Medicinal knowledge and ethnopharmacological applications of *Matricaria pubescens* (Desf.) Sch.Bip in the Draa-tafilalet region, Morocco

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Research

Abstract

Background: *Matricaria pubescens* is widely recognized for its therapeutic properties, however, detailed ethnobotanical information about its use in Morocco is still scarce. This study aims to document the traditional medicinal uses of *M. pubescens* in the Draa-Tafilalet region and to evaluate its importance using ethnobotanical indices.

Methods: A field survey was conducted in 2024 among 150 herbalists and traditional practitioners across two provinces of the Draa-Tafilalet region, southeastern Morocco. Data were collected through structured interviews and analyzed using key ethnobotanical parameters, including medicinal use value (UV), informant agreement ratio (IAR), and fidelity level (FL). Descriptive statistics were applied to determine the frequency of plant use, preparation methods, and the most commonly utilized plant parts.

Results: The study revealed that *M. pubescens* is primarily used for treating digestive disorders (80.67%), respiratory diseases (58%), and genitourinary conditions (48%). The plant is frequently administered in combination with other medicinal plants (72.67%), with aerial parts (79.33%) and leaves (40.67%) being the most commonly used plant components. The dried form (59.33%) is preferred, and decoction (82%) is the predominant preparation method. Ethnobotanical indices showed a medicinal use value (UV) of 1.77, informant agreement ratio (IAR) ranging from 0.98 to 0.77, and a fidelity level (FL) varying between 34.08% and 4.79%, reflecting the high consensus on its therapeutic potential.

Conclusions: This study highlights the widespread traditional use of *M. pubescens* in Moroccan ethnomedicine, particularly for digestive, respiratory, and genitourinary ailments. The high informant agreement and medicinal use value reinforce the plant's ethnopharmacological relevance.

Keywords: Ethnobotany, *Matricaria pubescens*, Medicinal plants, Traditional knowledge, Draa-Tafilalet, Morocco, Herbal medicine.

Background

Medicinal plants have been used for millennia to treat a wide range of ailments, long before the advent of synthetic pharmaceuticals (Davis & Choisy 2024). Today, they continue to play a vital role in contemporary medicine, particularly in regions where access to modern healthcare is limited (Zhang 2015). According to the World Health Organization (WHO), approximately 80% of the population in developing countries relies on traditional medicine for their primary healthcare needs (WHO 2013). Despite the extensive exploration of many plant-based substances in modern pharmacology (Najmi et al. 2022, Handa et al. 2006), numerous medicinal plants remain understudied from a scientific perspective.

Ethnopharmacological studies are essential for deepening our understanding of medicinal plants and their therapeutic applications (Süntar 2020). By documenting and analyzing traditional medicinal practices, particularly in North Africa as described by Sofowora (2010), ethnopharmacological studies provide a foundation for validating indigenous knowledge through clinical trials and scientific research (Muthu *et al*. 2006). Among the many plants that warrant further investigation is *Matricaria pubescens*, a member of the Asteraceae family (Elhasnaoui *et al*. 2024). This plant is widely used in traditional medicine across Morocco, Algeria, and other regions of the Northern Sahara for treating conditions such as rheumatic diseases, gastric ulcers, dysmenorrhea, fever, and skin inflammations (Telli *et al*. 2015, Hammich & Maiza 2006, Maiza *et al*. 1996).

Experimental studies have highlighted the pharmacological potential of *M. pubescens*, both as a direct therapeutic agent and as a source of bioactive compounds such as quercetin, kaempferol, chamazulene, α-bisabolol, and pinene (Chenna et al. 2024, Metrouh-Amir *et al*. 2024, Benmoussa *et al*. 2023, Ignatiadou *et al*. 2022, Kherraz *et al*. 2019). However, despite these promising results, further research is needed to fully understand its mechanisms of action, clinical efficacy, and potential applications in evidence-based medicine.

This study provides an in-depth exploration of the traditional knowledge related to *M. pubescens* in the Draa-Tafilalet region of Southeastern Morocco, particularly in the provinces of Errachidia and Zagora. By documenting its traditional uses, the study aims to preserve valuable ethnobotanical knowledge and lay the groundwork for future pharmacological and clinical investigations.

Materials and Methods

Study area

Occupying 12.5% of Morocco's total land area and encompassing 46% of the country's oasis zones, the Draa-Tafilalet region spans an impressive 88,836 km². It is bordered to the north by the Fès-Meknès and Béni Mellal-Khénifra regions, to the east by the Oriental region, to the west by Marrakech-Safi and Souss-Massa, and to the south and oriental with Algeria.

According to the latest census, the region is home to over 1,655,623 residents (HCP 2024). Its geographical location in the pre-Saharan zone gives it a distinctive arid, sub-desert climate. Temperature fluctuations range from 2°C in winter to 45°C in summer, with an annual average of 20°C. Rainfall varies considerably across the region, from 60 mm in the south to 250 mm in the far north (HCP 2014). This study focuses on two sites within the Draa-Tafilalet region (Table 1), Errachidia and Zagora.

Table 1. Demographic and geographic characteristics of the Two states studied in the Draa Tafilalet region (Errachidia and Zagora).

Study sites	Area (km²)	Inhabitants
Errachidia	42 852	427572
Zagora	20121	285545

Data Collection

The ethnopharmacological survey was conducted over a period of three months (April, May, and June 2024) in two provinces of the Draa-Tafilalet region, southeastern Morocco. A total of 150 participants were interviewed, including traditional healers and herbal medicine vendors operating in the provinces of Errachidia (85) and Zagora (65).
A structured survey form was developed for data collection, comprising the following sections:

a) Respondent Information
• Age
• Gender
• Education level
• Sources of knowledge

b) Plant Information
• Plant parts or organs used
• State of use (fresh, dried, etc.)
• Preparation methods
• Plant combinations
•Diseases or conditions treated

Data Analysis

Fidelity Level

The Fidelity Level index (FL) was used to assess the therapeutic potential of the plant based on the proportion of informants who reported its use for a specific disease category. FL was calculated using the following formula:

$$FL (\%) = (SF/TF) \times 100 \text{ (Del Rosario Jacobo-Salcedo } et\ al. \text{ 2011)}$$

Where :
SF: Frequency of citations for a given species in the treatment of a specific disease.
TF: Total number of citations for that species.

Medical Use Value

The medical use value (UVs) was calculated based on the total number of medicinal uses cited for the species (Uis) and the total number of informants (ns). The formula used is:

$$UVs=\sum Uis/ \ ns \text{ (Oliver \& Alwyn 1993)}$$

Index of Agreement on Remedies

The index of agreement on remedies (IAR) represents the consensus among traditional healers regarding the medicinal use of a plant. The IAR value was determined using the following formula:

$$IAR=(Nr-Na) / (Nr-1) \text{ (Mutheeswaran } et\ al. \text{ 2011)}$$

Where:
Nr: Total number of use citations for the species within a disease category.
Na: Total number of specific ailments (subcategories) mentioned within that disease category.
The IAR value for a given medicinal species ranges between:
0: When the number of diseases treated equals the number of citations recorded.
1: When all informants agree on the use of the species for a specific disease.

Results

Socio-Demographic Data

This ethnopharmacological survey involved interviews with 150 herbalists and medicinal plant vendors. Among the participants, 12 women (8%) and 138 men (92%), resulting in a female-to-male ratio of 0.087 (Figure 1A). The educational background of the respondents, as illustrated in Figure 2B, revealed that 51% had a primary level of education, while 39% had completed secondary education. Illiterate participants accounted for 9%, and only 3% held university degrees. The age distribution of the herbalists showed that the most represented group was 40 to 49 years (39%), followed by those aged 30 to 39 years (29%). Other age groups included 50 to 59 years (15%), 20 to 29 years (9%), and individuals aged 60 years and older (6%) (Figure 1C). When asked about the source of their knowledge on medicinal plants and traditional practices, the majority of respondents (54.6%) reported learning from family members. In contrast, 37.3% acquired their expertise from other herbalists, while 8% relied on documented sources such as books, internet, or other media to enhance their understanding of phytotherapy (Figure 1D). In terms of professional experience, 39.33% of the herbalists had been practicing

for 15 to 25 years, followed by those with 25 to 35 years of experience (22.67%). The remaining respondents were distributed across the following categories: 5 to 15 years (15.50%), more than 35 years (10.67%), and less than 5 years of experience (5%) (Figure 1E).
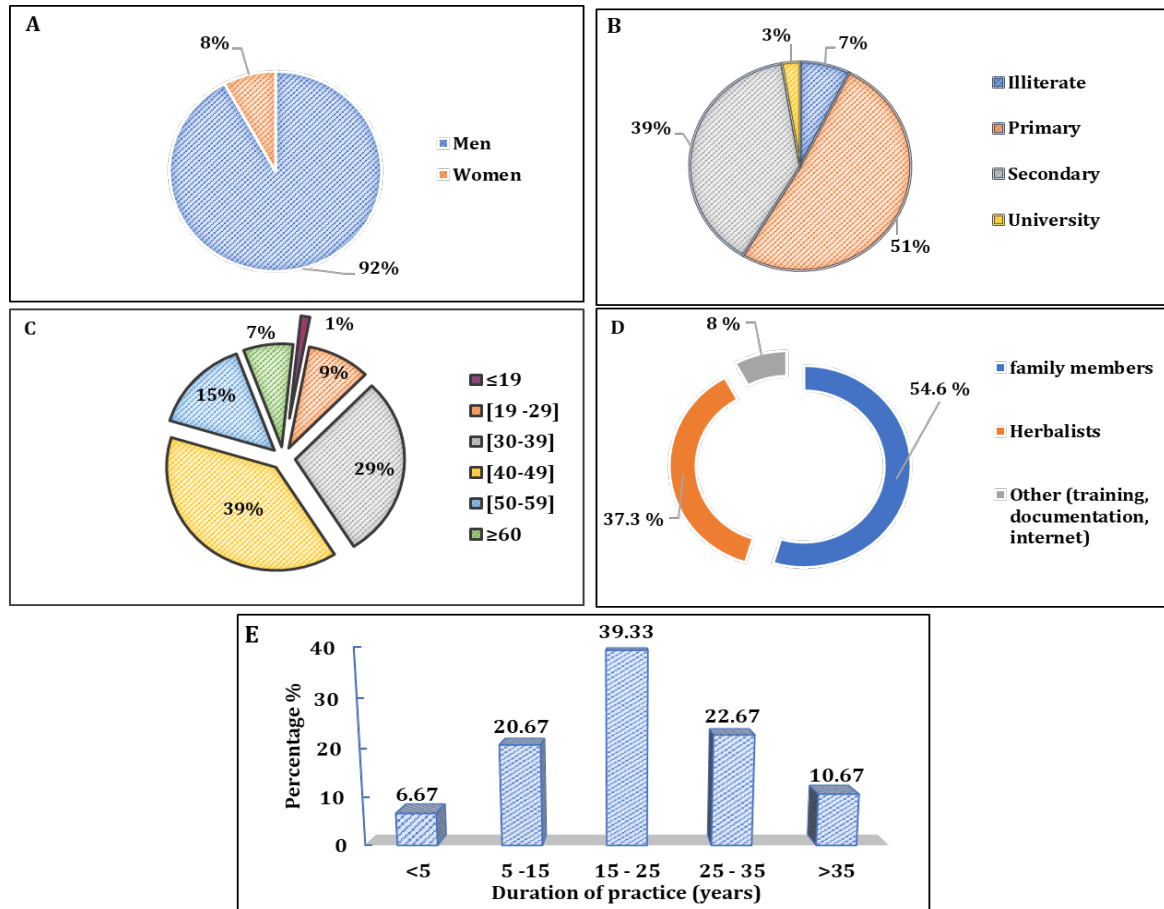

Figure 1. Socio-demographic characteristics of herbalists (n = 150): (A) gender, (B) education level, (C) age groups (years), (D) source of knowledge, and (E) duration of practice (years).

Floristic Analysis
Used Parts and Condition of Use
The data presented in Figure 2A reveal that respondents predominantly prefer the aerial parts of *M. pubescens* (79.33%) for preparing remedies, followed by the leaves (40.67%) and the stem (29.33%). Additionally, 16% of the surveyed herbalists reported using the entire plant, while other plant parts were less frequently utilized.

As shown in Figure 2B, 59% of herbalists and sellers of *M. pubescens* prefer using the plant in its dried form. In contrast, 15.33% of participants favour its fresh state, while 25.33% use the plant in both dried and fresh forms.

Methods of Preparation
Figure 2C illustrates the various preparation methods cited by the surveyed herbalists. The most frequently mentioned methods were decoction (123 citations) and infusion (96 citations), followed by maceration and powder, with 51 and 45 citations, respectively. Other preparation methods were less commonly used in the formulation of remedies.

Plant Mixtures
This study found that *M. pubescens* is frequently used in combination with other plants or liquids (72.67%), while 27.33% of the surveyed herbalists reported using the plant alone in the preparation of remedies (Figure 2D).
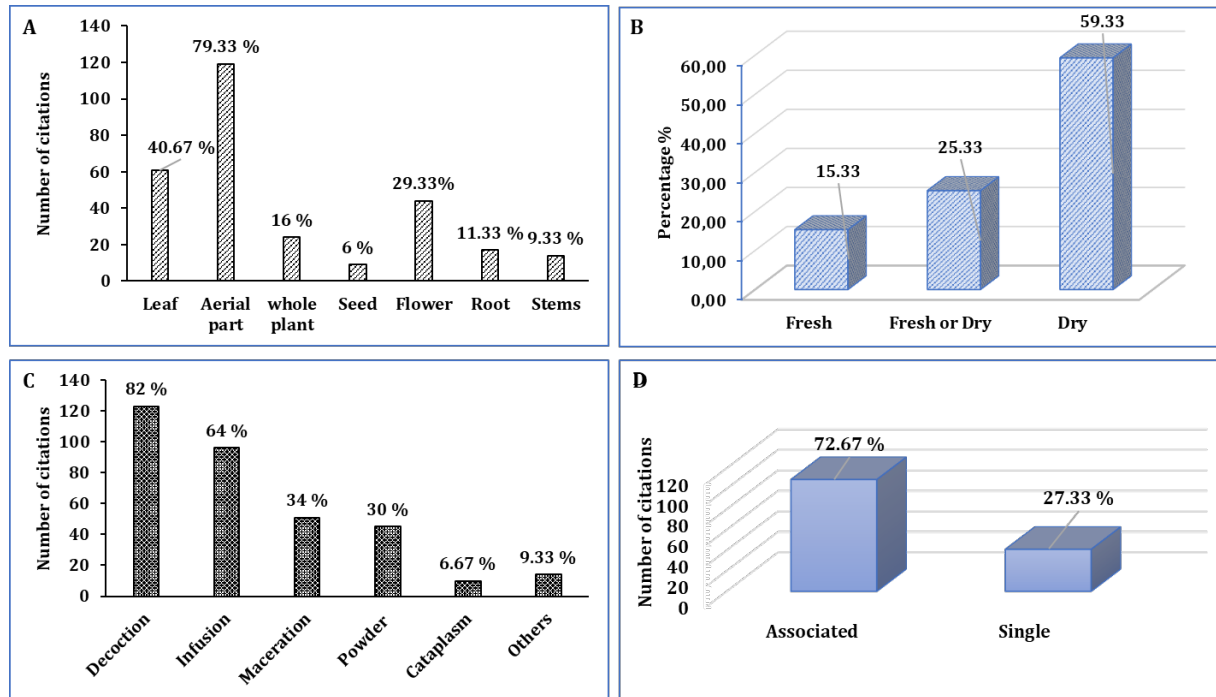
Figure 2. Ethnobotanical data: used parts (A), state of the plant (B), method of preparation (C), and plant mixture (D)

Diseases treated

The results, as illustrated in Figure 4, indicate that *M. pubescens* is used to treat a wide range of human health conditions. Among the surveyed herbalists, 80.67% recommend this plant for the treatment of gastrointestinal disorders, making it the most frequently cited application. This is followed by its use for respiratory system ailments (58%) and urogenital system disorders (48%). In contrast, a smaller proportion of herbalists in the study area advocate the use of *M. pubescens* for treating renal diseases, rheumatic conditions, and other illnesses.
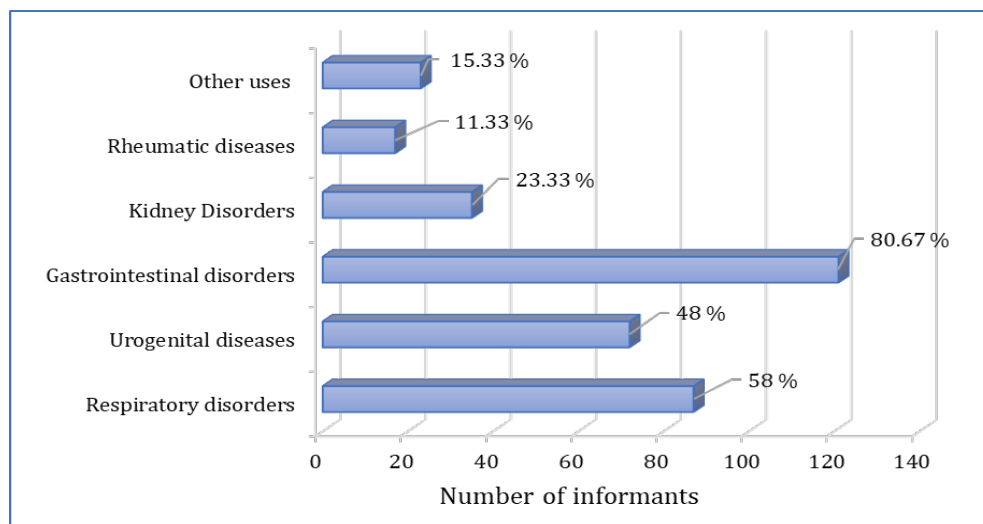

Figure 3. Ailments treated with *M. pubescens* according to Traditional Knowledge

Analysis of Ethnobotanical Indices

The results presented in Table 2 reveal that UVs of *M. pubescens* among the surveyed population is particularly high, reaching 1.77. This value underscores the significance of the plant among herbalists, reflecting the frequency with which it is recommended and used to treat various categories of diseases. This highlights its importance in traditional pharmacopoeia. The IAR values, ranging between 0.98 and 0.77, indicate a strong consensus among herbalists in the study area regarding the use of *M. pubescens* for treating specific ailments and disorders. These results demonstrate that the surveyed herbalists share similar knowledge about the traditional use of this species in local medicine.

Regarding the FL, the findings show that gastrointestinal disorders have the highest FL value (34.08%), followed by respiratory system ailments with an FL of 24.51%. Urogenital and renal disorders have a FL values of 20.28% and 9.86%, respectively. The remaining conditions mentioned exhibit very low FL values.

Table 2. Measurement of ethnobotanical indices (UVs, IAR, and FL) for *M. pubescens*.

Disorders categories	Subcategories of Disorders	IAR	FL (%)	UVs
Respiratory disorders	Asthma	0.97	24.51	1.77
	Influenza			
	Cough			
	Common cold			
Urogenital diseases	Dysmenorrhea	0.93	20.28	
	Hemorrhoids			
	Menstrual pain			
	Prostate			
	Cystitis			
	Urinary incontinence			
Gastrointestinal disorders	Cholelithiasis	0.98	34.08	
	Antihyperglycemic			
	Metabolic conditions			
Kidney Disorders	Kidney pain	0.94	9.86	
	Gallstones			
	Nephritis			
Rheumatic diseases	Muscle Soreness	0.81	4.79	
	Rheumatism			
	Osteoarticular conditions			
	Dermatoses			
Others	Scorpion stings	0.77	6.48	
	Eye diseases			
	Toothache			
	Fever			
	Allergy			
	Teething ailments			

IAR: Index of Agreement on Remedies, UVs: Medical Use Value, FL: Fidelity Level

Discussion

The present ethnobotanical survey highlights the significant role of *Matricaria pubescens* in traditional medicine within the Drâa-Tafilalet region of southeastern Morocco. This study revealed a predominance of male herbalists in the trade of medicinal plants, a finding consistent with previous studies (Elhasnaoui *et al*. 2024, Nadjette 2022, Dasylva 2001). The significant presence of older individuals in this field is of major importance for the transmission and preservation of traditional medicinal knowledge. Over 60% of the herbalists surveyed were over the age of 40, and their extensive experience and accumulated wisdom play a key role in maintaining the effectiveness of ancestral healing practices within the community. These observations align with the earlier works of Ben Akka *et al*. (2017) and the studies of El Hilah *et al*. (2015). Furthermore, this relationship is supported by our data on professional experience, which shows that 72.76% of the herbalists have been practicing for more than fifteen years. The aerial parts of *M. pubescens*, particularly the leaves, are the most recommended by herbalists for preparing remedies. These findings are consistent with results reported in other studies (Jdaidi & Hasnaoui 2016, Ambe *et al*. 2015). The frequent use of leaves can be attributed to their high availability, ease of harvesting, and simplicity in preparation. Additionally, leaves are the primary site of photochemical reactions, making them the main location for the biosynthesis and storage of secondary metabolites. This characteristic explains their high content of active compounds (Bahassan *et al*. 2014).

Decoction is the most commonly used method among the herbalists surveyed in this study. This preference is often attributed to its simplicity and widespread application in remedy preparation by the local population. Moreover, this technique allows for more efficient extraction of active compounds from plants. It is also well-suited for extracting delicate plant parts, as the plant material can be easily boiled in water (Abdurhman 2010, Ramana 2008). The majority of the surveyed herbalists recommend using *M. pubescens* in combination with other plants or substances. These findings align with studies conducted in Morocco and Algeria, which report that *M. pubescens* is often combined with other plant species, as well as

with tea and animal fat (Moussa *et al*. 2020, Cherif *et al*. 2017, Djellouli *et al*. 2013, Ghourri *et al*. 2012). *M. pubescens* occupies a prominent place in the Moroccan traditional pharmacopoeia, particularly due to its use in the preparation of remedies targeting a wide spectrum of ailments affecting vital systems, including the digestive, respiratory, and urinary tracts. Its importance in traditional medicine is not limited to southeastern Morocco but extends across the African continent. For instance, ethnobotanical surveys conducted in the Algerian wilayas of Ouargla and Ghardaïa reported its traditional use in managing diabetes (Djellouli et al. 2013; Telli et al. 2016), while other studies highlighted its application in the treatment of respiratory disorders, hemorrhoids, and rheumatism (Ghourri et al. 2012; Elhasnaoui et al. 2024). Moreover, *M. pubescens* is traditionally employed to alleviate a diverse array of health conditions, including fever, urogenital and osteoarticular disorders, dermatological issues, cardiovascular diseases, glandular and metabolic dysfunctions, childhood illnesses, neurological disturbances, and even scorpion envenomation (Moussa et al. 2011). These diverse indications strongly support its ethnomedical value and therapeutic versatility. The efficacy of *M. pubescens* is likely linked to its rich phytochemical composition, notably in flavonoids, sesquiterpene lactones, phenolic acids, and essential oils. These bioactive compounds are well-documented for their antioxidant, anti-inflammatory, antimicrobial, and spasmolytic properties, which may underlie many of the therapeutic uses observed in traditional contexts (Ignatiadou *et al*. 2022, Amssayef *et al*. 2021, Makhloufi *et al*. 2015, Gherboudj *et al*. 2012, Boutaghane *et al*. 2011). However, despite its wide-ranging applications, the phytochemical profile of *M. pubescens* remains underexplored compared to other members of the Asteraceae family. Comprehensive phytochemical screening and metabolomic studies are therefore essential to identify its key secondary metabolites and associate them with specific biological effects. Such investigations could not only substantiate traditional claims but also facilitate the discovery of novel pharmacologically active molecules. Given its strong ethnobotanical relevance, *M. pubescens* warrants further in-depth pharmacological and clinical evaluation. Experimental studies focusing on its antimicrobial, anti-inflammatory, and other therapeutic potentials are crucial to confirm its efficacy and ensure its safety. Additionally, clinical trials are needed to assess its pharmacokinetics, toxicity profile, and potential interactions with conventional therapies. Bridging traditional knowledge with modern biomedical research could ultimately lead to the sustainable development and medical valorization of this culturally and therapeutically significant species.

Conclusion

This study provides a comprehensive ethnobotanical assessment of *Matricaria pubescens*, reinforcing its importance in traditional medicine for treating various ailments. The high informant agreement and medicinal use values highlight the reliability of its therapeutic applications. However, future research should integrate phytochemical characterization and pharmacological validation to support its incorporation into modern medicine while ensuring its sustainable use and conservation in the Draa-Tafilalet region.

Declarations

List of abbreviations: IAR: Index of Agreement on Remedies, UVs: Medical Use Value, FL: Fidelity Level
Ethical Approval: All participants provided oral prior informed consent.
Consent to Participate: Not applicable.
Consent to Publish: Not applicable
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Authors Contributions: AEH and IJ: Methodology, investigation, writing, participation in surveys, development of the questionnaire, identifying plant species and data acquisition. AH and NL: Conceptualization, critical review, editing, and approval of the final version.

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