Ethnomedicinal study of medicinal plants used for treatment of urinary tract infections in Mara region, Tanzania

David Sylvester Kacholi, Mary Zacharia Charwi and Neema Gideon Mogha

Correspondence

David Sylvester Kacholi[1*], Mary Zacharia Charwi[2] and Neema Gideon Mogha[1]

[1]Department of Biological Sciences, Dar es Salaam University College of Education (DUCE), University of Dar es Salaam (UDSM), P. O. Box 2329 Dar es Salaam, Tanzania.
[2]Department of Languages and Literature, Dar es Salaam University College of Education (DUCE), University of Dar es Salaam (UDSM), P. O. Box 2329 Dar es Salaam, Tanzania.

[*]Corresponding Author: kacholi78@gmail.com; david.kacholi@udsm.ac.tz

Ethnobotany Research and Applications 26:30 (2023) - http://dx.doi.org/10.32859/era.26.30.1-13
Manuscript received: 28/07/2023 – Revised manuscript received: 03/09/2023 - Published: 03/09/2023

Research

Abstract

Background: Medicinal plants (MPs) are a valuable inheritance for humanity, especially in most rural communities that rely on them for their primary healthcare needs. This study aims to document MPs used by Kuria Traditional Healers (KTH) in managing Urinary Tract Infections (UTIs) in Mara region, Tanzania.

Methods: This study was conducted in Tarime and Serengeti districts in Mara Region, Tanzania. Ethnobotanical information were collected using semi-structured interviews and field walks with 20 KTH from July 2021 to February 2022. The study focused on MPs' names, parts used, preparation, and administration of remedies. Descriptive statistics and inferential indices were performed to analyze the data, and conservation statuses of the recorded MPs were retrieved from IUCN RedList online database.

Results: A total of twenty MPs belonging to 8 families were documented. The families with the higher number of MPs were Asteraceae (31.6%), followed by Lamiaceae (26.3%) and Fabaceae (15.8%). Most plants were shrubs (53%) and herbs (37%). Leaves (53%) and roots (29%) were the most preferred MPs parts for remedy formulation. Decoction (55%) and oral route (100%) were the most cited preparation and application of remedies, respectively. Among the recorded MPs, 35% fall within the least concern category in the IUCN database. Gender, age, education level, and experience significantly ($p < 0.05$) affected traditional medicinal knowledge.

Conclusion: The study discloses that the KTHs have rich knowledge of MPs used to treat UTIs. Their expertise on MPs should be validated with phytochemical and pharmacological studies, and their knowledge and practices must be conserved for future generations.

Keywords: Ethnomedicine, indigenous healers, infectious diseases, remedies, traditional medicines, UTIs

Background

Globally, urinary tract infections (UTIs) are one of the common bacterial infections affecting different parts of the urinary system of both men and women. Urinary Tract Infections (UTIs) are the most common casualty infections, with 50 - 60% prevalence in adult women (Medina & Castillo-Pino 2019), the leading cause of morbidity in the general population and the second most common infectious disease after respiratory infections (Addis *et al.* 2021). In Africa, the prevalence of UTIs is significantly high for women than men; for instance, in Nigeria, the prevalence of UTIs for women is 42.8%, while for men is 10.2% (Oladeinde *et al.* 2011). In Tanzania, the prevalence of UTI for women is 58.5% (Sekharan *et al.* 2017). Women are more pretentious than men due to their anatomical structures, sexual activities, use of some birth control measures, and menopause (Dougnon *et al.* 2020). Moreover, pregnant women, the elderly, or patients with spinal cord injuries, catheters, and diabetes are at high risk (Magliano *et al.* 2012, Shaikh *et al.* 2008).

Escherichia coli is the predominant pathogen responsible for UTIs. It is commonly found in the gastrointestinal tract and constitutes up to 80 - 85% (Kostakioti *et al.* 2012, Ronald 2002), followed by *Staphylococcus saprophyticus,* which accounts for 5 - 10% (Fazly Bazzaz *et al.* 2021). Other pathogens, such as *Klebsiella pneumoniae*, *Proteus mirabilis*, and *Enterococcus faecalis, als*o cause UTIs (Flores-Mireles *et al.* 2015, Ronald 2002). The occurrence of infections due to viral or fungal agents is a rare phenomenon. Prolonged illness of UTIs may result in severe consequences such as frequent recurrences, pyelonephritis with sepsis, and birth to an immature baby, for the case of children, can result in renal damage and complications caused by regular antimicrobial use (Flores-Mireles *et al.* 2015).

Urinary Tract Infections (UTIs) are effectively treated through several antibiotics, including trimethoprim, ciprofloxacin, co-amoxiclav, or cephalexin. In cases of severe infections, broad-spectrum parenteral antibiotics and admission for intravenous fluids are necessary (Fazly Bazzaz *et al.* 2021). Although antibiotics seemed effective and efficient in treating UTIs, the current evolution of resistance of microbial infectious developed resistance to the antibiotic, which made the antibiotic drugs lose their efficiency and effectiveness in treating contagious diseases, including UTIs (Khameneh *et al.* 2019, Loubet *et al.* 2020). These have caused a reliance on alternative medications to overcome drug resistance against microbial infectious diseases. Medicinal plants (MPs) are the common alternative medicines to treat microbial infections in most rural African settings with limited health facilities. In developing countries, including Tanzania, documentation of indigenous knowledge and associated cultural practices on MPs and their applications is vital because it is a vehicle for preserving cultural heritage, the ethnopharmacological base of drug research, and the preservation of biological diversity.

Mara region is the ancestral home of the Kuria tribe in Tanzania, and MPs' applications are popular among its residents. Unfortunately, there are limited records of in-depth ethnobotanical research in the Mara region (Charwi *et al.* 2023). The autochthonous knowledge can vanish because of the immigration of locals to urban areas for employment, loss of natural habitats, industrialization, and extreme change in local ecology (Usman et al. 2022). This study, therefore, aims to document and compile the MPs used by the KTHs in treating UTIs in the region. The obtained data will help as a baseline for forthcoming phytochemical and pharmacological studies and for preserving the Mara region's cultural practices.

Material and Methods

Description of the study area

This study was conducted in Tarime and Serengeti districts in Mara Region, Tanzania (Figure 1). Geographically, the region is located at 01^0 46´ South latitude and 34^0 09´ East longitude at about 1317 meters above sea level and covers a total area of 30,150 km^2. The region has a tropical wet and dry or savanna climate and receives biannual rainfall, with an annual average of 227 mm. Mara region is located along the East African Rift Valley, which is naturally endowed with a wide range of biodiversity resources given biannual rainfall seasons. Tarime and Serengeti districts were purposely selected due to the experiences of one author of this article. The literature review in this study has realized that ethnobotanical studies in the region are limited, and hence more studies on traditional medicinal plants are paramount. Four villages were investigated in the two districts: Rosana and Nyamwigura in Tarime; and Bhonchugu and Kebhosongo in Serengeti. The map below (Figure 1) depicts the setting of the villages in the region, and the study was carried out as per the schematic flowchart Figure 2.

Ethnobotanical data collection

The study was conducted between July 2021 and February 2022 using a semi-structured questionnaire (Martin 2010), and the interviews were performed using the local language so that KTH could adequately express themselves. A total of 20 KTH were selected, 13 from Tarime and 7 from Serengeti districts. Before interviewing, each KTH was informed about the study's goal, and their consent to participate was requested. All plants mentioned were collected and identified with the help of

informants on separate field walks and a trained botanist. Voucher specimens were adequately prepared and deposited at the Herbarium of the Dar es Salaam University College of Education in Dar es Salaam. The scientific names were verified using the Plants of the World Online database (https://powo.science.kew.org/). The global conservation status of all the plants mentioned was then surveyed using the IUCN online database (2023).

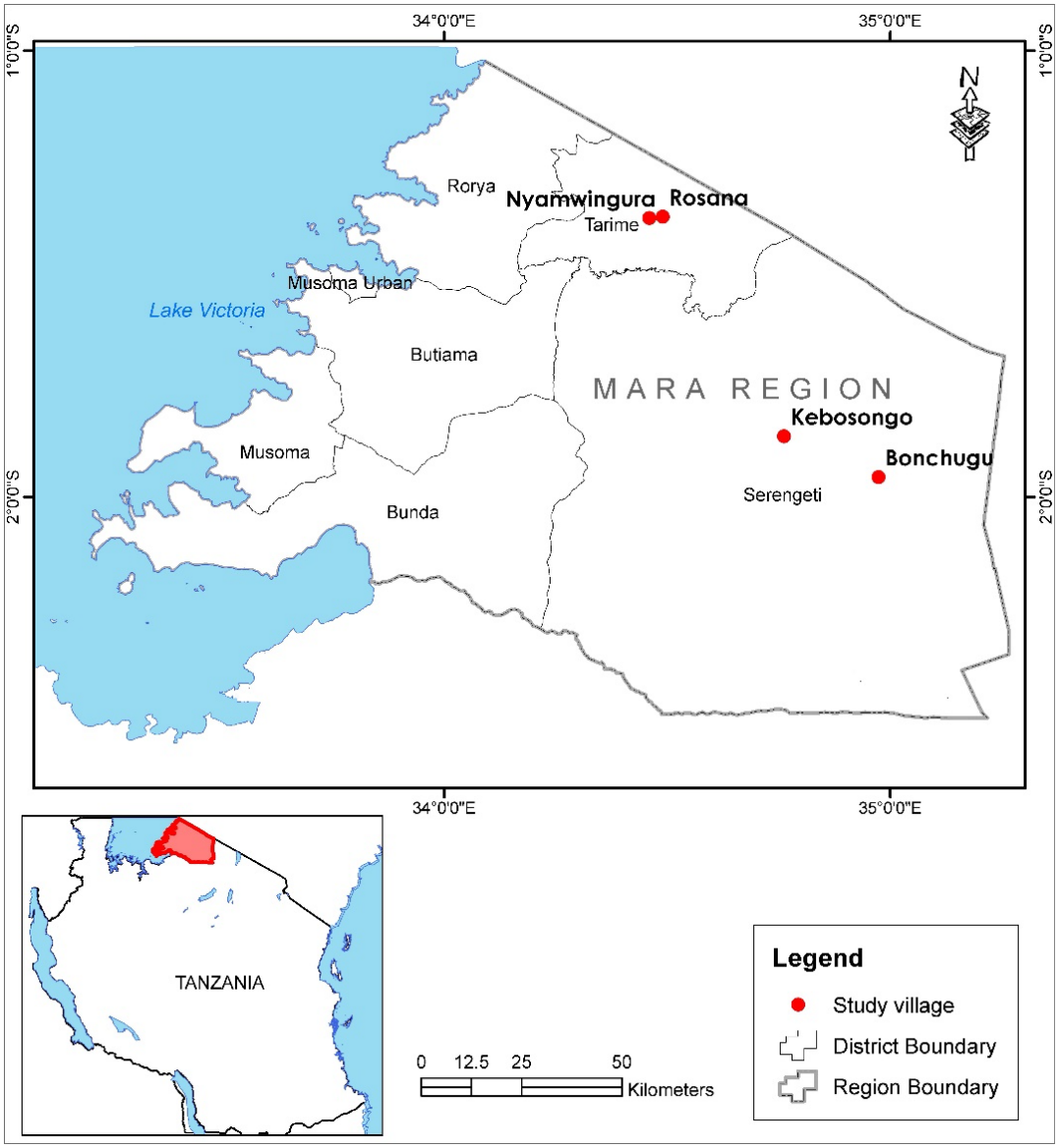

Figure 1. Map showing locations of the study sites in Mara region and placement of the region in Tanzania.

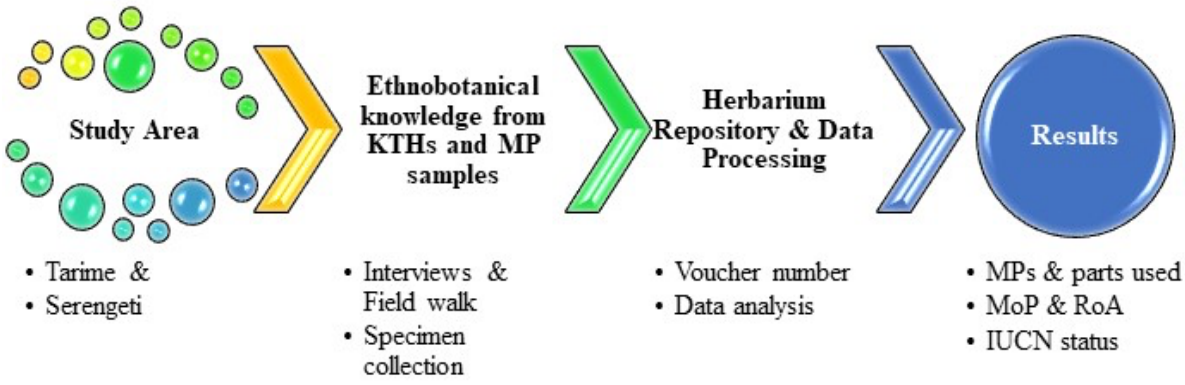

Figure 2. Figure Schematic flowchart of the study plan

Data analysis

The collected ethnobotanical information was organized and analyzed for descriptive statistics such as frequencies and percentages using Microsoft Excel 2013 version, while the Independent t-test and Analysis of Variance (ANOVA) were analyzed using QED statistic software. The conservation status of the collected MPs was derived from the International Union for Conservation of Nature RedList (IUCN RedList) threatened species database.

Results and Discussion

Kuria traditional healers' demographic profile

The KTHs are essential in providing primary health care in the Kuria community in the Mara region. In this study, women constituted 65% of the total KTHs in the two districts, while men represented 35% (Table 1). Unlike in Urambo District in Tanzania (Kacholi & Amir 2022a), Katsina State, Nigeria (Kankara *et al.* 2018), and Livingstone, Southern Province, Zambia (Chinsembu 2016), where male healers are highly trusted and dominate the traditional healing sector, for Kuria tribe is different. In many households, Kuria women are the central authority in home-based herbal therapeutics (Charwi et al. 2023). Similar supremacy is also reported among the Bambara in Mali (Imperato 1981).

Furthermore, the study revealed that most KTHs are older, as shown in Table 1. The data informs us of the traditional healing knowledge gap between the old and younger generation, as reported in Tabora (Kacholi & Amir 2022a) and Kagera (Kisangau *et al.* 2007) regions in Tanzania. Hence, the trend jeopardizes the existence of indigenous knowledge as it may get lost after the demise of the older generation and if not well documented for the future generation. Regarding education level, Most KTHs (65%) had primary education. A similar observation was also reported in Nsenda ward in Tabora region, Tanzania (Kacholi & Mvungi 2022). Also, most THs (52%) reported having acquired their healing practice from family members, while others gained knowledge from herbalists (19%), friends (14%), ancestor spirits (10%), and 5% trained themselves.

Table 1. Socio-demographic profile of Kuria traditional healers

Biodata	Category	No. of KTHs	% of KTHs	Mean No. of MPs
Gender	Male	7	35	5.6 ± 1.6^{a}
	Female	13	65	7.7 ± 2.3^{b}
Age (year)	30 - 45	4	20	3.7 ± 0.9^{a}
	46 - 65	8	40	6.6 ± 1.9^{ab}
	> 65	8	40	7.2 ± 2.1^{b}
Education level	None	7	35	8.1 ± 1.9^{a}
	Primary	13	65	5.9 ± 1.2^{b}
Experience (year)	< 5	2	10	2.5 ± 0.7^{a}
	5-10	5	25	3.6 ± 1.5^{a}
	11 - 15	7	35	4.8 ± 1.5^{a}
	> 15	6	30	8.3 ± 1.6^{b}

Note: Differences in the superscript letters indicate significant differences between the two means at a 5% significant level.

Traditional Medicine Knowledge

The findings revealed that the average number of cited MPs within gender, age groups, education level, and experience categories differed appreciably. Female KTH cited a significantly higher number of MPs than men ($t = -2.38$, $df = 17$, $p = 0.02$). Reporting more MPs by women indicates a relatively better knowledge of women in traditional medicine. The transfer of knowledge on traditional medicine is conventionally transferred to daughters than sons in many parts of the Mara region through oral communication. The KTH with greater than 65 years ($F_{(2, 17)} = 4.98$, $p = 0.01$) and those with experience of greater than 15 years ($F_{(3,16)} = 12.19$, $p = 0.0002$) had noticeably higher knowledge of MPs than the rest within respective categories (Table 2). Older people's high level of medicinal knowledge could be due to the accumulated knowledge obtained through their long years of interaction with their environments (Usman et al. 2022). Other ethnobotanical studies such as (Abebe and Chane Teferi 2021, Girma et al. 2022, Kacholi & Mvungi 2022, Kassa et al. 2020) support our findings. The lower medicinal knowledge of younger KTH suggests the possible deterioration of information flow, which can be considered a risk to indigenous knowledge. Thus, the older KTH generation should communicate their knowledge to the youths as early as possible before they depart.- Moreover, the knowledge of traditional medicine was also significantly varied between educational levels of the KTH ($t = 2.74$, $df = 8$, $p = 0.02$). The number of cited MPs declined with increasing education levels. The negative correlation between formal education and MPs knowledge has been reported elsewhere (Charwi et al. 2023, Girma et al. 2022, Kacholi & Mvungi 2022, Kassa et al. 2020). Most of the KTH informed to have learned the practices from their family members or close friends.

Medicinal plant diversity

A total of 20 MPs belonging to eight families and 20 genera were documented from the two studied Districts to be used by KTHs for managing UTI (Table 2). Asteraceae was observed to be the dominant family with 31.6% of the documented MPs, followed by Lamiaceae (26.3%) and Fabaceae (15.8%), while the remaining five families were represented by one species each (5% each) (Figure 3). Asteraceae and Lamiaceae were also commonly used as UTI therapies in Burkina Faso (Kam *et al.* 2018) and South Africa (Cock *et al.* 2021). Among the reported MPs, such as *Abrus precatorius* L. is also used in Nigerians (Prenner 2013) and Beninese (Dougnon *et al.* 2020) pharmacopoeia to treat UTI. Also, *Bidens pilosa* L. is used by Indians (Pattanayak *et al.* 2017) and the people of Trinidad and Tobago (Lans 2006) for treating UTIs.

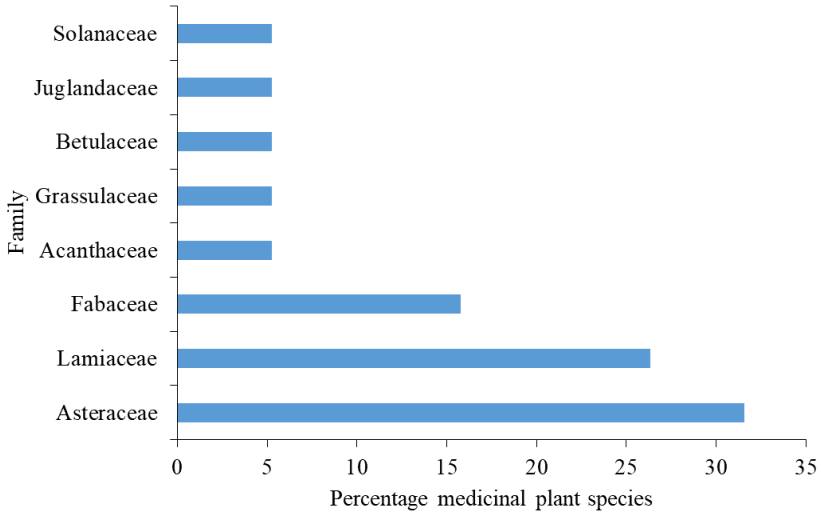

Figure 3. Families of Kuria traditional medicinal plants used in the treatment of UTI

Life form and source of medicinal plants

The life form analysis of the documented MPs revealed shrubs (53%) to be dominant, followed by herbs (37%). The other two life forms (trees and climbers) accounted for 5% each (Figure 4). The finding agrees with similar works conducted in Burkina Faso (Kam et al. 2018) and India (Pattanayak et al. 2017), which reported that shrubs and herbs are dominant MPs for treating UTIs. Moreover, the present result is in line with studies conducted in Uganda (Tugume and Nyakoojo 2019), Tanzania (Kacholi & Amir 2022b), and Ethiopia (Tuasha *et al.* 2018), which reported shrubs and herbs to manage various human ailments. The exploitation of shrubs and herbs indicates that KTHs are more knowledgeable about using the two forms. Most (60%) of the MPs were obtained from wild habitats, including forests, grasslands, roadsides, and around rivers, while the rest (40%) were cultivated in farmlands or home gardens (Table 1). This finding agrees with studies conducted in different parts of the country (Augustino and Gillah 2005, Kacholi and Amir 2022b, Kacholi & Mvungi 2022, Kingo & Maregesi 2020, Mahonge et al. 2006).

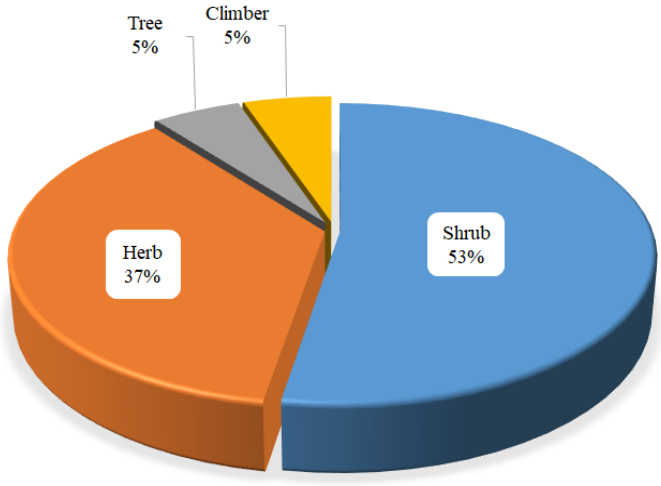

Figure 4. Medicinal plants life forms of medicinal plants used

Table 1. Kuria Medicinal Plants with their respective scientific name, family, growth form, parts used, and ailments cured

Voucher No.	Scientific Names[1]	English name	Kuria Plant Name[2]	Family	Life form	HB	Plant part used	Preparation and administration
MC083	*Abrus precatorius* L.	Rosary pea	umri ghwi irighena imiri ghwi irighena	Fabaceae	Climber	W	Whole plant	Decoction drunk
MC067	*Alnus rhombifolia* Nutt.	White alder	omokénde/ emekénde	Betulaceae	Shrub	W	Leaves	Decoction drunk
MC062	*Asystasia gangetica* (L.) T.Anderson	Chinese violet or foxglove	mokéráoghetángó	Acanthaceae	Herb	W	Leaves	Decoction drunk
MC060	*Bidens pilosa* L.	Blackjack	iritótónimaísó/ amatótónimaísó	Asteraceae	Herb	W	Leaves, Fruits	Decoction drunk Powdering mix with water and drink
MC044	*Chromolaena odorata* (L.) R. King & H. Rob,	Siam weed	irihémbúhémbú/ amahémbúhémbú	Asteraceae	Herb	W	Leaves	Decoction drunk
MC030	*Conyza bonariensis* (L.) Cronq.	Hairy fleabane, Asthma weed	ikinyáitóróra/ ibhinyáitóróra; irinyáitóróra/ amanyáitóróra	Asteraceae	Herb	W	Leaves	Decoction drunk
MC006	*Indigofera suffruticosa* Mill.	True indigo	eghesángúchi/ ibhisángúchi	Fabaceae	Shrub	Cu	Roots	Chewing and gulping the liquid from the roots or pound, soak in water for 3 hours, and drink the infusion.
MC094	*Juglans regia* L.	Walnut tree	umurííbha/ imirííbha	Juglandaceae	Tree	W	Bark, Leaves Seeds	Decoction drunk. Pound seeds, mix with water, and drink the infusion
MC003	*Kalanchoe pinnata* (Lam.) Pers.	Cathedral Bell, Miracle leaf	eghekénékéné/ ibhikénékéné	Crassulaceae	Herb	W	Roots	Infusion is drunk
MC047	*Leonurus cardiaca* L.	motherwort,	irinyabhoghághá/ amanyabhoghághá	Lamiaceae	Herb	W	Leaves	Infusion drunk
MC034	*Leucas urticifolia* (Vahl) R.Br. ex Sm.	Horse mint	inyímíría/ ichinyímíría	Lamiaceae	Herb	Cu	Leaves	Decoction drunk
MC027	*Ocimum gratissimum* L.	African basil, clove basil	ikiíri/ ibhiíri	Lamiaceae	Shrub	Cu	Leaves	Chewing and gulping the liquid and Decoction drunk (for kids)

[1] The Latin and English names were confirmed using the Plants of the World Online database (*https://powo.science.kew.org/*).

[2] Kuria is a tonal language, which means that the tone pattern of a word can be the only phonological feature distinguishing it from other words. Kuria has two basic tones, i.e. high and low. Only high tones are noted with an acute accent mark on the vowel, e.g. á. Unmarked vowels are low-toned. Kuria plant names are inventoried in both their singular and plural forms, which are separated by a slash. Plant names with only one form are non-count nouns. Some of medicinal plants have two names, others have more than one noun class. All these possibilities have been shown in the column of Kuria plant names.

Voucher No.	Scientific Names[1]	English name	Kuria Plant Name[2]	Family	Life form	HB	Plant part used	Preparation and administration
MC055	*Plectranthus amboinicus* (Lour) Spreng.	Mexican mint	iririlebhána irikuria/ amaríghabhána amakuria	Lamiaceae	Herb	Cu	Leaves	Decoction drunk
MC051	*Ricinus communis* L.	Castor oil plant	iriransanyi amaransanyi	Euphorbiaceae	Shrub	Cu	Roots	Decoction drunk
MC058	*Senecio mannii* (Hook.f.) C. Jeffrey	Groundsel/ Ragwort	iritághárá/ amatághárá	Asteraceae	Shrub	W	Leaves	Decoction drunk
MC084	*Senna occidentalis* (L.) Link	Coffee senna	umubhíbhí/ imibhíbhí	Fabaceae	Shrub	Cu	Roots	Decoction drunk
MC009	*Solanum incanum* L,	Nightshade or Thorn apple	eghetárátórá/ ibhitárátórá iritárátórá/ amatárátórá	Solanaceae	Shrub	Cu	Bark, Roots Fruits	Chewing and gulping the liquid Cut the fruits, mix with lemon, then boil in water and drink the Decoction
MC049	*Tetradenia riparia* (Hochst.) Codd.	Ginger bush, Misty plume bush	irirákwá/ amarákwá	Lamiaceae	Shrub	W	Leaves	Decoction drunk
MC041	*Tithonia diversifolia* (Hemsl.) A. Gray,	Mexican sunflower or tree marigold	irichonkíná/ amachónkíná inchókíná)/ ichinchókíná)/	Asteraceae	Herb	Cu	Leaves	Decoction drunk
MC052	*Vernonia gigantea* (Walter) Trel.	Giant ironweed	irirárárwé/ amarárárwé	Asteraceae	Shrub	W	Leaves, Roots	Infusion drunk Decoction drunk

Plant parts used

The study observed that leaves (53%) followed by roots (29%) are the most preferred plant parts in remedy formulation (Figure 5). Other used plant parts include fruits, bark (7% each), and seeds (4%). Similarly, leaves are the most common plant part used in Iran (Bahmani *et al.* 2016), Burkina Faso (Kam *et al.* 2018), and Indonesia (Nisa *et al.* 2021) to treat UTIs. The use of leaves in herbal remedies is mainly due to easy accessibility and because they are the seat of photosynthesis and preferential sites for accumulating active ingredients (Mukaila *et al.* 2023). Moreover, compared to using plant roots or stem bark, which endangers MPs' survival, the harvest of leaves presents a diminutive risk to MPs' survival and encourages recurrent and sustainable utilization of MPs for herbal preparations (Omara 2020, Reimers *et al.* 2019, Sadeghi *et al.* 2014). Thus, applying leaves in herbal remedy formulations should be emphasized as a more sustainable practice due to less adverse impacts on the parent plant and renewability.

Roots are known to be rich in bioactive compounds (Alebie *et al.* 2017), but their frequent exploitation in herbal remedy preparations may threaten the existence of used MPs. Therefore, suitable harvesting approaches, including using alternative plant parts like leaves and conservation measures, are inevitable if sustainable consumption of MPs is to be realized (Kacholi and Amir 2022b, Omara 2020). Other used plant parts, such as seeds, bark, and fruits, which are known for accruing phytochemicals, are seldom utilized, similar to other reports from Zimbabwe (Ngarivhume *et al.* 2015), Ethiopia (Alebie *et al.* 2017) and Uganda (Okello & Kang 2019).

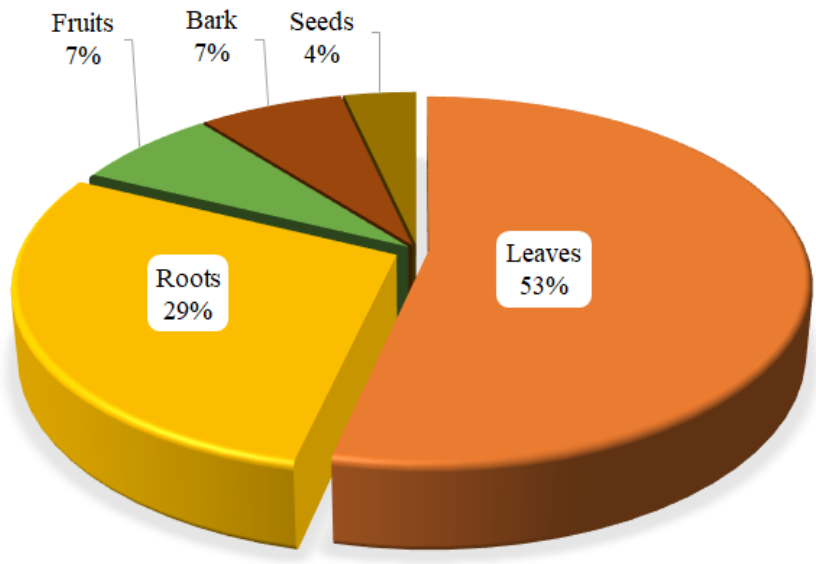

Figure 5. Plant parts used for herbal remedies formulation

Preparation and administration of remedies

Most herbal remedies are prepared through the decoction technique (55%) followed by infusion (26%) and chewing (11%), while the remaining methods (powdering and burning) contribute 4% each (Figure 6). The decoctions and infusions were made by boiling from fresh plant materials and taken orally. Similar to this study finding, ethnobotanical studies conducted in the Blouberg area, South Africa (Mathibela *et al.* 2019), Burkina Faso (Kam *et al.* 2018), and Shiraz City in Iran (Bahmani *et al.* 2016) reported Decoction as the most dominant technique in preparing remedies for urinary tract ailments. Besides, other studies conducted in the Tabora region, Tanzania (Kacholi & Amir 2022b), Ejisu-Juaben Municipality, Ghana (Appiah *et al.* 2018), Rukungiri District, Uganda (Tugume & Nyakoojo 2019) and Guangxi, China (Hu *et al.* 2020) reported Decoction as the preferred method of preparing herbal remedies for treating various ailments. Decoctions are simple to prepare and allow high flexibility of recipes. The technique also speeds up the extraction of active compounds from plant materials, disinfects the materials, and clears poisonous compounds (Sheridan *et al.* 2012). The routes of administration of remedies were mainly oral (100%) because most KTHs established that oral administration was the most convenient for treating UTIs. Likewise, studies conducted elsewhere (Kam *et al.* 2018, Nisa *et al.* 2021) have reported the same route as the most dominant in treating urinary infections.

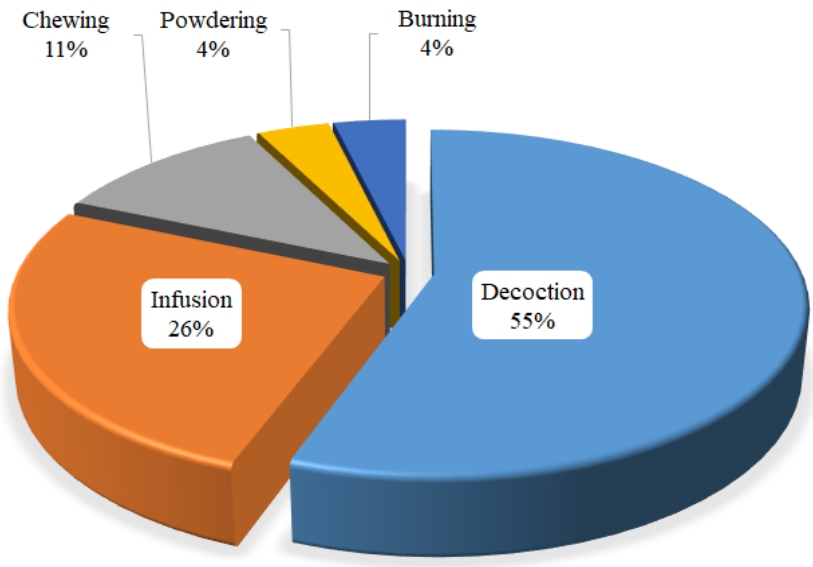

Figure 6. Methods of preparing herbal remedies

Pharmacological activities of some medicinal plants

Various studies conducted elsewhere have shown that some of the reported MPs possess essential compounds that can be used to treat UTIs. For instance, a study conducted in Kenya showed that the leaves extract of *Tatradenia riparia* (Hochst.) Codd can inhibit the growth of *Serratia liquefaciens,* indicating that the plant can be crucial in treating the infections caused by the bacteria, which cause nosocomial urinary tract infections (Ndiku & Ngule 2014). The mature leaves crude extracts of *Ricinus communis* L. (Anthony *et al.* 2022) and *Plectranthus amboinicus* (Lour) Spreng. (Yadav *et al.* 2021) indicated the significant potential to inhibit the growth of pathogenic fungal and bacterial strains and are medicinally safe. The aqueous extract of leaves of *Indigo suffruticosa* Mill showed potent inhibitory activity against the Gram-positive bacteria *Staphylococcus aureus and Bacillus subtilis* (Leite *et al.* 2006). Moreover, the extracts of leaves of *Kalanchoe pinnata* (Lam.) Pers. showed good antibacterial activity against resistant UTIs isolates (Dholaria & Desai 2014). Nevertheless, investigating the MP's toxicity is vital as prolonged use of the remedies can jeopardize patient safety. For instance, the 70% ethanol extract of the aerial parts of *Tithonia diversifolia* (Hemsl.) A. Gray was reported to cause kidney and liver toxicity at the lowest dose tested (Elufioye *et al.* 2009). Thus, its use for treating UTIs raises alarms over its safety.

ICUN conservation status for the medicinal plants

The KTH sourced most of the MPs from wild environments near the villages. Most of the KTH are mindful of the importance of MPs in the local's livelihoods but do not recognise the likelihood of extinction due to overharvesting and lack of conservation of the MPs. Therefore, the IUCN RedList online database (https://www.iucnredlist.org/) was used to survey the conservation status of the recorded plants. The findings revealed information for only 35% (7 species) of the recorded MPs, emphasising that most plant species lack conservation information. All seven MPs (*Alnus rhombifolia* Nutt., *Juglans regia* L., *Leonurus cardiaca* L., *Senecio mannii* (Hook.f.) C. Jeffrey, *Senna occidentalis* (L.) Link, *Solanum incanum* L., and *Tetradenia riparia* (Hochst.) Codd.) have a Least Concern (LC) conservation status, which ratifies a sufficiently stable population for the MPs worldwide. Although these are international conservation standings, the findings are an overall combination of the individual local exploitation of the world's flora. Thus, studies on the conservation of the recorded MPs are encouraged. Also, it is essential to assess the conservation status of the MPs that have not been evaluated too.

Conclusion

The study exposed that the KTH are rich in ethnomedicinal knowledge. Along with contemporary medications, people of the two districts still depend on herbal plant-based remedies for their primary health care needs. The socio-demographic statuses such as gender, age, education level, and experience were found to affect the traditional medicine knowledge of the local healers on conventional medicine. Since traditional knowledge is diminishing among the younger generations, knowledge transfer from older adults should be promoted and emphasized. The study suggests that the reported MPs should be subjected to pharmacological investigations to validate their efficacy and safety for extensive usage.

Declarations

Conflict of Interest: Authors have no conflict of interest.

List of abbreviations: MPs - Medicinal plants; UTIs - Urinary Transmitted Infections; KTHs - Kuria Traditional Healers; IUCN - International Union for Conservation of Nature.

Ethical approval and consent to participate*:* All the involved KTHs provided prior informed consent before the interviews.

Consent for publication*:* Oral permission from KTHs and local authorities has been taken.

Data and material availability: Voucher specimens were deposited in the herbarium of the Department of Biological Sciences, Dar es Salaam University College of Education. The rest of the details are available in this article.

Disclosure statement: The authors declare that there are no competing interests.

Funding: No funds received during this research.

Author's contributions: MZC, NGM, and DSK conceptualized and designed the overall strategy of the study. MZC and NGM conducted fieldwork and collected plant materials for identification. DSK, MZC, and NGM processed, interpreted the surveyed data, drafted the manuscript, and All authors read, reviewed, and approved the final manuscript for publication consideration.

Acknowledgements

The authors thank the authorities for permitting this study in their administrative areas. We are also grateful to KTHs who participated enthusiastically and shared their knowledge. We also want to thank the anonymous reviewers for their in-depth review and valuable suggestions for this work.

Literature cited

Abebe BA, Chane Teferi S. 2021. Ethnobotanical Study of Medicinal Plants Used to Treat Human and Livestock Ailments in Hulet Eju Enese Woreda, East Gojjam Zone of Amhara Region, Ethiopia. MN Ghayur (ed.). Evidence-Based Complementary and Alternative Medicine 2021, Article ID 6668541.

Addis T, Mekonnen Y, Ayenew Z, Fentaw S, Biazin H. 2021. Bacterial uropathogens and burden of antimicrobial resistance pattern in urine specimens referred to Ethiopian Public Health Institute. PLOS ONE 16:e0259602.

Alebie G, Urga B, Worku A. 2017. Systematic review on traditional medicinal plants used for the treatment of malaria in Ethiopia: Trends and perspectives. Malaria Journal 16:307.

Anthony OO, Nasif MA, Kowanga DK. 2022. Assessment of *Ricinus communis* Ml crude extracts towards urinary tract infection strains with their associated ailments. Journal of Pharmaceutics and Pharmacology Research 5:1-16.

Appiah K, Oppong C, Mardani H, Omari R, Kpabitey S, Amoatey C, Onwona-Agyeman S, Oikawa Y, Katsura K, Fujii Y. 2018. Medicinal plants used in the Ejisu-Juaben Municipality, Southern Ghana: an ethnobotanical study. Medicines 6:1.

Augustino S, Gillah PR. 2005. Medicinal plants in urban Districts of Tanzania: Plants, gender roles and sustainable use. International Forestry Review 7:44-58.

Bahmani M, Baharvand-Ahmadi B, Tajeddini P, Rafieian-Kopaei M, Naghdi N. 2016. Identification of medicinal plants for the treatment of kidney and urinary stones. Journal of Renal Injury Prevention 5:129-133.

Charwi MZ, Mogha NG, Muluwa JK, Bostoen K. 2023. Indigenous knowledge and use of medicinal plants among the Kuria communities in the Tarime and Serengeti Districts of Mara Region, Tanzania. Journal of Herbs, Spices & Medicinal Plants 2023:1-20.

Chinsembu KC. 2016. Ethnobotanical study of medicinal flora utilised by traditional healers in the management of sexually transmitted infections in Sesheke District, Western Province, Zambia. Revista Brasileira de Farmacognosia 26:268-274.

Cock I, Mavuso N, Van Vuuren S. 2021. A Review of Plant-Based Therapies for the Treatment of Urinary Tract Infections in Traditional Southern African Medicine. OO Olajuyigbe (ed.). Evidence-Based Complementary and Alternative Medicine. Volume 2021, Article ID 7341124.

Dholaria MD, Desai PV. 2014. Phytochemical analysis and in-vitro antibacterial activity of Kalanchoe Pinnata against human pathogens isolated from UTI. International Conference on Multidisciplinary Research & Practice 2014

Dougnon V, Assogba P, Koudokpon H, Ayena C, Vissoh S, Akpaka G, Klotoe JR, Baba-Moussa L, Bankole H, Koudouvo K, *et al.* 2020. Treatment of urinary tract infections with medicinal plants: Monographs of some plants species revealed by traditherapists. Infectious Diseases and Herbal Medicine 1:16-29.

Elufioye TO, Alatise OI, Fakoya FA, Agbedahunsi JM, Houghton PJ. 2009. Toxicity studies of *Tithonia diversifolia* A. Gray (Asteraceae) in rats. Journal of Ethnopharmacology 122:410-415.

Fazly Bazzaz BS, Darvishi Fork S, Ahmadi R, Khameneh B. 2021. Deep insights into urinary tract infections and effective natural remedies. African Journal of Urology 27:6.

Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ. 2015. Urinary tract infections: epidemiology, mechanisms of infection and treatment options. Nature Reviews Microbiology 13:269-284.

Girma Z, Abdela G, Awas T. 2022. Ethnobotanical study of medicinal plant species in Nensebo District, south-eastern Ethiopia. Ethnobotany Research and Applications 24:1-25.

Hu R, Lin C, Xu W, Liu Y, Long C. 2020. Ethnobotanical study on medicinal plants used by Mulam people in Guangxi, China. Journal of Ethnobiology & Ethnomedicine 16:40.

Imperato PJ. 1981. The role of women in traditional healing among the Bambara of Mali. Transactions of the Royal Society of Tropical Medicine and Hygiene 75:766-770.

Kacholi DS, Amir HM. 2022a. Ethnobotanical survey of medicinal plants used by traditional healers in managing gonorrhoea and syphilis in Urambo District, Tabora Region, Tanzania. Journal of Herbs, Spices & Medicinal Plants 28:179-192.

Kacholi DS, Amir HM. 2022b. Herbal remedies used by traditional healers to treat haemorrhoids in Tabora region, Tanzania. Pharmaceutical Biology 60(1):2182-2188.

Kacholi DS, Mvungi HA. 2022. Ethnomedicinal survey of antidiarrheal plants of the Nyamwezi people of Nsenda ward in Urambo District, central western Tanzania. Ethnobotanical Research and Applications 24:1-14.

Kam SE, Meda RN-T, Kabre Z, Koama BK, Ouoba HY, Yameogo V, Zon DM, Zongo E, Ouedraogo GA. 2018. Ethnobotanical survey of plants used by traditional healers for treatment of urinary infections in Hauts-Bassins Areas of Burkina Faso. International Journal of Science and Research 9:1113-1118.

Kankara SS, Isah AB, Bello A, Ahmed A, Lawal U. 2018. Medicinal plants used for the management of hepatic ailments in Katsina State, Nigeria. Journal of Medicinal Plants Research 12:375-386.

Kassa Z, Asfaw Z, Demissew S. 2020. An ethnobotanical study of medicinal plants in Sheka Zone of Southern Nations Nationalities and Peoples Regional State, Ethiopia. J Ethnobiol Ethnomedicine 16:7.

Khameneh B, Iranshahy M, Soheili V, Fazly Bazzaz BS. 2019. Review on plant antimicrobials: a mechanistic viewpoint. Antimicrobial Resistance & Infection Control 8:118.

Kingo RM, Maregesi SM. 2020. Ethnopharmacological study on some medicinal plants used in Ujiji, Kigoma, Tanzania. Journal of Phytopharmacology 9:102-109.

Kisangau DP, Lyaruu HV, Hosea KM, Joseph CC. 2007. Use of traditional medicines in the management of HIV/AIDS opportunistic infections in Tanzania: a case in the Bukoba rural district. Journal of Ethnobiology & Ethnomedicine 3:29.

Kostakioti M, Hultgren SJ, Hadjifrangiskou M. 2012. Molecular blueprint of uropathogenic *Escherichia coli* virulence provides clues toward the development of anti-virulence therapeutics. Virulence 3:592-593.

Leite SP, Vieira JRC, de Medeiros PL, Leite RMP, de Menezes Lima VL, Xavier HS, de Oliveira Lima E. 2006. Antimicrobial Activity of *Indigofera suffruticosa*. Evidence-Based Complementary and Alternative Medicine. Volume 3, Article ID 839056.

Loubet P, Ranfaing J, Dinh A, Dunyach-Remy C, Bernard L, Bruyère F, Lavigne J-P, Sotto A. 2020. Alternative therapeutic options to antibiotics for the treatment of urinary tract infections. Frontiers in Microbiology 11:1509.

Magliano E, Grazioli V, Deflorio L, Leuci AI, Mattina R, Romano P, Cocuzza CE. 2012. Gender and age-dependent etiology of community-acquired urinary tract Infections. The Scientific World Journal 2012: 349597.

Mahonge C, Nsenga J, Mtengeti E, Mattee A. 2006. Utilization of medicinal plants by Waluguru people in East Uluguru mountains Tanzania. African Journal of Traditional, Complementary and Alternative Medicines 3:121-134.

Martin GJ. 2010. Ethnobotany: a methods manual. Routledge. London; Sterling, VA

Mathibela MK, Potgieter MJ, Tshikalange TE. 2019. Medicinal plants used to manage sexually transmitted infections by Bapedi traditional health practitioners in the Blouberg area, South Africa. South African Journal of Botany 122:385-390.

Medina M, Castillo-Pino E. 2019. An introduction to the epidemiology and burden of urinary tract infections. Therapeutic Advances in Urology Volume 11, 1756287219832172.

Mukaila YO, Oladipo OT, Arogundade OO, Ajao AA-N. 2023. Traditional knowledge of medicinal plants used in Ile-Ife, Southwestern Nigeria. Asian Journal of Ethnobiology 5:71-83.

Ndiku MH, Ngule MC. 2014. Antibacterial activity and Preliminary phytochemical screening of hot- aqua extract of *Tetradenia riparia* leaves. International Journal of Pharmacy and Life Sciences 5:3780-3786.

Ngarivhume T, van't Klooster CIEA, de Jong JTVM, Van der Westhuizen JH. 2015. Medicinal plants used by traditional healers for the treatment of malaria in the Chipinge district in Zimbabwe. Journal of Ethnopharmacology 159:224-237.

Nisa U, Astana PRW, Triyono A, Ardiyanto D, Fitriani U, Zulkarnain Z, Novianto F, Jannah WDM. 2021. Ethnobotanical study of medicinal plants used for treating urinary tract problems in eastern Indonesia. IOP Conference Series: Earth and Environmental Science 905:012119.

Okello D, Kang Y. 2019. Exploring antimalarial herbal plants across communities in Uganda based on electronic data. Evidence-Based Complementary and Alternative Medicine. Volume 2019, Article ID 3057180.

Oladeinde B, MSc. MSc, Aimls. Aimls, Omoregie R, MPhil. MPhil, Fimls. Fimls, Olley M, MSc. MSc, Aimls. Aimls, Anunibe J, *et al.* 2011. Urinary tract infection in a rural community of Nigeria. North American Journal of Medical Sciences 3:75-77.

Omara T. 2020. Antimalarial plants used across Kenyan communities. Evidence-Based Complementary and Alternative Medicine. Volume 2020, Article ID 4538602.

Pattanayak S, Das DC, Sinha NK, Parida S. 2017. Use of medicinal plants for the treatment of urinary Tract infections: a study from Paschim Medinipur district, West Bengal, India. International Journal of Pharma and Bio Sciences 8:250-259.

Prenner G. 2013. Flower development in *Abrus precatorius* (Leguminosae: Papilionoideae: Abreae) and a review of androecial characters in Papilionoideae. South Africa Journal of Botany 89:210-218.

Reimers, Fernández, Reimers, Chaloupkova, del Valle, Milella, Russo. 2019. An ethnobotanical survey of medicinal plants used in Papantla, Veracruz, Mexico. Plants 8:246.

Ronald A. 2002. The etiology of urinary tract infection: traditional and emerging pathogens. American Journal of Medicine 113:14-19.

Sadeghi Z, Kuhestani K, Abdollahi V, Mahmood A. 2014. Ethnopharmacological studies of indigenous medicinal plants of Saravan region, Baluchistan, Iran. Journal of Ethnopharmacology 153:111-118.

Sekharan CB, Kumari KR, Kuwingwa EE, Kumar DD. 2017. Evaluation of the Prevalence of Urinary Tract Infection in Women Aged 6-50 Years at Kinondoni District, Tanzania. Science International 5:42-46.

Shaikh N, Morone NE, Bost JE, Farrell MH. 2008. Prevalence of Urinary Tract Infection in Childhood: A Meta-Analysis. Pediatric Infectious Disease Journal 27:302-308.

Sheridan H, Krenn L, Jiang R, Sutherland I, Ignatova S, Marmann A, Liang X, Sendker J. 2012. The potential of metabolic fingerprinting as a tool for the modernisation of TCM preparations. Journal of Ethnopharmacology 140:482-491.

Tuasha N, Petros B, Asfaw Z. 2018. Medicinal plants used by traditional healers to treat malignancies and other human ailments in Dalle District, Sidama Zone, Ethiopia. Journal of Ethnobiology & Ethnomedicine 14:15.

Tugume P, Nyakoojo C. 2019. Ethno-pharmacological survey of herbal remedies used in the treatment of paediatric diseases in Buhunga parish, Rukungiri District, Uganda. BMC Complementary and Alternative Medicine 19:353.

Usman KA, Egigu MC, Mahalingam JS. 2022. Ethnobotanical study on traditional medicinal plants used by Oromo ethnic people of Goro district, Bale zone of Oromia region, Ethiopia. Ethnobotany Research and Applications 24:1-21.

Yadav S, Raut D, Nayak S. 2021. Antibacterial activity of *Plectranthus Amboinicus* against multiple drug-resistant isolates obtained from samples of urinary tract infection. International Journal of Botany Studies 6:558-565.