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Ethnopharmacological Study on Some Medicinal Plants Used in Ujiji, Kigoma, Tanzania

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ABSTRACT

The purpose of this study was to document medicinal plants used for management of various diseases in Simbo and Ujiji, Kigoma, Tanzania. Structured questionnaires were used to interview the traditional healers on the use of various plants for management of various diseases. Voucher specimens were collected, coded and identification by the Botanist. Previous ethnobotanical literatures were used to compare to the provided information. 54 plant species from 30 families were identified and collected from 5 informants, the family Euphorbiaceae ranked highest (11%) among others. Leaves were the most used plant part and the oral administration predominated. Some of the recorded plants (35.2%) have previously been reported for same use. Study suggests the area as potential site for further ethnopharmacological surveys.

Keywords: Ethnopharmacology, Traditional medicine, Kigoma, Tanzania

INTRODUCTION

Ethnopharmacology is the interdisciplinary scientific exploration of biologically active agents traditionally employed or observed by man ^[1]. Traditional medicine has a long history of serving peoples all over the world. In many countries and cultures of different races, the use of medicinal plants to treat diseases and maintaining public health is highly prevalent. About 65-80% of the world's population in developing countries depends essentially on plants for their primary health care ^[2]. As a result, utilization of national traditional systems of medicine with regulations suited to national health care systems were adopted by a 30th world health assembly ^[3].

Tanzania is wealthy in terms of medicinal plants, but it is very fortunate that little has been achieved regarding their proper documentation and biological activity evaluation. Moreover, few of these plants have been subjected on safety evaluation ^[4].

This ethnopharmacological survey was conducted in Ujiji and Simbo wards located in Kigoma region found in the Western Tanzania. Kigoma is located in tropical zone with adequate amount of rainfall and good temperatures for the growth of many plants. The area has culture diversity, good use and practice of traditional medicine. The area is potential for documentation of useful medicinal plants that could be further subjected to biological screening and subsequent bio-guided isolation to identify bioactive phytochemicals.

METHODOLOGY

Study site and design

Study was conducted in Ujiji and Simbo wards in Kigoma region, Western Tanzania. The region is an ideal site for the survey, about 45% of its area is natural forest with tropical climate long wet rainy seasons periodically. It is a gently inclined plateau with steep hills rising very sharply from 800 m. at the level of lake Tanganyika to altitudes of 1, 750 m. to the East descending from the North and East into gently rolling hills with three major perennial rivers of Malagarasi, Luiche and Ruchugi (5), and located at 4.6498° S, 30.5279° E.

The survey was conducted for 14 days (June - July 2018). Informants involved were Traditional healers and/or Elders knowledgeable on traditional medicines. Information on medicinal plants was obtained

through face to face interview at homes using structured questionnaire followed by herbaria specimen collection at the field areas.

Identification of voucher specimens

Herbaria specimens coded with initials and numbers (RMK01 to RMK54), later identified by a Senior Botanist (Mr. Haji Selemani), Department of Botany, University of Dar es salaam by comparison with other voucher specimens. The voucher specimens deposited in Pharmacognosy department, Muhimbili University of Health and Allies Sciences.

RESULTS

Source of information

Five informants, Traditional Healers/Knowledgeable Elders on traditional medicine practices and use aged 32 to 74 years were interviewed, as some informants were reluctant and refused to participate in the study. Their background history revealed that, all of them obtained their knowledge through succession from family lines. Level of education was standard IV to VII of primary school. Some of the medicinal plants were mentioned by more than one informant.

Recorded Plants and their Medicinal Uses

Table 1: Medicinal plants and uses from Ujiji and Simbo wards

Family	Botanical Name	Vernacular or Local Name (Language)	Voucher Serial Number	Plant Part(s)	Claimed Ethnomedical Use(s) Preparation and Route of Administration	Previous Ethnomedical uses Pharmacological action(s) / biological activity
Anacardiaceae	<i>Lannea fulva</i>	Mpapa	RMK037	L	<i>Neuropathy.</i> Fresh leaf decoction is taken orally.	Published supporting evidence was not retrieved.
	<i>Lannea schimperi</i>	Kabumbu (Kitongwe)	RMK005	SB	<i>Antidote for snake spit eye poisoning.</i> Ground stem barks is macerated for days. The extract is applied as eye drops to treat poisoned eyes.	For management of stomach pains, diarrhoea, and chest problems [6] Used to treat tuberculosis, skin rashes, herpes zoster, herpes simplex, and chronic diarrhea [7].
	<i>Rhus natalensis</i>	Mfunguzi	RMK045	L	<i>Enhances fertility to women.</i> Dried powdered leaf cold infusion is taken orally. <i>Skin conditions and rashes.</i> <i>Treatment of bone fractures (joining)</i>	Strengtheners, management of respiratory disorders, stomachic, and malaria [8]. Viral infections especially Herpes Simplex Virus (HSV 1) [9].
Apocynaceae	<i>Landolphia buchananii</i>	Malandula	RMK008	L	Fresh leaf paste applied topically on the affected area. <i>Coughs</i> Fresh leaves paste is macerated in water and the extract is taken orally. <i>Stomach discomforts and Dysentery.</i>	Antipyretic [10]. Stomach ache, diarrhea, hernia [11]. Treatment of gonorrhoea and bilharzias [12].
	<i>Landolphia sp</i>	Msongatinyamata	RMK042	R	Roots decoction is taken orally or applied by enema	General body swelling, rheumatism and pneumonia, management of wounds and itching, arrow poison supplement, hypertension, treatment of gonorrhoea and other venereal diseases, treatment of scabies and jigger [12].
Asteraceae	<i>Rauvolfia sp</i>	Mtundaugoro	RMK010	L	<i>Treatment of hypertension.</i> Leaves are macerated in water, and the extract taken orally.	Treatment of syphilis, dysentery and diarrhoea [13]. As mosquito repellent against the <i>Anopheles arabiensis</i> and for management of fever especially in infants [14].
	<i>Bidens sp</i>	Magorogombe	RMK020	F	<i>Treatment of anaemia.</i> Fresh flowers decoction is taken orally.	Antimalarial [15], Increases intestinal motility and gastric emptying [16]. Antibacterial, antitumor and antifungal action [17].
	<i>Vernonia amygdalina</i>	Kilulungunja	RMK018	L	<i>Typhoid, Malaria, Abortion and Urinary tract infection (UTI).</i>	

During the survey, 54 plant species from 30 families were documented and their medicinal uses are presented in Table 1. Euphorbiaceae ranked highest and proportion in percentages among the families is shown in Table 2. Leaves were the most used plant parts with 51.42%, followed by roots 32.86%; bark 7.14% and, 8.58% for exudates, flowers, fruits and seeds jointly.

Among the mentioned plants, 33.3% were claimed to treat more than one disease. Both communicable and non-communicable diseases were mentioned as presented in Table 1. Proportions of plants with supportive data, mono and multi applications are shown in Table 3, where by also 35.2% of plants treatment claims are supported by previous ethnomedical reports and/or scientific investigations. All plants were collected from the wild source.

Dosage forms and routes of administration

Both liquid and solid dosage forms reported, these were prepared by infusions, decoctions, maceration, or as pastes, dry powders, teas and baths. Oral administration most reported route (74.58%), topical/local applications (20.34%) and then, enema (5.08%).

Variations on dosing schedules and scales were observed among the informants. They were unaware on the proper dosing and duration for use which are important parameters for effective therapy. Despite the variations in the dosing pattern, they were all insisting to their clients on the importance usage of plant medicine rationally.

					Fresh leaves decoction is taken orally. <i>Tonics, stomach upsets, anaemia, and neuropathy.</i> Powdered root or bark is added in the porridge or tea.	Managing HIV/AIDS related diseases, syphilis, sore, gonorrhoea and other venereal diseases [13, 18]. Antidiarrheal and antimalarial [19, 20].
Bignoniaceae	<i>Kigelia africana</i>	Mlemela	RMK053	R/ B		
Burseraceae	<i>Commiphora mollis</i>	Katwala	RMK003	R	<i>Impotence.</i> Roots cold infusion is taken orally.	Antioxidant, cytotoxicity, antifungal activity and antimicrobial activities [21].
Caesalpineaceae	<i>Piliostigma thonningii</i>	Kifumbe	RMK035	R	<i>Reducing the HIV viral loads</i> Roots infusion is taken orally	Managing loss of appetite, alleviating stomach problems, treatment of haematochezia, cough, menorrhagia, convulsions and bilharzia [22, 23]. Management of HIV/AIDS and related diseases, malaria and
Celastraceae	<i>Maytenus senegalensis</i>	Muheza	RMK006	R	<i>Increasing CD4 levels</i> Roots infusion is taken orally	toothache, abdominal pain, tonic, skin rashes, anaemia, muscle soreness, diarrhoea, relieving feet burning sensations and gangrene [9, 24, 25]. Treatment of dysentery in combination with <i>Rhus vulgaris</i> , treatment of yellow fever in combination with leaves of <i>Tremaorientalis</i> and <i>Erythrina abyssinica</i> [26].
Combretaceae	<i>Combretum collinum</i>	Msongatimakoba	RMK016	R	<i>Male impotence</i> Roots infusion is taken orally	
	<i>Terminalia mollis</i>	Muhongolo	RMK033	R/ B	<i>In combination with Erythrina sp for yellow fever.</i> Root or bark infusion is taken orally.	Management of abdominal disorders, pain, bilharzia, cancer, coughs and colds, dysentery, diarrhoea, fever, venereal disorders, HIV/AIDS, heart disorders, hypertension, jaundice, malaria and diabetes [27,28].
	<i>Terminalia sp</i>	Bumbuzi	RMK002	L	<i>Anaemia.</i> Fresh leaf decoction is taken orally	
Compositae	<i>Sphaeranthus sp</i>	Mtibu	RMK027	L	<i>Dysmenorrhoea.</i> Fresh leaf decoction is taken orally.	Treatment of viral hepatitis, skin infections, bronchitis, jaundice, nervous depression, worms, management of indigestion, asthma, leucoderma, and dysentery [29].
	<i>Acalypha fruticosa</i>	Mpasua Jabari	RMK015	L/ Roots	<i>Neuropathy.</i> Leaf or root decoction is taken orally.	For management of dyspepsia, colic, diarrhoea, cholera, burns and bee stings, colds, coughs and headaches, jaundice, fever, antidote as well as antioxidant [30]. Management of
	<i>Acalypha sp</i>	Mtagali	RMK019	L	<i>Dilation of cervix to easy delivery</i> Clean grounded fresh leaf paste is applied at the vagina near term.	rheumatism, pneumonia, asthma, contraception, antifertility to women, snake bite, anthrax and impotence [31,32].
Euphorbiaceae					<i>Stomach ulcers.</i> Powdered leaves are added to porridge or tea.	Treatment of dysentery, diarrhoea, promoting lactation, anthelmintic effect, skin rashes, oral candidiasis, rheumatism, syphilis and other sexually transmitted diseases [7, 33].
	<i>Jatropha curcas</i>	Mbono kaburi	RMK017	L/ E	<i>Treatment of superficial fungal infections.</i> The exudate is applied locally at the affected sites.	
	<i>Phyllanthus sp</i>	Mgara	RMK026	R/ L	<i>Increases women fertility, anaemia, and stomach upset.</i> Fresh leaf or root decoction is taken orally, or through enema.	
	<i>Phyllanthus sp</i>	Mafundo	RMK036	L	<i>Treatment of dysentery and antidote for poisoning.</i> Powdered leaves are added to porridge or tea.	Treatment of bacterial and viral infections, diabetes, fever, malaria, tumors, anaemia, worms, reduces intestinal gas and mild laxative [15, 20, 34]
	<i>Phyllanthus sp</i>	Mwepesi	RMK038	L	<i>Enhance fertility in women, neuropathy, and reduction of body weight/cholesterols</i> Powdered leaves are taken orally with porridge or tea.	
Flacourtiaceae	<i>Flacourtia sp</i>	Kairokabali (Kitongwe) Nyamalandula (Kiha)	RMK041	L/ R	<i>Watery rashes.</i> Leaf or root decoction is applied topically or administered as enema.	Treatment of rheumatism, colic, headache, and diarrhoea [23, 33].
Lamiaceae	<i>Leonotis nepetifolia</i>	Kivumbasi	RMK051	F	<i>Asthma</i> Powdered flower is added in porridge or tea.	Treatment of rheumatism, cold, dysmenorrhoea, bronchial asthma, fever, diarrhoea, diabetes, coughs, malaria, pneumonia, stomach aches, and have antioxidant and antitumor actions [35-37]

					<i>Fever, Urinary Tract Infection.</i> Leaf or root decoction is taken orally. <i>Dilates cervix in pregnant women.</i> Clean grounded fresh leaf or root paste is applied at the vagina near term.	Has antimicrobial and antiplasmodial activity, treating the eye and urinary tract infections, gonorrhea ^[38] . Management of fainting conditions ^[39] .
Loganiaceae	<i>Strychnos potatorum</i>	Mshindwi	RMK039	L/ R		
	<i>Strychnos spinosa</i>	Libuaje (Kitongwe) Makomwe (Kiswahili)	RMK022	L/ R	<i>Impotence.</i> Leaf or root decoction is taken orally.	Treatment of snake bites, ulcers, wounds, headache, gastric and intestinal problems, venereal diseases, leprosy, diarrhoea, fever, management of liver damage ^[40] .
Malvaceae	<i>Sida acuta</i>	Tevere	RMK028	L	<i>Diabetes</i> Leaf decoction is taken orally.	Analgesic during labour, treatment of gonorrhea, snake bites, and worms infestations ^[41,42] .
	<i>Cissampelos pareira</i>	Mlangamia	RMK029	L	<i>Skin conditions</i> Clean fresh leaf paste is applied topically.	Management of different skin conditions, asthma, cough, fever, arthritis, obesity, snakebite, dysentery, jaundice, heart and blood pressure conditions. Analgesic, anti-allergic, antipyretic, antiinflammatory, anticancer, antimalarial, bronchodilator, antifertility, and antimicrobial activities ^[43, 44] .
Menispermaceae	<i>Cissampelos sp</i>	Shubiri	RMK025	S (P)	<i>Stomach aches, Hernia.</i> Powdered seeds are added in porridge and mixed with honey, then taken orally using table spoon.	
Mimosaceae	<i>Acacia seyal</i>	Kasemele (Kitongwe) Mgungamdogo (Kiswahili)	RMK043	L/ R	<i>Pneumonia</i> Leaf or root decoction is taken orally.	Diarrhoea, dysentery, toothache, and body pain ^[24, 45] .
Moraceae	<i>Ficus sp</i>	Mchekeo	RMK049	L	<i>Neuropathy.</i> Powdered leaves are added in porridge or tea.	Management of diabetes, jaundice, amoebiasis, diarrhoea and sickle cell disease ^[46, 47] Ear ache, poisoning and dysmenorrhea ^[48] .
	<i>Ficus sp</i>	Kabukobuko (Kitongwe)	RMK011	B R	<i>Anaemia.</i> Viscous decoction of root or bark is taken orally.	
Olacaceae	<i>Ximenia americana</i>	Busantu (Kitongwe)	RMK048	L/ B	<i>Treatment of dysentery.</i> Leaf or bark infusion is taken orally.	Treatment of worms infestation, diarrhoea, abdominal pains and gastric ulcers ^[42, 49] . Stomachache in kids, food, tonic, constipation and backache ^[8, 23] .
	<i>Abrus precatorius</i>	Msikesike or Mturuturu	RMK050	L/ F	<i>Treatment of worms and asthma.</i> Powdered leaf or fruit decoction is mixed up with honey and then taken orally.	Treatment of asthma, bronchitis, inflammation, oral candidiasis associated with HIV/AIDS, management of rheumatism, also has documented antimicrobial, antifertility, immunopotentiating, anthelmintic, anti-tumor, and anti-diarrheal actions ^[18, 33, 50] .
Papilionaceae	<i>Erythrina sp</i>	Mlinzi	RMK032	L	<i>Kidney diseases</i> Leaf decoction is taken orally.	Management of cough, bacterial, fungal infections and other diseases related to HIV/AIDS infection, yellow fever, diarrhoea, schistosomiasis, malaria and has analgesic action ^[9,15] .
	<i>Lonchocarpus capassa</i>	Kapara/Muwasha	RMK031	R	<i>Stomach upsets</i> Root decoction is taken orally.	Mosquito repellent ^[51] .
	<i>Senna siamea (cassia siamea)</i>	Msonobali or Mjohoro (Kiswahili)	RMK030	R	<i>Worms</i> Root decoction is taken orally or administered through enema.	Treatment of malaria and shown to have antimicrobial, antidiabetic, anticancer, hypotensive, diuretic, antioxidant, laxative, antiinflammatory, analgesic, antipyretic, anxiolytic, antidepressant and sedative activities ^[20, 52] .
Polygalaceae	<i>Securidaca longipedunculata</i>	Doktere (Kibembe) Mnyakaso (Kiha) Mulimba (Kitongwe)	RMK046	L/ R	<i>Worms, hernia and stomach aches.</i> Powdered leaf or root is added in porridge or tea.	Treatment of worms infestations, gonorrhea, syphilis, meningitis, coughs, tuberculosis, oral candidiasis associated with HIV/AIDS and reported to have antibacterial, analgesic, antimalarial, anti-allergic, antiinflammatory, antithrombotic, antioxidant, vasodilation, antitypanosomiasis, antidepressant, and aphrodisiac activities ^[3, 18, 42, 53] .
Ranunculaceae	<i>Clematis brachiata</i>	Ange (Kibembe)	RMK013	L	<i>Joining of broken bones.</i>	Treatment of syphilis, diarrhoea, unspecified skin disorders, sore throats, headache, malaria, abdominal

Rhamnaceae	<i>Ziziphus mucronata</i>	Kagobole	RMK009	R	Clean fresh leaf paste mixed with palm oil is applied topically to the broken areas. <i>Joint pains, headaches, dizziness, blurred vision and impotence.</i> Root infusion is taken orally.	disorders cracking and blistering feet, antioxidant, antiinflammatory and cytotoxicity ^[54, 55] . Treatment of bilharzia, sickle cell, blennorrhagia, dysmenorrhea, wounds boils, infertility in women, wounds and has antioxidant action ^[23, 47, 48, 56] . Management of diabetes, constipation, toothache, skin rashes, herpes zoster, herpes simplex, tuberculosis, chronic diarrhoea as diseases associated with HIV/AIDS, ornamental, and has antimalarial and antimicrobial actions ^[18, 23, 46, 57] . Management of diabetes and topical ulcers, impotence and treatment of malaria ^[48, 58] .
Rosaceae	<i>Parinari curatellifolia</i>	Mnazipori	RMK021	R	<i>Diabetes, tonic, anaemia, stomach problems, and neuropathy.</i> (Mostly used in combination with <i>Kigelia africana</i>). Root infusion is taken orally.	Management of hypertension, wound healing and has antimalarial and antibacterial actions ^[59, 60] . Supportive evidence was not retrieved.
	<i>Fadogia sp</i>	Bwisompofu (Kitongwe)	RMK004	L	<i>Management of anaemia and tonic</i> Powered leaf used as tea.	
	<i>Gardenia ternifolia</i>	Mshilantengela (Kiha/Kitongwe)	RMK023	R/L	<i>Impotence</i> Root or leaf infusion is taken orally.	Management of hypertension, wound healing and has antimalarial and antibacterial actions ^[59, 60] .
	<i>Leptactina sp</i>	Kasato (Kitongwe)	RMK052	L	<i>Antidote for any poison</i> Leaf infusion is taken orally.	Supportive evidence was not retrieved.
Rubiaceae	<i>Multidentia crassa</i>	Bungogolo or Mgugunwa	RMK040	R	<i>Delays ejaculation in men.</i> Root decoction is taken orally for several days twice every day. The duration depends on type and level of the individual's problem. <i>Increases fluidity of the vagina during sex.</i>	Convulsion, infertility, stomachache ^[14] .
	<i>Pavetta schumanniana</i>	Muliyambogo (Kitongwe)	RMK044	L	Fresh leaf paste applied in the vagina just before intercourse or leaf decoction taken orally about two hours before intercourse. <i>Treatment of heart burn and peptic ulcers.</i>	Treatment of theileriosis ^[61] .
Rutaceae	<i>Zanthoxylum sp</i>	Mkote (Kitongwe)	RMK012	R	Peeled dry root powder is added to hot porridge or tea which then mixed with either, a chicken egg, two tablespoon of honey or lamb oil. The concoction taken orally before three times a day before meals.	Management of diabetes, treatment of dental problems, anticonvulsion, malaria, gastrointestinal disorders, gonorrhoea, lung diseases, diarrhoea, rheumatism, worms, aphrodisiac, analgesic, skin conditions, febrifuge, cancer, diuretic, tonic, febrifuge, antihemorrhoids, and stimulant ^[62, 63] .
Solanaceae	<i>Datura stramonium</i>	Kamlevya	RMK047	L/F	<i>Tranquilizer</i> Fresh leaf/root paste is applied topically on the forehead of an individual.	Treatment of ulcers, inflammation, wounds, rheumatism and gout, sciatica, bruises, swellings, fever, asthma, bronchitis, fever recreational and parkinsonism ^[64, 65] . Skin disorders (<i>Datura stramonium</i> in combination with mustard oil), cough, fever, asthma, analgesic, purgative and mosquito repellent action ^[66] .
	<i>Dombeya shupangae</i>	Musubu	RMK014	L	<i>Treatment of haemorrhoids.</i> Powder of dried leaves is applied topically.	Abortion, management of diabetes, treatment of wounds and malaria ^[15, 67] .
Sterculiaceae	<i>Sterculia quinqueloba</i>	Mparamisi (mzungupori) jike	RMK007	L	<i>Dilating cervix to aid easy delivery/reducing dryness.</i> Paste prepared from clean fresh leaves is mix with palm oil (or other vegetable oil) is applied through the vagina.	Management of skin, earaches, diarrhoea and venereal diseases, fungal and mycobacterium infections ^[68] .
	<i>Bridelia carthatica</i>	Kamembe (Kitongwe)	RMK054	L	<i>Management of hypertension and diuretic.</i> Leaf infusion is taken orally.	Anaemia, asthma, constipation, fever, anorexia, cardiac pains, amoebic dysentery, hemorrhoids, female and male infertility, coughs, aphrodisiac, epigastric pain, malaria, rectal prolapsed, headache, epilepsy, kidney pain, purgative ^[23, 69] .
Tiliaceae	<i>Grewia sp</i>	Mkole (Kitongwe) Msha (Kiswahili)	RMK034	L	<i>Antidote for common poisons</i> Powder the leaves; mix with freshly boiled and cooled water, then drink.	Management of epilepsy ^[70] and Dental hygiene ^[71] .
	<i>Grewia sp</i>	Msubiani	RMK024	R/L	<i>Treatment of worms and fever</i> Leaf or root powder decoction is taken orally.	
Umbeliferaceae	<i>Steganotaenia araliaceae</i>	Kamunywanywa (Kitongwe)	RMK001	L	<i>Antidote for snake poisoning.</i> Leaf infusion is taken orally.	Vermifuge, ophthalmic solution, anticonvulsant, and diuretic ^[72] .

Mganasha/
Msubesubepori
(Kiswahili)

Hair growth promotion for
neonates.
Leaf powder, mix with any
oil like palm oil is as hair
tonic or the powder is added
in warm water for bathing.

Treatment of snake bite, arthritis,
chronic ulcer, gynecological
conditions, hypoglycemia, sore throat,
diuretic, dysentery, hypotensive,
wound healing, malaria, and
opportunistic infections from
HIV/AIDS [73].

Key; L – Leaves; SB – Stem bark; R – Roots; F – Flowers; E – Exudate; S – Seeds; P – Powdered

Table 2: Proportion of Plants in each Family

Family	Percentage of plants	Family	Percentage of plants
Euphorbiaceae	11.1%	Anacardiaceae,	5.6%
Rubiaceae	9.2%	Sterculiaceae	3.7%
Papilionaceae,	7.4%	Menispermaceae	3.7%
Tiliaceae	5.6%	Loganiaceae	3.7%
Combretaceae	5.6%	Asteraceae	3.7%
Apocynaceae	5.6%	Other families	1.85% each

Table 3: Proportions on Uses per Plant and Previous support

	Number of Plants	Percentage
Use(s) per plant		
More than one disease/health	18	33.3%
One disease/ condition	36	66.7%
Previous support		
Supported	19	35.2%
Not supported	33	61.1%
No reported studies retrieved	2	3.7%

DISCUSSION

In many societies, knowledge on traditional medicine and practices are left to old generations leading to knowledge gap between generations and pose the risk of losing these vital informations [7]. More or less similar case has been observed in our study. To preserve this knowledge, necessary scientific efforts of documentation through ethnopharmacological surveys to be conducted regularly. Simultaneously, voluntary succession of this knowledge to younger generations should be encouraged. To facilitate active participation of traditional healers, incentives should be provided and a proper mode of giving feedback to the traditional healers in a language they understand to be done. Their attitude towards researchers is built by feeling of being valued.

The most exploited plant parts reported to be used as medicine in our study were leaves followed by roots. Leaf medicinal plant drugs are environmentally favoured and friendly as they allow harvesting without destructing the wild plant when not over-exhausted. Mahonge *et al.*, 2006 [74], has reported a similar trend on leaf drugs predominating other plant parts. Although in some instances, roots have been reported as the predominant plant part being used [8,75]. In some places, the root drug is believed to contain high proportion of the active constituents [75]. To avoid flora extinction, it is better to avoid root drugs harvesting, unless necessary, should not over-harvested. For the purpose of enhancing this, knowledge on effective utilization of natural resources especially plants is very important to these traditional healers.

There are different modes of traditional medicine drug administration employed, depending on the purpose and disease/condition of the patient. In our study, internal oral administration was the most common route of administration stated. The trend has also been reported by Šavikin *et al.*, 2013 [76]. Though, enema and other topical routes of drug administration were also reported in our study.

The variations in dose and dosage observed are challenging, and the units of measures used were neither validated nor individualized. This could potentially lead to serious life threatening health conditions to

clients as a high number of toxic medicinal plants available [77]. Knowledge on proper dose scaling is important to traditional healers to prevent lethal effects to clients.

CONCLUSION

Traditional medicine serves as a primary health care in various remote areas. Plants reported in our study, also have been reported to be used in various areas for different health conditions indicating their potential in therapy. Necessary measures are needed to be in place to protect and preserve the future use of these plants. Scientific studies should be carried out for the purpose of drug discovery and development as well as formulation of standardized herbal medicines.

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Conflict of interest

Authors declare no conflict of interest

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