, as they are conveniently available, affordable, and acceptable within these communities [5].

Africans, particularly the San people in Southern Africa, value the Manketti tree for its oil and food [6]. According to Highland Essentials, S. rautanenii is gaining popularity as the rest of the world becomes aware of its benefits. Research by Bennett [7] showed that about 200,000 people are currently employed in gathering *S. rautanenii* fruits and trading in this species, and its products have the potential to generate close to US$20 million in Southern Africa. The demand for tree nuts is increasing by 8% every year, with an estimated global revenue of US$60 billion [8]. *S. rautanenii* and its products are traded in informal markets in Malawi, Mozambique, Zambia, and Zimbabwe, while oil extracted from the species is exploited commercially in Botswana and Namibia. In Zambia, the wood and timber obtained from the species are used in producing curios and other crafts that are marketed in tourist resorts. Kivevele and Huan [9] evaluated the fuel properties of biodiesel from *S. rautanenii* seeds, while Maroyi [10] found that most of the determined fuel attributes of the species fulfilled the minimum chemical requirements of global biodiesel standards. The biodiesel produced from *S. rautanenii* seed oil may be used as a substitute for common mineral diesel. Seed oil extracted from *S. rautanenii* has over the years been used in producing lubricants, soaps, and personal cosmetic care products, as well as health products used in the topical treatment of various ailments and conditions such as hair dandruff, muscle spasms, varicose veins, and wounds. Fruits and nuts of *S. rautanenii* are widely used in rural areas in Botswana, Malawi, Mozambique, Namibia, Zambia, and Zimbabwe to reduce food insecurity and as an important source that supplements their food, particularly during periods of drought [10]. This is largely due to Zimbabwe's Community Land Law, which grants individuals the right to access forest products locally. Communities located outside protected areas are recognized as beneficiaries of timber and non-timber forest products.

Zimbabwe is one of the countries that has promoted the harvesting of *Schinziophyton rautanenii* nuts and other nuts such as *Ximenia caffra*, Sond., *Sclerocarya birrea* (A. Rich.) Hochst, and other Ximenia species, as well as nuts from melons. Bio-Innovation Zimbabwe (BIZ) and other USAID funders facilitate the collection of nuts in Zimbabwe. Engagement in seed collection increased during the COVID-19 lockdown, when movements were banned and some individuals could not generate income to sustain their families. Such projects have been ongoing in Lupane district, Binga, and parts of Hwange district in Zimbabwe. The nuts are collected under the trees, and elephant dung and other kernels are gathered after fermentation and after using fruit for making porridge. Cracking nuts can be quite difficult and is usually done by women who first scorch the nuts in the fire and then use stones or small hammers to break the outer shell. This process can be carried out year-round, making *Schinziophyton rautanenii* an important source of income for women between agricultural seasons.

The main aim of this study is to contribute to the understanding of how communities use and sustain their livelihoods from natural resources such as natural woodlands, focusing on *Schinziophyton rautanenii*. This was achieved through the following objectives.

- To assess the effect of age and gender on the knowledge of *Schinziophyton rautanenii*'s role in the environment.
- To evaluate whether the knowledge of the species' role in the environment influences the willingness to conserve.
- Determine the influence of distance from the protected area on the amount of nuts harvested.
- To assess the social and economic contribution of harvesting *Schinziophyton rautanenii* nuts in Hwange District communities.

The study adds to the existing body of scientific knowledge on *Schinziophyton rautanenii*'s importance. The socioeconomic implications of nut harvesting provide insights into the importance of the species as a source of income, food security, and cultural heritage. By generating new data and insights, researchers can contribute to

academic discussions, interdisciplinary research collaborations, and conservation science initiatives aimed at protecting biodiversity and supporting sustainable development.

2. MATERIALS AND METHODS

2.1. Study Area

The study was conducted in Hwange Rural District, which is in Matabeleland North, Zimbabwe (18.22° S, 26.29° E longitude). The assessed area shares boundaries with Sikumi Forest and Hwange National Park on the southeastern side. To the east lies the Bulawayo/Victoria Falls road running in a southwest direction. It is located about 93 km from Hwange town and 300 km from Bulawayo.

Hwange district is classified under agro-ecological zone V [11]. The average annual rainfall is approximately 620mm [12], although it varies across the prior forest from 570mm in areas around Ngamo Forest to 620mm at Sikumi and Hwange National Park. Between 1918 and 1990, annual rainfall has ranged from 335.6mm to 1159.8mm [13]. Mean monthly maximum temperatures recorded at Sikumi offices range from 24°C in June to 33°C in October (unpublished data). Frost may occur during the months of May to August, with ground minimum temperatures reaching -5°C or lower. Black frost, defined as temperatures lower than 7°C, occurs approximately once every five years. Hwange consists of three vegetation types, which are woodland, bushland, and grassland. Woodland vegetation occupies 96.2% of the area, bushland 2.48%, grassland 1.3%, and settlement 0.09% of the area. *Baikiaea plurijuga* Harms is the most common constituent of woodland vegetation [14]. *Terminalia sericea* Burch. ex DC. occupies more than 50% of the bushland. *Croton pseudopulchellus* Pax, *Combretum psidioides* Welwitschia, and *Guibourtia coleosperma* (Benth.) J. Leonard species are only found on the Kalahari sands.

The district is dominated by Kalahari sands that support the forest areas with various woodlands, teak vegetation, and acacia species. Rich clay soils are commonly found in Matetsi areas, and red clays are partially found in Dete areas [15]. However, areas bordering protected areas have poor soils that are unproductive [16]. Kalahari sands of Amorphic order and Regosol group. These aeolian sands cover a large area, supporting a predominantly teak woodland vegetation. The remainder of the soils between the forest and the communal area is a mosaic of many types and is mostly sand.

Figure 1 illustrates the map of Ward 15, located in Hwange District, Matabeleland North, Zimbabwe.

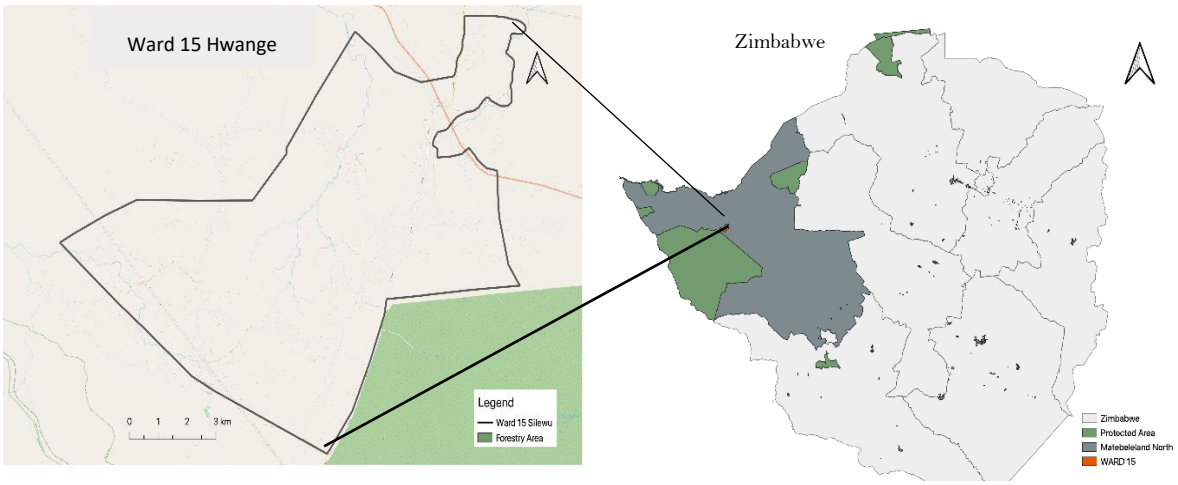

Figure 1. Location of the study area.

2.2. Study Species

The Manketti, Mongongo, or Mgoma, *Schinziophyton rautenanii*, is an indigenous tree that is found both sporadically scattered and in large groves throughout northern Namibia, southern Angola, Zambia, Botswana, Zimbabwe, Mozambique, and Malawi Cheikhyoussef, et al. [17]. Helgren [18] *Schinziophyton rautenanii* is always found on deep Kalahari sands, and it is never found on compacted soils, clay, or areas characterized by flooding

[18]. It usually grows up to 7-20 meters and does not bear fruit until the age of 15-25 years. The leaves are grouped alternately on branches and are digitally complex. *Schinziophyton rautenanii* starts flowering as soon as it produces leaves in October and is harvested in April (Highland essentials). The flowers are produced in paniculate cymes or thin, loose sprays that can reach a length of 12 cm. The mangongo tree can yield as many as 1000 fruits per season [6].

2.3. Study Design and Field Sampling

Data collection was conducted in Hwange District. Semi-structured interviews were used to collect both qualitative and quantitative data from subsistence harvesters of *Schinziophyton rautanenii.* Despite the heterogeneity in ethnic groups in Hwange District, most individuals can communicate effectively in Ndebele; therefore, the interviews were conducted in Ndebele. Semi-structured interviews addressed issues related to knowledge of the ecology, social and economic contributions, and harvesting strategies. The purposive sampling method was used for sampling. According to BIZ, a total of 54 individuals were trained in harvesting nuts in Hwange District. Only 31 of them specialized in harvesting manketti nuts, and 30 of these were interviewed. The interview conduction mainly took place in areas surrounding protected zones; the sample comprised *Schinziophyton rautanenii* nut harvesters found in three villages (Magoli, Dingani, and Sialwindi), which are in ward 15. To incorporate socio-cultural dimensions, each respondent indicated their age, ethnic group, and level of education. During data collection, both males and females of different ages within households were interviewed to capture data from various members involved in harvesting.

2.4. Data Analysis

All data analysis was carried out in the PAST4Project software or an analysis package. All the associations were analyzed using the chi-squared test. Plant Part Value (PPV) was calculated using the formula.

$$PPV = \frac{RU_p}{RU_w} \times 100,$$

Where PPV is the plant part value, RU_p is the number of reported uses of the plant, and RU_w is the number of reported uses of the whole plant. The Use Value for each informant was calculated using the Medeiros et al. [19] formula.

$$UV_{is} = \frac{\sum U_{is}}{n_{is}},$$

Where U_{is}= number of uses quoted in each interview by informant I, n_{is}= number of quotations for the species given by the informant. The Use Value for each category was calculated using the Medeiros et al. [19] formula.

$$UV = \frac{\sum U_c}{n_c},$$

Where $\sum U_c$= sum of all the use citations of the category, either gender, education or age, n_c= total number of individuals in the category. Overall Use Value (OUV) was obtained using the Ncube et al. [20] formula.

$$OUV = \sum^{U} V_k,$$

OUVs were calculated as the sum of all use values per category for each respondent. A univariate ANOVA was used to evaluate whether there was any variation in overall use values based on different age groups. A t-test was employed to compare gender and different education levels to determine if there were significant differences in use values.

3. RESULTS

3.1. Demographic Characteristic

A total of 30 individuals were interviewed. Based on the demographic characteristics of the study, the following observations were made: 90% (n=27) were female, and 10% (n=3) were male. Additionally, 10% (n=3) were considered youth below the age of 40, 77% (n=23) were adults aged 41-59 years, and 13% (n=4) were seniors aged 60 years and above. Regarding marital status, 10% (n=3) were single, 33% (n=10) were widowed, and 57% (n=17) were married. Among the respondents, 40% (n=12) attended only primary school, while 60% (n=18) attended secondary school; none attended tertiary education.

3.2. Age and Gender on the Knowledge of S. Rautanenii's Role in the Environment

Generally, all age groups showed poor knowledge, with all youth not knowledgeable. All respondents below the age of 40 were females and had achieved secondary education. 85% of female respondents had good knowledge, whereas 67% of male respondents had good knowledge about species' role in the environment, as shown in Figure 2. The knowledge of species' role in the environment is dependent on gender and age, with Chi-square values of X^2= 27.01 and X^2= 7.92, respectively, P < 0.0001 for both among gender and age groups, as shown in Table 1.

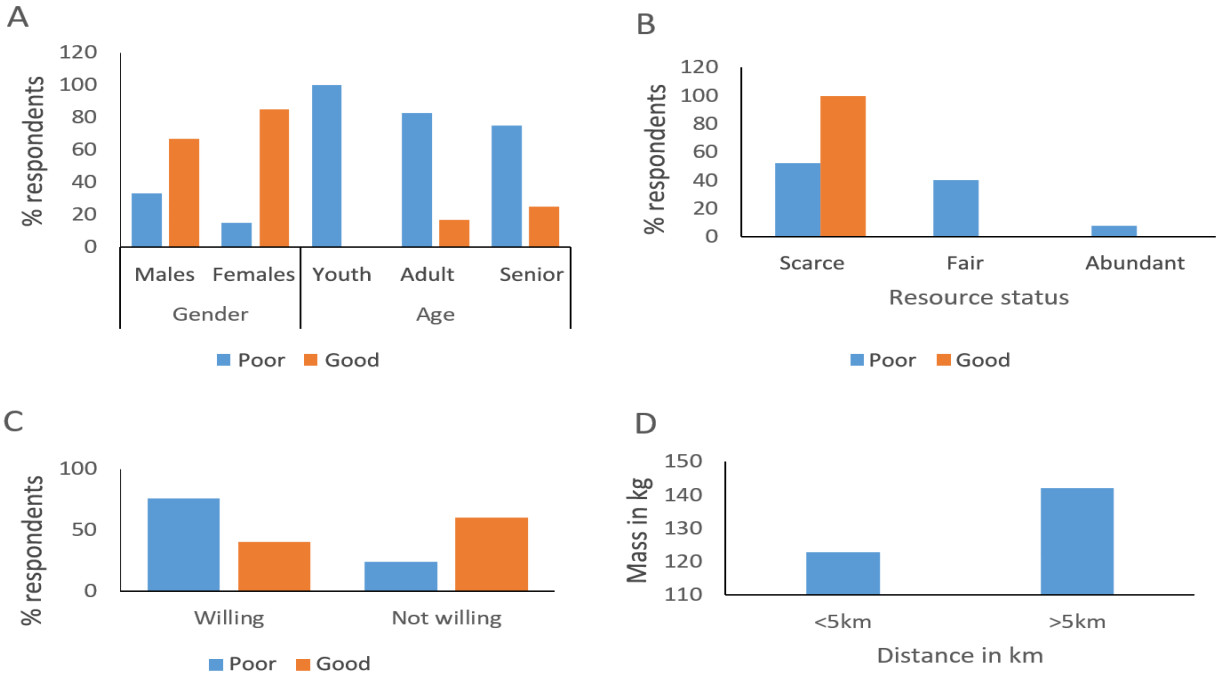

Figure 2. Shows the knowledgeable and less knowledgeable about species' roles in the environment across gender and age (A). The resource status is based on their understanding of species' roles in the environment (B), their willingness to conserve (C), and the distance traveled in relation to the amount of nuts harvested.

3.3. Resource Distribution for Schinziophyton rautanenii Based on Understanding of the Species' Role in the Environment

3.3.1. Resource Status

The resource is scarce according to all respondents with good knowledge; scarcity was also confirmed by 52% of poorly knowledgeable respondents, 40% of whom said it was fairly distributed, while 8% of poorly knowledgeable respondents said the species was abundant. As shown in Figure 2. The resource status is dependent on the knowledge about the species' role in the environment. Table 1 shows the chi-test results: p < 0.0001 and X^2 = 63.16.

3.4. Understanding the Environmental Importance of Schinziophyton Rautanenii and Its Impact on Willingness to Conserve

As shown in the figure, five individuals with poor knowledge are more willing to conserve than individuals who are knowledgeable. All those who are below 40 years old are willing to conserve. (See Figure 2). Chi-squared results ($p<0.0001$, see Table 1): Willingness to conserve is dependent on knowledge about the species' role in the environment; those who are less knowledgeable are less willing to conserve than those who are more knowledgeable.

3.5. Distance from the Protected Area Affects the Amount of Nuts Harvested

The average amount of nuts harvested by individuals who traveled more than 5 km was higher than that of individuals who traveled less than 5 km, as shown in Figure 2, a graph that illustrates a significant difference between the mass averages. The t-test confirmed that there is no significant difference ($p=0.526$) between the means of those who traveled more and less than 5 km.

3.6. Economic Contribution of Harvesting Schinziophyton Rautanenii According to Gender and Age

3.6.1. Economic Contribution According to Gender and Age

52% of females said it contributes less (the amount between \$2 and \$13.5 USD) per harvesting season, 48% said it moderately contributes (between \$13.51 and \$26 USD). 67% of males also revealed less contribution, with 33% saying it contributes moderately. In general, both genders said it contributes less. The majority of all age groups said income from selling nuts contributes less to daily living. Figure 3 shows the graph of different age groups and genders in response to economic contribution. Table 1 indicates that the economic contribution is dependent on gender and not dependent on age.

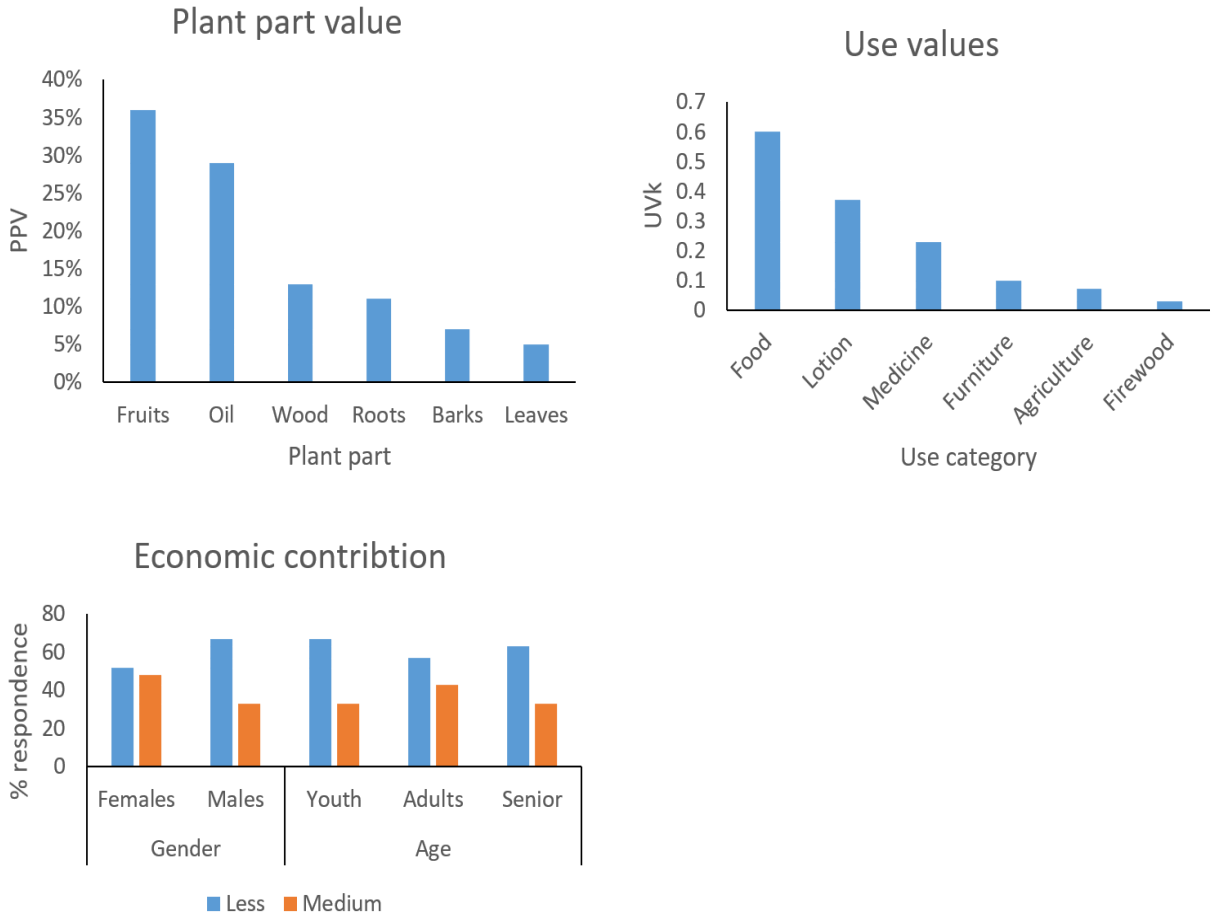

Figure 3. Shows the graph of plant part value starting with one with the highest value. The graph showing use value per use category and the graph showing the economic contribution based on different age groups and gender.

Table 1. Association between age, gender, and level of knowledge on knowledge, resource status, willingness to conserve, and economic contribution.

Association	Chi-squared value	Df	P-value
Knowledge Vs Age	7.92	1	0.004
Knowledge Vs Gender	27.01	2	<0.0001
Knowledge Vs Resource status	63.16	2	<0.0001
Knowledge versus willingness to conserve	26.01	1	<0.0001
Economic contribution vs. gender	4.67	1	0.031
Economic contribution versus age	2.88	2	0.24

3.7. Plant Part Value

The plant parts that were recorded as being used are leaves, bark, roots, wood, oil, and ripe fruit. Fruits were recorded as the most used part, accounting for 36%, while leaves were recorded at 4%, as shown in Figure 3.

3.8. Use Value Index

Average UV_k for each category showed that food was the most used among respondents (UV_k = 0.6), followed by lotion (UV_k = 0.37) and medicine (UV_k = 0.23). Furniture (UV_k = 0.1), agricultural use (UV_k = 0.07), and firewood (UV_k = 0.03) were the least common. Plant use values were also calculated based on gender, age, and education.

Table 2 Plant use values (UV_k) in relation to gender, age, and education. Females had the highest use value in food, seniors also had the highest use value in food, and individuals with secondary education showed the highest use value in food. Food has the highest use value across all categories.

Table 2. Use value per category.

Category		Medicine	Food	Lotion	Agriculture	Furniture	Firewood
Gender	Males	0.000	0.000	0.000	0.000	0.333	0.000
	Females	0.259	0.667	0.407	0.074	0.111	0.037
Age	Youth	0.667	0.667	0.333	0.333	0.333	0.333
	Adult	0.174	0.565	0.391	0.043	0.043	0.000
	Senior	0.250	0.750	0.250	0.000	0.000	0.000
Education	Secondary	0.250	0.661	0.389	0.111	0.111	0.056
	Primary	0.222	0.583	0.333	0.000	0.056	0.000

Table 3: Effect of locality, age category, gender, and education on overall use-values. There is a significant difference between use value indices in gender, and there is no significant difference between use value indices across different ages and education levels.

Table 3. Overall use value.

Factor	Level	OUV	SE	P-value
Gender	Males	0.33	±0.066	0.038
	Females	0.888	±0.068	
Age	Youth	1.999	±0.066	0.23
	Adult	0.651	±0.071	
	Senior	0.500	±0.061	
Education	Secondary	0.917	±0.060	0.60
	Primary	0.611	±0.066	

4. DISCUSSIONS

Knowledge about *Schinziophyton rautanenii*'s role in the environment was found to be significantly correlated with age and gender in the study. Those who were older, especially those over 40 years, showed that they knew more than respondents who were younger. In addition, a gender difference was noted, with a higher proportion of

females than males demonstrating good knowledge. A study conducted in Mozambique also indicated that men know of aspects of generation, location, and uses of the plant as a species, while women have a deeper knowledge of the Manketti nut itself (preparing, technological process, and feeding) [21]. Women are the main agents of cultural transmission to the younger generation, as they involve children in the entire process. While younger generations may have had limited exposure to traditional practices and cultural transmission over time due to changing lifestyles and modernization, older individuals may have gained knowledge through these means. It is also possible that females participate more in activities related to gathering nuts or using natural resources, which may contribute to a greater understanding of the species' role in the environment. The discovery that the majority of younger respondents with good knowledge were females who had finished secondary school raises the possibility that formal education may impact an individual's ability to acquire knowledge, particularly in relation to environmental awareness and understanding. The study found a positive relationship between the willingness to conserve and understanding of the species' role in the ecosystem. People with good knowledge may view *Schinziophyton rautanenii* as a scarce resource because they are aware of its ecological significance and vulnerability to overexploitation. However, people with poor knowledge showed a surprisingly higher willingness to conserve than people who are knowledgeable. They might not, however, feel personally accountable for conservation efforts, particularly if they think others, such as governmental bodies or environmental organizations, should take the initiative in these matters. Even knowledgeable people may prioritize short-term financial gain over long-term conservation objectives, despite being aware of the resource's scarcity.

Despite knowledge of the resources' scarcity, harvesting activities may be driven by economic pressures such as the need to support their families or meet daily expenses, which may override concerns about resource depletion. Well-informed people may have doubts about conservation efforts because they believe they are unable to or do not address the underlying socioeconomic problems. Because of this, people might become ignorant of conservation efforts and choose to prioritize short-term survival over long-term sustainability. Conservation may seem like an expensive luxury to people who are primarily dependent on *Schinziophyton rautanenii* for their livelihoods, such as those who reside in isolated rural areas with little access to towns. They may feel forced to keep harvesting even though they are aware of the resources' scarcity if there are no other alternatives to support themselves.

Attitudes toward conservation may be influenced by cultural values, social conventions, and community beliefs. People may find it difficult to let go of accepted norms even when they are aware of the scarcity of a resource because of cultural practices or social expectations that occasionally place a higher priority on resource usage than conservation. Overall, the difference in willingness to conserve among knowledgeable individuals and their recognition of resource scarcity highlights the significant interactions between socio-economic, cultural, and psychological factors that influence attitudes and behaviors regarding conservation in rural communities. To effectively promote sustainable resource management practices, addressing this challenge requires holistic approaches that take into account socioeconomic context and environmental knowledge. It is probable that people with more knowledge would put competing needs and goals ahead of conservation in favor of other economic or social goals. According to the study, people who traveled farther than 5 km on average harvested more nuts than those who traveled shorter distances. This implies that gathering methods are influenced by the distance traveled to the protected area. People who travel longer distances may need their journeys to be worthwhile; harvesting more nuts will reduce the number of trips required. *Schinziophyton rautanenii* trees may be more accessible to those who live close to protected areas, enabling more regular and plentiful harvesting. Being near protected areas may also increase competition for available resources, which could lead those farther away to harvest more to compensate. Harvesting practices may also be impacted by local laws or agreements with the community regarding resource use.

The studies by Gregory and Kulima [21] show that there are differences in today's consumption compared to the past. In Hwange, men and women reported that collecting *Schinziophyton rautanenii* nuts contributed less to their daily living expenses, indicating differences in the economic benefits of this activity. Kamwi et al. [22]

indicated that the species significantly contributes to food security, which is the opposite of the findings in Hwange district. The research also determined which plant parts were used and how valuable they were. The study in Mozambique and Namibia [21] shows that the people of the Maccosa district use only a few parts, which are fruits and nuts, whereas, according to the Hwange survey, the communities use all parts of the plants.

Market variables that can differ with the grade of nut oil, with the high-priced oil grade having a higher price than food grade, include changing prices and dynamics. These factors can all impact economic contributions. Even though harvesting nuts may not seem like a significant economic contribution, it can nonetheless serve as an additional source of income for households employing various livelihood strategies. Because different plant parts serve a variety of functions, from food to medicinal and commercial uses, the utilization of these parts demonstrates the cultural significance and adaptability of *Schinziophyton rautanenii* in the communities where it is found. In Zambia, *S. rautanenii* is also cultivated and used as a live fence around arable agricultural fields and animal enclosures [23]. The findings in Hwange indicated that, in the agricultural sector, leaves of Manketti are mostly used for mulching, and trees are used for shade for both humans and animals.

5. CONCLUSIONS

Gender-sensitive approaches are essential in environmental education and awareness campaigns, as evidenced by the gender gap in knowledge levels. Although women possess more knowledge about *Schinziophyton rautanenii* than men, gender inequality in access to resources and information must be addressed through targeted interventions. The urgency of conservation efforts to protect *Schinziophyton rautanenii* and its associated ecosystems is underscored by the widespread perception of resource scarcity. While opinions may vary based on individual understanding, a community's acknowledgment of resource scarcity reflects a collective commitment to conservation. Identifying distribution patterns based on soil type and land use highlights the importance of ecological knowledge in guiding resource management and conservation planning. Targeted interventions aimed at preserving and restoring *Schinziophyton rautanenii* habitats can be effectively designed by understanding these patterns. Knowledge levels influence willingness to conserve, with individuals exhibiting lower knowledge sometimes showing higher conservation willingness. The study indicates a positive correlation between knowledge levels and willingness to conserve *Schinziophyton rautanenii*. Interestingly, individuals with limited knowledge demonstrate greater willingness to conserve compared to those with higher knowledge levels. These findings suggest complex socio-economic and behavioral factors influence conservation attitudes and behaviors within the community. Residents who live further away from protected areas tend to harvest more nuts due to their proximity to these areas. The study finds that the quantity of *Schinziophyton rautanenii* nuts harvested is correlated with the distance from protected areas. People who live farther away from protected areas typically harvest more nuts than those who live closer. This implies that resource availability and harvesting methods may be impacted by a location's closeness to protected areas. The study emphasizes how important *Schinziophyton rautanenii* nut harvesting is to the local communities in Hwange District, both socially and economically. People of all ages and genders harvest nuts. This activity supports household incomes and satisfies a range of socio-economic needs. The study's conclusions stress how crucial it is to incorporate community viewpoints, local expertise, and scientific research when developing conservation and sustainable resource management plans. Conservation efforts can effectively address the complex challenges facing *Schinziophyton rautanenii* and its associated ecosystems by understanding how ecological, socio-cultural, and economic factors are interconnected.

6. RECOMMENDATIONS

Develop targeted education and outreach programs to raise awareness about the ecological importance of Schinziophyton rautanenii among individuals with higher knowledge levels. Utilize community-based approaches, such as interactive workshops, field demonstrations, and storytelling sessions, to engage diverse audiences and

promote understanding of conservation issues. Implement incentive-based conservation programs that reward individuals and communities for adopting sustainable harvesting practices and actively participating in conservation initiatives. Offer tangible benefits, such as access to alternative livelihood opportunities, ecotourism revenues, or community development projects, to incentivize conservation actions and behavior change.

Empower local communities to take ownership of conservation efforts by involving them in decision-making processes and resource management activities. Facilitate community-led conservation initiatives that leverage indigenous knowledge, traditional practices, and cultural values to promote sustainable resource use and conservation outcomes. Conduct behavioral insights research to better understand the underlying motivations and decision-making processes driving conservation behaviors among different demographic groups. Tailor communication strategies and messaging to resonate with target audiences, highlighting the socio-economic benefits, cultural significance, and long-term value of conserving *Schinziophyton rautanenii* and its associated ecosystems. Provide capacity-building and training opportunities to equip community members with the skills, knowledge, and resources needed to effectively conserve *Schinziophyton rautanenii* and its habitats.

Offer training in sustainable harvesting techniques, habitat restoration practices, and biodiversity monitoring methods, empowering individuals to become stewards of their natural environment. Advocate for policies and regulations that support community-based conservation initiatives, recognize indigenous rights, and promote sustainable resource management practices. Engage with government agencies, NGOs, and other stakeholders to create an enabling policy environment for conservation and sustainable development in Hwange District, Zimbabwe. By implementing these recommendations, stakeholders can address the complexities of conservation attitudes and behaviors, foster community engagement and participation, and promote the sustainable management of *Schinziophyton rautanenii* and its associated ecosystems in Hwange District, Zimbabwe.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: Conceptual framework, sampling protocols, Ashley Mpofu (AM); Experimental design, report writing, review, Angela Chichinye (AC); Data collection, report writing, Kudzai N Kundishora (KNK); Data collection, report writing, Caleb Dube (CD); Data analysis, Donald Mlambo (DM). All authors have read and agreed to the published version of the manuscript.

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