





Therapeutic uses of *Mimusops zeyheri* Sond., by the Vhavenda Traditional Health Practitioners in the Vhembe Biosphere Reserve, South Africa

Nonhlanhla Prudence Lubisi¹ , Mueletshedzi Manyaga¹, Wilfred Otang Mbeng¹, Salnina Ngoakoana Mokgehle², Luambo Jeffrey Ramarumo^{1*} 

¹School of Biology and Environmental Sciences, Faculty of Agriculture and Natural Sciences, University of Mpumalanga, Private Bag X11283, Nelspruit, 1200, South Africa.

²School of Agricultural Sciences, Faculty of Agriculture and Natural Sciences, University of Mpumalanga, Private Bag X11283, Nelspruit, 1200, South Africa.

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ABSTRACT

Approximately half of traditional medicines worldwide, particularly those possessing the potential to remedy the most challenging ailments, have not yet been comprehensively studied. Within the same context, this study aimed to explore therapeutic uses, preparatory techniques, and administration modes by the Vhavenda traditional health practitioners in the Vhembe Biosphere Reserve, Limpopo Province, South Africa. The required data were sampled using triangulation research techniques, including semi-structured interview questionnaires with the first two arbitrarily selected traditional health practitioners and 19 additional practitioners selected using an exponential non-discriminative snowball sampling method. The results revealed that traditional health practitioners of the region utilize *Mimusops zeyheri* to remedy multiple ailments, including external wounds (RFC = 1; FL = 100%), throat wounds (RFC = 0.8; FL = 80%), ulcers (RFC = 1; FL = 100%), womb cleaning to improve fertility (RFC = 1; FL = 100%), enhancing weight loss (RFC = 0.9; FL = 90%), and the combinations of assorted ailments such as Erectile dysfunctionality, Bilhazia, and Gonorrhoea (RFC = 0.7; FL = 70%). The recent study reported ethnomedicinal uses, preparatory techniques, and modes of administration of *M. zeyheri* by the Vhavenda traditional health practitioners in the Vhembe Biosphere Reserve. The documentation of the medicinal uses of *Mimusops zeyheri* is essential for sustaining the immediate traditional healthcare systems and preserving regional ancient cultural heritage.

INTRODUCTION

Genus *Mimusops* is known to belong to diverse genera of flowering plants [1]. Hamdy *et al.* [1] approximated the number of species distributed within this genus to reach 47. Therefore, only four species among these 47 members of this genus are considered indigenous in Southern African countries [2]. This includes *Mimusops caffra* E.Mey. ex A.DC.,

Mimusops obovata Nees ex Sond., *Mimusops zeyheri* Sond., and *Mimusops obtusifolia* Lam., [1]. In South Africa, *M. caffra* is spread alongside the coastal belt in the KwaZulu Natal and the Eastern Cape region [3], with *M. obovata* widespread across the eastern escarpment of the Limpopo and Mpumalanga provinces through the Kingdom of Eswatini to KwaZulu Natal and stretch towards the Eastern Cape Province [4], while the distribution of *M. obtusifolia* is considered uncertain in South Africa; however, some scholars argued that its distributional range stretches across the northern provinces [5]. The distributional range of *M. zeyheri* is also considered widespread in South Africa, stretching across the northern provinces of Limpopo, Mpumalanga, Gauteng, North-West, and KwaZulu Natal [4]. This plant species is known to have adapted to different

*Corresponding Author

Luambo Jeffrey Ramarumo, School of Biology and Environmental Sciences, Faculty of Agriculture and Natural Sciences, University of Mpumalanga, Private Bag X11283, Nelspruit, 1200, South Africa.
E-mail: Luambo.Ramarumo@ump.ac.za

habitats, including the Tzaneen Sour Bushveld, Sekhukhune Mountain Bushveld, Limpopo Sweet Bushveld Soutpansberg Mountain Bushveld, Waterberg Mountain Bushveld, Makhado Sweet Bushveld [4], but not the least. Different tribal ethnic groups in the northern provinces of South Africa called *M. zeyheri* using distinct vernacular names, which differ from one group to another [4]. As an example, the Afrikaaner vernacular name for *M. zeyheri* is Transvaalmelkhout, whereas its Venda name is Mumbubulu, and therefore, in the Ndebele language, it is called Umbumbulu [4,6]. Therefore, these vernacular names translate to *M. zeyheri*'s distributional range and diverse utilizations in various parts of South Africa. Ramarumo and Maroyi [7] stated that vernacular names for a particular species provide information about its uses and distributional range. Furthermore, it is a mutual understanding that most indigenous local communities do not give names to plants they do not utilize [7].

Due to that, it is, therefore, arguable that those tribes utilize *M. zeyheri* for varied purposes and visa-versa. Scientific evidence suggests that indigenous people from different tribes differ in their knowledge about the utilizations of similar or diverse plant species [8–11]. For example, the study by Mabogo [12] reported that the Vhavenda tribe of South Africa utilizes the *Opuntia ficus-indica* (L.) Mill. 's root to remedy toothache. In contrast, Mbambala *et al.* [13] asserted that the same tribe utilizes the root of a similar species for treating mouth sores and wounds, while Maema *et al.* [14] accentuate that the Bapedi tribe utilizes the same root to remedy sexually transmitted ailments such as Syphilis and Gonorrhoea. Due to this, and since *M. zeyheri* is widespread across various tribal regions in the northern provinces of South Africa, there is no doubt that local people across those tribal communities utilize it for varied purposes. The search for alternative medicines has swiftly increased nationwide and worldwide [15]. This was due to an increase in market value and share of medicinal plants [16], an increasing number of pandemics [17], and the growing number of patients who are rapidly consulting traditional healthcare systems nationwide [18]. According to Mander *et al.* [19], 27 million people countrywide consult traditional health practitioners for their daily immediate healthcare.

However, there are still inadequate numbers of ethnobotanical studies that report on certain medicinal plants, including the utilization of *M. zeyheri* for both medicinal and fruit purposes [20–23], whereas, it contributes to local traditional primary healthcare, but remains not definitively studied [24]. This justifies the utmost need to investigate further ethnomedicinal knowledge associated with *M. zeyheri* by the Vhavenda traditional health practitioners in the Vhembe Biosphere Reserve of the Limpopo Province, South Africa. The study by Ahad *et al.* [25] emphasizes that approximately half of the traditional medicines worldwide, particularly those possessing the potential to remedy most challenging ailments, have not yet been comprehensively studied. Within the same context, this study aimed to explore therapeutic uses, preparatory techniques, and administration of *M. zeyheri* by the Vhavenda traditional health practitioners in the Vhembe Biosphere Reserve, Limpopo Province, South Africa. It is worth noting that no previous studies have evaluated detailed therapeutic usage, preparatory techniques, and administration

of *M. zeyheri* by the Vhavenda traditional health practitioners. The recent study sought to preserve local indigenous medicinal knowledge associated with *M. zeyheri* in the Vhembe region. This study contributes to addressing some issues linked to South Africa's Version 2030 National Development Plan, African Union Priorities incorporated within Agenda 2063, and the United Nations Sustainable Development Goals, particularly the aspects concerning the improvement of life on land and primary health care system [26–29].

MATERIALS AND METHODS

Description of the study sites

This study was conducted in five villages located within the jurisdictions of the Vhembe Biosphere Reserve, namely, Duthuni, Ha-Manyuwa, Khalavha, Tshirezheni, and Tshivhiliqulu Villages (Fig. 1). The five target villages were positioned within the coordinates stretching from 22°54'12.596" to 22°58'22.552" South latitude and 30°13'6.891" to 30°23'36.531" East longitude. The study areas were set within the Soutpansberg Region of the Vhembe Biosphere Reserve in the Limpopo Province, South Africa. Climatically, the study areas are categorized as humid, with the most rainfall in the summer season, elongating from October to April, and the least rain in the winter, extending from May to September [30]. The area received the mean annual rainfall ranges between 755 mm and 798 mm [31], and the typical temperatures are approximated to be running between 18°C during winter and 28°C in the summer season [7,32]. The land use in the study sites incorporates various agricultural activities such as home gardens, orchards, stock farming, tea, and forestry silviculture in both communal and state land.

Geologically, the regional features incorporate the Bushveld Igneous Intracacy, the Soutpansberg's Wylie Poort Geological Formation Group, Kalahari Cratons, Limpopo Belt, Karoo System, and the Archaean Cratons [33–35]. The entire region is considered the centre for botanical endemism and plant diversity refugia in Southern Africa [20,36]. The area is typically a Savanna biome with the vegetation type characterized by a varied and constant mixture of vegetation units, which ranges from the Soutpansberg Mountain Bushveld with territories of Afromatane Forest surrounded by semi-desert scrubland [7,36–38]. The Soutpansberg Mountain Bushveld is dominated by species including *Syzygium legatii* Burt Davy and Greenway, *Diospyros whyteana* (Hiern) P. White, and *Rothmannia capensis* Thunb., [20,36,37,39].

Ethnomedicinal data gathering

Semi-structured questionnaires were used in an interview with two first traditional health practitioners discovered through arbitrary informants section to elicit information regarding the ethnomedicinal uses, preparatory techniques, and administration process in the Vhembe Biosphere Reserve [40–41]. An exponential non-discriminative snowball sampling method was then applied to systematically discover an additional 19 traditional health practitioners to take part in the current study. Furthermore, a total number of 21 traditional health practitioners participated in the recent study. The unwillingness of suggested practitioners in the region

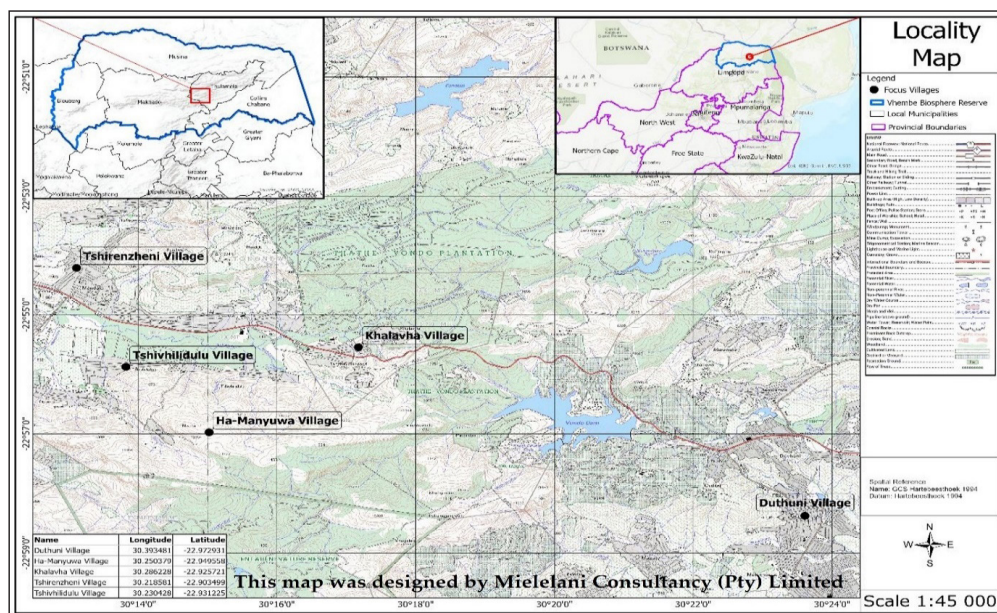


Figure 1. Vicinity map of the study areas.

influenced the small sample size of participants in the recent study. It is worth indicating that 69 suggested traditional health practitioners were visited at their homesteads between June and July 2023; however, only 21 agreed to participate in the recent study. The selected sample size of 21 participants was informed by the number of suggested people who gave the informed consent. This was justified by Crouch and McKenzie [42]; Guest *et al.* [43], Latham [44], and Atyosi *et al.* [41], who suggested that saturations mostly occurred when less than 12 participants were homogeneously selected; however, heterogeneous sample, participants should be at least more than 12. The first two arbitrarily selected traditional health practitioners were purposefully interviewed about the medicinal usage of *M. zeyheri*, and therefore, afterward, requested to suggest any of their colleagues and let them know that the researchers were interested in interviewing them about the medicinal uses of the targeted species. Following the receipt of informed consent, homestead visits were made to traditional health practitioners to enlighten the study's objective, show them the photographs of the targeted species, and then interview them individually in their native Tshivenda language. It should be mentioned that every traditional health practitioner contacted was requested to refer or suggest one or more of their colleagues with similar medicinal expertise until no one was suggested. Then, the suggested practitioners were visited either at their homestead or workspace. This was to grant the flow of information and afford traditional health practitioners their required privacy while sharing their inherited medicinal expertise. Scientific evidence suggests that traditional health practitioners, particularly of the Vhembe Biosphere Reserve, are reserved when sharing their medicinal knowledge and wisdom with other practitioners [40,45,46]. It should also be stated that all the traditional health practitioners interviewed gave their verbal informed consent. Equivalent questions were administered to all traditional health practitioners interviewed to validate

the authenticity of acquired medicinal information. The same validation techniques were also used in the studies by Atyosi *et al.* [41] and Bazzicalupo *et al.* [46]. The following questions were administered to all participants: (a) Do you use *M. zeyheri* for medicinal purposes?; (b) If yes, kindly specify its medicinal uses, preparatory techniques, and dosage administration?; (c) How do you describe yourself in terms of gender?; (d) How old are you?; (e) Tell us about your educational background. When did you start practicing as a traditional health practitioner, and how did you gain such knowledge?

Ethical consideration

Since the current study involves people and their local knowledge linked to the utilization of *M. zeyheri*, the University of Mpumalanga approved the recent study and endorsed it with an ethics reference number: UMP/Lubisi/BSc Hons/2023 before it commences. Furthermore, it is also pivotal to state that all the traditional authorities of the targeted jurisdictions gave the go-ahead in the form of written approval letters of reference numbers, Tshirenzheni: 006/23/P12; Khalavha: 109/05/2023/001; Duthuni: DU16/Res01; Tshivhilidulu: TS10/06/2023 and Ha-Manyuwa: Research/17/06/23 to support the commencement of this study. Before the beginning of the interview sessions, the objectives of the recent study were clearly explained to all the informants involved, and they all verbally consented. Traditional health practitioners were made aware that practitioners in the current study were completely voluntary and that the information they provided would be utilized for academic research purposes, including writing for publication and teaching purposes. Traditional health practitioners were also advised of their autonomy rights, comprising the freedom to discontinue participation at any given moment, with or without warning or by handing a written letter of acquittal to the researcher. Therefore, they were informed that there should be no repercussions for doing so.

Data analysis

Collected data were subjected to version 16.0.16026.20146 Excel program of Microsoft Office 365. Subsequently, the recent study was ethnobotanical, and data analysis was executed through expressive statistical analysis consisting of frequency, Fidelity level of percentage (FL%), and relative frequency of citations (RFCs) [41]. The FL (%) is determined using this formula:

$$FL\% = \frac{N_p}{N} \times 100, [41]$$

N_p is the number of traditional health practitioners cited for using a particular medicinal taxon for treating specific ailments, and N is the absolute total of all recruited traditional health practitioners familiar with the therapeutic uses of that taxon. The RFC is evaluated using the formula:

$$RFC = \frac{FC}{N} \quad (0 < RFC < 1), [41]$$

FC is the number of traditional health practitioners who cited the medicinal uses of a taxon, and N is the absolute total of recruited traditional health practitioners familiar with that taxon's therapeutic benefits.

RESULTS

Figure 2 classifies traditional health practitioners' socio-demographic details. A total of 21 traditional health practitioners from varying demographic backgrounds participated in the recent study, including those from different age groups, educational levels, genders, and marital statuses. Among the participants, females constituted 57.9%, while male respondents constituted 42.1%. A total of 57.1% of all the traditional health practitioners who participated were married,

whereas 33.3% of them were widowed, and only 9.5% of them were divorced. Their age categories are varied, with the most participants aged between 69 > < 86 years old (47.6%), tailed by those aged 52 > < 69 years old (33.3%), and the least were those aged between 86 > years old (19.1%). More than 80% of all the traditional health practitioners who took part in this study have at least acquired formal education, either primary (47.6%), secondary (28.6%), or tertiary (4.8%).

Moreover, 52.4% of them claimed that most of their medicinal plant knowledge originated as dreams while sleeping or visions (while awake). In comparison, others (28.6%) claimed that the knowledge they possessed was their family knowledge passed from one generation to another through the word of months, and therefore, 19.1% indicated that they received training to become traditional health practitioners.

According to the traditional health practitioners who had undergone traditional healing initiations, most of their medicinal knowledge originates through ancestral visits, dreams, and visions (personal communication with the traditional health practitioners). All the traditional health practitioners who participated in the recent study have more than 15 years of experience in traditional herbal medicines. More than 52% possessed herbal medicinal healing experience ranging between 20 > < 25 years, followed by those with greater than 25 years of experience, and the least 14.3% possessed 15 > < 20 years of practicing experience.

Table 1 illustrates the therapeutic uses, preparational methods, and administration modes of *M. zeyheri* by the Vhenvenda traditional health practitioners of the Vhembe Biosphere Reserve, Limpopo province, South Africa. This study demonstrates that practitioners across the studied sites utilize *M. zeyheri* to remedy multiple ailments. A total of six categorized ailments were remedied using *M. zeyheri*. This includes external wounds, throat wounds, ulcers, womb cleaning to improve fertility, Enhancing weight loss, and

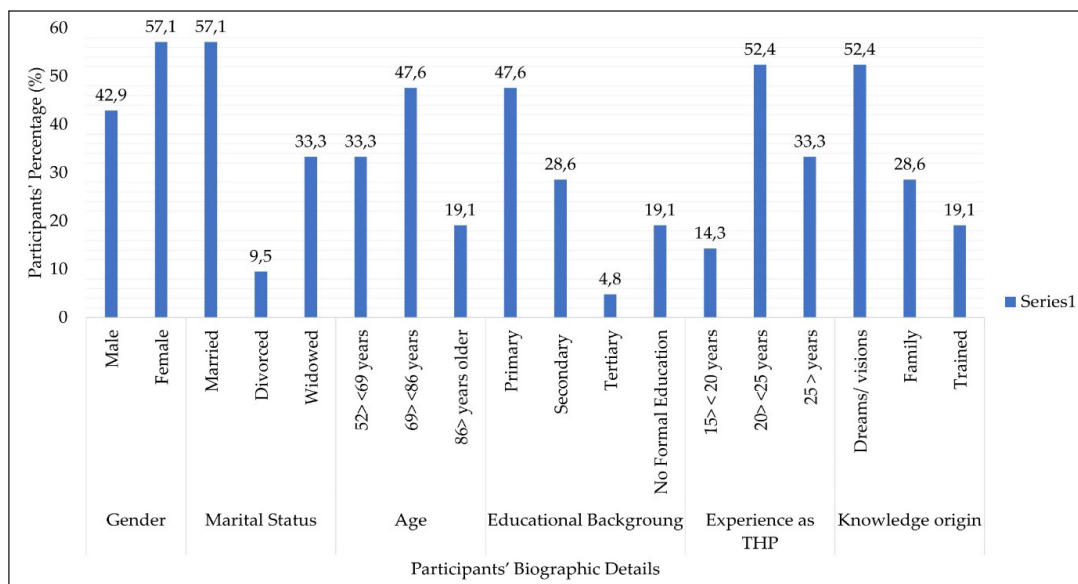


Figure 2. Traditional health practitioner's socio-demographic information.

Table 1. Therapeutic uses, preparation method, and administration of *M. zeyheri* Sond., (Keys: n, number of traditional health practitioners participated; and Frequency; RFC; and FL (%), fidelity level of percentage).

Treated ailments	Parts	Preparation method	Administration	n = 21	RFC	FL(%)
External wounds.	Stem bark	The Stem barks of <i>M. zeyheri</i> and <i>Zanthoxylu davyi</i> are mixed and ground into fine powder.	Fine powder is administered or applied to the affected wound using a bare hand.	21	1	100
Throat wounds.	Stem bark	A combination of <i>M. zeyheri</i> and <i>Zanthoxylu davyi</i> stem bark is ground to become a well-fine powder.	The powder is then orally taken with a glass of water to remedy throat wounds.	17	0,8	80
Ulcer.	Stem bark	Decoction water and stem bark.	The decoction is then taken orally to remedy ulcers (three times a day, in the morning, noon, and evening before eating).	21	1	100
Womb cleaning to improve fertility.	Stem bark	Infusion of a soaked combination of <i>M. zeyheri</i> stem bark, chopped Cucumis Africana tuber, and warbugia salutaris barks.	The infusion is taken orally twice a day (in the morning and evening after eating) to improve women's fertility.	21	1	100
Enhancing weight loss.	Fruits	Decoction of grounded dried riped fruits (rough powder) is combined with dried leaves of <i>Moringa olifera</i> .	The decoction is then taken orally as tea and remedy to enhance weight loss (Taken twice a day, morning and evening, before eating).	18	0,9	90
Erectile dysfunction, Bilhazia, and Gonorrhoea.	Root bark	Decoction of <i>M. zeyheri</i> root bark, in combination with root bark of <i>Elephantorrhiza elephantina</i> , <i>Securidaca longependunculata</i> , <i>Albizia versicolor</i> , and <i>Annona senegalensis</i> .	The decoction is then taken orally to remedy sexual ailments (Taken twice a day, morning and evening, after eating).	14	0,7	70

the combinations of associated ailments such as Erectile dysfunctionality, Bilhazia, and Gonorrhoea. However, the study findings revealed that traditional health practitioners of the region, for instance, in more than 80% of their preparation of *M. zeyheri* for medicinal purposes, they combined it with other medicinal plants. For instance, when prepared for remedying either external (RFC = 1; FL = 100%) or throat (RFC = 0.8; FL = 80%) wounds, it is mixed with grounded stem barks of *Zanthoxylu davyi*, while prepared for womb cleaning (RFC = 1; FL = 100%) and weight loss (RFC = 0.9; FL = 90%) was mixed with *Warbugia salutaris* and *Moringa olifera*.

Furthermore, when prepared for assorted ailments such as Erectile dysfunction, Bilhazia, and Gonorrhoea (RFC = 0.7; FL = 70%), it is combined with multiple medicinal plants, including the root barks of *Elephantorrhiza elephantina*, *Securidaca longependunculata*, *Albizia versicolor*, and *Annona senegalensis*. The findings of the recent study show some commonality among the participated traditional health practitioners concerning medicinal uses, preparations, and administration of *M. zeyheri*, particularly for remedying ailments including external wounds, ulcers, and womb cleaning for improving fertility, both with RFC value of 1 and the fidelity level of percentage 100.

DISCUSSION

The number of respondents who participated in this study is aligned with the population demography of different genders in the Vhembe region [47]. Unequal participation of correspondents was also recorded by several ethnobotanical studies across the Vhembe Biosphere Reserve [48–50].

Furthermore, Scherrer *et al.* [51] stated that women express more interest in practicing traditional herbal healing than their male counterparts. The data collection methods influenced the varied age categories of respondents. However, such finding corroborates the widely accepted scientific notion stating that indigenous herbal medicinal knowledge is primarily rooted amongst older people [52–55]. The educational status of respondents within the study areas concurs with the results of the 2022 census in the region, as illustrated on the Statistics South Africa website [56].

The fact that traditional health practitioners stated that most of the knowledge originated through ancestral visits, dreams, and visions differs from the findings reported by Ramarumo *et al.* [57], who articulated that most indigenous healing knowledge is family-based, transmitted by parents or relatives to their children. According to African cultural beliefs, ancestors are departed family members or relatives [58]. Therefore, it is within this context that, although the findings of this study regarding the origin of participants healing knowledge differs from those of previous studies, it is still arguable that such difference is too slim or there is no difference at all since ancestors are also known as the departed relatives family members [58]. The experiences of practitioners demonstrate the wealth of traditional therapeutic knowledge and expertise associated with the use of *M. zeyheri* for remedying multiple ailments that they have accumulated over these years.

The use of *M. zeyheri* in combination with other medicinal plants was not unusual in traditional African healthcare systems, mainly in the Vhembe region, since previous studies

observed comparable findings [59–60]. This was an ancient cultural practice by Vhavanḁa traditional health practitioners to increase the efficacy of prepared herbal medications. Such findings concur with those from various studies in the equivalent region [57,61,62]. According to Wang *et al.* [63], the therapeutic results obtained from combinations of multiple herbal medicinal plants are more efficient. This demonstrates richness in diagnostic and ethnopharmacological knowledge amongst the Vhavanḁa traditional health practitioners. Jimenez-Fernandez *et al.* [64] reported that most traditional health practitioners from similar tribes had the same medicinal knowledge about specific plant species and used similar methodological techniques to prepare and remedy multiple ailments. In addition, traditional health practitioners of the region were revealed to be remedying or treating multiple ailments similarly because they share similar medicinal knowledge. Therefore, the research method utilized in this study allows participants only to suggest their counterparts with whom they shared similar knowledge, and therefore, comparable findings were reported by Mashile *et al.* [65].

CONCLUSION

The recent study reported on therapeutic uses of *M. zeyheri* by the Vhavanḁa traditional health practitioners in the Vhembe Biosphere Reserve. No study has previously specified ethnomedicinal usage or documented preparatory techniques and administration modes associated with *M. zeyheri* by the Vhavanḁa traditional health practitioners. Indeed, the Vhavanḁa practitioners utilize *M. zeyheri* for multiple medicinal benefits. The results of this study cemented the value of traditional healthcare systems in providing immediate healthcare to rural and marginalized communities across the region and countrywide. The recent study contributed to the record of medicinal plants used for remedying distinctive ailments by the Vhavanḁa traditional health practitioners in the Vhembe Biosphere Reserve and nationwide. Even though the research technique used in this study validates the medicinal utilizations of the target plant species, it is worth recommending that the assessment of active biological compounds and pharmacological properties of *M. zeyheri* could enhance plant-derived drugs. The documentation of the ethnomedicinal uses of *M. zeyheri* is essential for sustaining the immediate traditional healthcare systems and preserving regional ancient cultural heritage. In this regard, it is arguable that the recent study contributes to the knowledge bodies encompassing social-ecological systems, ethnobotany, ethnomedicine, anthropology, and sustainability studies.

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AUTHOR CONTRIBUTIONS

All authors contributed substantially to conception and design, while NPL, MM, and LJR conducted fieldwork, data analysis, and interpretation. NPL, drafted the article, while

SNM, WOM, and LJR, supervised and revised it critically for important intellectual content. All the authors agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work. All the authors are eligible to be authors as per the International Committee of Medical Journal Editors (ICMJE) requirements/guidelines.

CONFLICTS OF INTEREST

The authors report no financial or any other conflicts of interest in this work.

ETHICAL APPROVALS

Ethical approval details are given in 'Material and Methods section'.

DATA AVAILABILITY

All data generated and analyzed are included in this research article.

PUBLISHER'S NOTE

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USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declares that they have not used artificial intelligence (AI)-tools for writing and editing of the manuscript, and no images were manipulated using AI.

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