Documentation and consensus of indigenous knowledge on medicinal plants used by the local communities of western Uganda

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ABSTRACT

An ethnobotanical study was conducted to document the uses of medicinal plants among the local communities of western Uganda. The aim of the study was to identify and document plant species used for treatment of various ailments in the study areas, identify the commonly used plants, parts used, preparation and administration of herbal drugs. To find out the level of consensus or agreement between informants regarding the uses of plants for particular disease categories. Information on the plants was gathered between December 2010 and May 2011 from 124 informants using semi-structured interviews and discussions. For analysis of general use of plants, factor informant consensus (Fic) was used. The reported plants were collected and identified. The study revealed 231 plant species belonging to 72 families and 164 genera. These plants were used to treat various diseases and ailments grouped under 14 ailment categories, with the highest number of species (127) being used for gastrointestinal disorders followed by reproductive health disorders (75). The factor informant consensus highlighted low agreement in the use of plants. The highest Fic (0.61) was scored for the digestive problems, such as intestinal worms, stomachache and constipation. Aloe vera was used for malaria with the highest frequency of mention (26 mentions). Herbs (55%) were the main source of medicine followed by shrubs (18%). Leaves (65%) and roots (19%) were the main plant parts used in remedy preparation while decoction was the major form of preparation. Family Asteraceae accounted for 16% of the total species recorded. The majority of plants (53%) were harvested from wild habitats. The most important species according to their fidelity are Senna occidentalis (L.) Link for deworming, Aloe vera L. for malaria, Maytenus senegalensis (Lam) Exell for syphilis and Senecio hadiensis Forssk for miscarriages.The low consensus means the majority of informants do not agree or exchange information on the use of plant species and this may require bioactivity screening to justify the use for the reported ailments. The documented information regarding therapeutic uses provides basic data for further studies focused on pharmacological studies and conservation of the most important species.

Key words: Documentation, indigenous knowledge, medicinal plants, consensus, Uganda.
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INTRODUCTION

Medicinal plants have played an important role in treating and preventing a variety of diseases throughout the world [1]. They are an important source of therapeutic drugs and play a significant role in the survival of indigenous

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communities. Indigenous people treasure the rich knowledge of medicinal plants which has been developed over generations through trial and error. This knowledge is passed on orally from generation to another and is still retained by them. Recently, there has been an increased demand in herbal/ traditional medicine. These drugs are gaining popularity because of their natural origin and efficacy in treating various ailments [1]. Herbs are valued for their virtues as food as well as medicine. Herbal remedies may be prepared in different ways for use in treatment of diseases and ailments as decoctions, infusions, concoctions, maceration and bathing remedies. Ethnobotanical studies are important in revealing locally important plant species for the discovery of important drugs [2]. Documentation of indigenous knowledge of medicinal plants is important for preserving the knowledge before it diminishes with the knowledgeable people, so that plants can be conserved and sustainably managed and utilized by the local communities. The purpose of this study was to assess traditional knowledge with regard to respondents' demographic characteristics, such as, age, gender, knowledge transfer, etc. To document medicinal plant uses and associated indigenous knowledge for the management of various ailments in western Uganda; which is part of an initiative to document baseline data for future phytochemical and pharmacological studies. For analysis of general use of plants, factor informant consensus (Fic) was used.
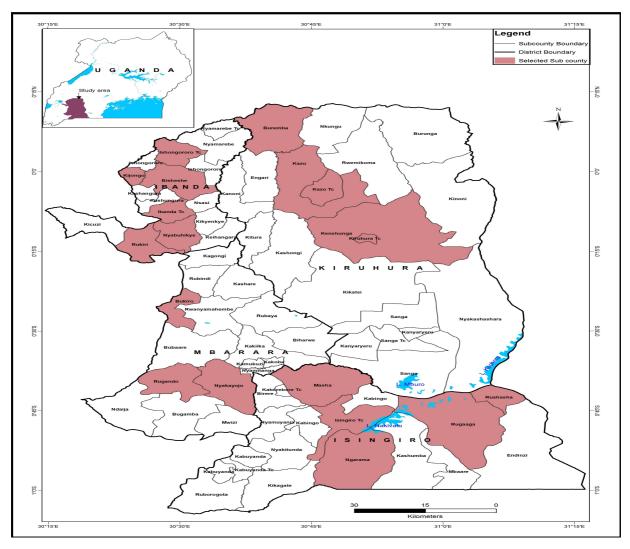

Figure 1. Location of study areas in western Uganda

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MATERIALS AND METHODS

Study area
The study was carried out in four districts in western Uganda; Mbarara, Ibanda, Kiruhura and Isingiro districts (Fig 1). The main livelihood activity in all the districts is agriculture which includes cultivation of crops and rearing of cattle and goats. The region experiences a mean annual rainfall ranging from 1,100 mm- 1,200 mm and temperatures ranging from 17ºC and 30ºC; where there are two wet seasons and 2 dry seasons. The people are mainly Banyankore, Bahima, Bakiga and some Immigrants from Rwanda, Democratic Republic of Congo and Sudan.

Ethnobotanical data collection
Field studies were conducted from December 2010 to May 2011. Methods of Martin [3] were followed for data collection and voucher specimen during field study. Local administrators were consulted with the explanation of aims of the research for the identification of key informants. They give advice regarding people with good information on herbal medicine. These informants also suggested the potential informants. Before conducting interviews, informants were asked for their consent.

The interview guide was used for gathering data about nutri-medicinal plants. Key informants who included herbalists, traditional birth attendants and other knowledgeable people like the elderly women were selected purposively based on their skills, knowledge and practices in medicinal plants usage. Semi-structured questionnaires designed for the traditional healers about medicinal plants knowledge mainly focused on local names of plants used, parts used and growth forms, ailments treated / managed, conservation status, mode of preparation and administration of the herbal remedies. The demographic characteristics of the respondents in this study include gender, age, occupational status and mode of knowledge acquisition. Interviews were conducted mainly in Runyankore dialect, with few exceptions in Kinyarwanda. Plant voucher specimens were collected and identified at Makerere University herbarium. Plant names were verified using the International Plant Name Index (IPNI).

Ethnobotanical data analysis
Ethnobotanical data obtained during the study were summarized using descriptive statistics [4]. Microsoft Excel software (2007) was used to identify proportions like plant families, habit, parts, frequency of citation and popularly used plants.

- Factor of informant consensus (Fic) for different ailment categories was calculated for testing homogeneity or consistency of the informant's knowledge about a particular remedy for a particular ailment [5,6].

$$Fic = \frac{N_{UR} - N_{taxa}}{N_{UR} - 1}$$

Where N_{UR} is the number of use reports in each category, N_{taxa} is the number of species in each category. The relative importance of a species is evaluated by the proportion of respondents who cited it.

- The percentage of respondents who have knowledge (PRK) regarding the use of a species (frequency of citation) in the treatment of diseases was estimated using the formula: (number of people interviewed citing species/ the total number of people interviewed) x 100 [7].
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- The percentage of informants claiming the use of a plant species for the same major purpose was estimated using the Fidelity level index, $FL = I_p/I_u$ x100, where I_p is number of informants who indicate use of a species for the same major ailment, I_u is the total number of informants who mentioned the plant for any other use [7].

RESULTS AND DISCUSSION

Demographic profile of the respondents
A total of 96 females (77%) and 28 males (23%) were interviewed. The age of respondents ranged from 23 to 83 years of age, with 50 of respondents (40%) above 50 years of age (Table 1). This is in agreement with previous studies which found that ethnobotanical knowledge increased with age [8,9,10]. In this study, 77% of respondents were women because of their role in preserving the knowledge of nutri- medicinal plants as home care takers, responsible for looking after children's health. The source of indigenous knowledge of medicinal plants is an

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important factor for the difference in knowledge among respondents. Inheritance of traditional knowledge of medicinal plants (95%) was the major source of knowledge acquisition; only 2% acquired knowledge through training. Knowledge was acquired from different sources which include parents, mothers –in-law, husbands, friends and elders. It was found that 51% of respondents learn from their parents since traditional knowledge is freely passed on among family members to the favoured children**.** Two percent (2%) of respondents obtained knowledge through supernatural powers. The study indicates that 72% of respondents were subsistence farmers and business people. Although these respondents use medicinal plants to treat ailments, they are not necessarily herbal medicine practitioners. Only 27% confirmed that they are traditional medical practitioners.

Table 1. Demographic data of the study respondents (*n=124***)**

Characteristic	Count	Percentage (%)	Characteristic	Count	Percentage (%)
Gender			**Occupation**		
Female	96	77	Farmer / business	90	72
Male	28	23	Traditional healer/herbalist	10	08
Age group			Traditional birth attendant (TBA)	23	19
20-29	11	09	LC 1	01	1.0
30-39	22	18	**Mode of acquisition of knowledge**		
40-49	41	33	Inheritance	118	95
>50	50	40	Training	3	02
			Supernatural powers	3	02

Informants' knowledge and consensus about medicinal plants

For the analysis of the general use of plants, factor informant consensus (Fic) was used to highlight plants of particular cultural relevance and agreement in the use of plants. Informants' consensus within a community and between cultural groups indicates which plants are widely used and thus aids in the selection of plants for pharmacological and phytochemical studies. In order to use this tool, illnesses were classified into categories (Table 2). Fic values range from 0-1 where increasing values of the factor indicate high rate of informant consensus among the illness category. A value near to zero (0) means that there is low degree of consensus / agreement among the informants about the use of plant species for the treatment of particular ailment category, or the plants used are chosen randomly. The average informant consensus value was 0.46. Medicinal plants presumed to be effective in treating a certain ailment have higher Fic values**.** The highest Fic (0.61) was scored for the gastrointestinal disorders including stomachache, intestinal worms, indigestion and colic pains. Within the GIT category, the main reported ailments were intestinal worms (108 reports and 60 species) and colic pains (55 reports, 51 species). The important plants used for deworming and colic pains were *Vernonia amygdalina* and *Erythrina abssinica* respectively. Other studies have indicated gastrointestinal disorders as the main problems in their study areas [11]. This may indicate the high incidence of these types of ailments in the study areas. Diseases that were found to be prevalent in the area were treated by variety of medicinal plants. The least agreement between informants was observed in the cardiovascular category with a Fic value of 0.14 followed by respiratory system disorders (Fic 0.20).

Table 2. Consensus of agreement about uses of medicinal plants among informants

Ailment category	$*N_{taxa}$	N_{UR}	Fic
Allergy (skin, eyes, teeth)	20	32	0.38
Cardiovascular (High Blood Pressure)	26	30	0.14
Dermatological (warts, measles, wounds, swollen scars, tinea, burns, paronychia, arthlete's foot)	37	56	0.34
Ear, Nose and throat (tonsillitis, sinuses, nosal bleeding	21	30	0.31
Endocrine and liver disorders (diabetes, liver disorders)	13	17	0.25
Gastrointestinal disorders (deworming, stomachache, colic pain, ulcers, dysentery, constipation, bloating)	127	327	0.61
Infectious diseases and genito-urinary disorders (cholera, syphilis, gonorrhea, Urinary infections, kidney problems, herpes zoster)	55	89	0.38
Fevers (malaria, typhoid, jaundice)	64	154	0.60
Neurological & Nervous system disorders (epilepsy, convulsions)	34	46	0.27
Reproductive and birth disorders (prolapsed uterus, uterine pains, placenta expulsion, promote fertility in women, induction of labor pains, sexual fluids in women, improve lactation, miscarriage, blocked fallopian tubes, Viagra)	75	134	0.44
Respiratory infections (whooping cough, asthma, flue, lung infections, chest pain)	23	28	0.20
Skeletal muscular pain & inflammation (headache, cancer/tumors, Splenomegally, arthritis, backache, joint pains, mastitis, cellulitis, bone fractures)	77	127	0.40
General health (hemorrhoids, eye infection, body cleanser, children diseases)	5	8	0.40
Poisonous animal bites (snake bite, dog & cat bites)	5	7	0.33
Total	582	1081	0.46

A species may be listed in more than one ailment category

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Medicinal plants and their uses

A total of 231 medicinal plants belonging to 72 families and 164 genera were documented from the study area. These plants were used to treat various diseases and ailments grouped under 14 ailment categories (Table 2). The frequency of citation for each ailment was used as a basis to identify the most frequently occurring ailments in the study areas. The common sicknesses in the study areas include deworming, stomach pains, malaria, syphilis and colic pains. The most utilized plant families were Asteraceae with 35 species, followed by Lamiaceae (18), Fabaceae (16) and Euphorbiaceae (13). Similar studies recorded Asteraceae, Fabaceae, Euphorbiaceae and Lamiaceae as the most represented families [12, 13, 14, 15]. The plants with high citations for any ailment were *Vernonia amygdalina* (44), *Aloe* species (38), *Ocimum suave* Willd (21), *Erythrina abyssinica* (19), *Plectranthus barbatus* (18) and *Rhus natalensis* (16) respectively. The frequency of citation could be an indication of the therapeutic value of a species [16]. *Aloe vera* has been reported as one of the frequently used plants for stomachaches and burns in a study done in Nepal [17]. In another study, *Vernonia amygdalina* was mentioned as the most frequently used plant for malaria [18]. In this study, most plants (76%) were mentioned more than once. For this analysis, plants mentioned 8 times and above were considered. Some plants were used to treat multiple ailments and therefore, could be of great importance in the management of various ailments**.** For instance, *Erythrina abyssinica* was reported to be used for colic pains, gonorrhea, dysentery, high blood pressure, headache, malaria, liver problems, syphilis, Splenomegally and nausea. The degree of agreement between informants on each medicinal plant in treating specific health problems was observed. *Aloe* species were the most popular plants having cited by 26 out of 124 informants (21%) for its medicinal value to treat malaria; followed by *Vernonia amygdalina* cited by 25 informants (20%) (Table 3). Some of the plants recorded in this study have been reported by other researchers; *Ageratum conyzoides* [19, 20], *Bidens pilosa* [21, 18], *Hoslundia opposita* [22], *Jatropha carcus* [23], *Microglossa pyrifolia* [24] , *Vernonia amygdalina* [25, 14] and *Fleuggea virosa* [15].

Plant parts used, growth forms, methods of preparation and administration

In this study, most plants (69%) were harvested from the natural vegetation; only 31% of the plants are domesticated. This is because all the respondents indicated that the plants are readily available and more so, such plants are more efficient than the cultivated ones. The plant parts commonly used for herbal remedy preparation are the leaves (63%) and roots (18%). Whole plants, fruits, seeds, flowers and tubers contributed less than 3%**.** The use of leaves is less destructive to the plant unlike the use of roots that involves digging up the plant which has a negative influence on the survival and continuity of the plant, hence affecting the sustainable utilization of the plant. This finding is consistent with the findings elsewhere [12, 26, 27] . Some plant species had all their parts used in remedy preparation. For instance, the leaves, stem bark, roots and flowers of *Erythrina abyssinica* are used to prepare different concoctions. This kind of harvesting is not good for the survival of the plants. Out of 219 medicinal plants recorded, highest numbers of plants belonged to herbs (54%) followed by shrubs (19%), trees (16%), climbers (10%) and lianas (1%). There was no standardized measure on dosage of herbal remedies. Herbal remedies were prepared using either fresh plant material (72%) or dried material (8%). In some cases, a plant was used both in dry and fresh forms (20%). Plant remedies were prepared by boiling plant parts, pounding or squeezing the fresh material, cooking or steaming, burning and chewing. Herbal remedies were prepared mainly as water extracts using single plant species. A single plant species contains chemical compounds that curtail several infections, while a mixture (concoction) of plants is effective due to the additive and synergistic effects of a combination of plants that they have during treatment, as well as similar compounds acting on different pathogens. To enhance extraction of phytochemical compounds, different additive substances like honey, fermented porridge, rock salt, eggs and milk are mixed with plant parts during preparation of remedies. The medicinal plant preparations were administered through oral and topical routes.

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Table 3. Ethnobotanical data on medicinal plants and uses in the study areas

*Species identity	Growth habit	Parts used	Conservation status	Use reports per ailment	Preparation and administration	PRK (n=124) (%)
Acanthaceae *Justicia betonica* L. Nalongo (Ru) AS097	Climber	L	C/R	Colic pains (1), deworming (1), dysentery (1), malaria (4), Splenomegally (1)	Boil, or pound, add water and drink 250 ml 3x daily	6.0
Monechma subsessile C. B. Clarke Erazi (Ru) AS101	Herb	L/R/Fl	W/A	Deworming (6), asthma (1), malaria (1)	Boil, mix extract with eggs & milk; pound add water and drink	6.0
Aloaceae *Aloe* sp Rukaka (Ru), Kikaka rubamba (Ki) AS107	Herb	L/sap	W/C/A	Burns (1), malaria (26), Jaundice (3), colic (1), constipation (2) diabetes (1), High blood pressure (1), kidney stones (1), wounds (1), headache (1)	Apply sap on affected area; boil, drink with hot millet porridge	30
Anacardiaceae *Rhus natalensis* Bernhrex Krauss Omusheeshe (Ru), Umusagara (Ki) AS067	Tree	L	W/A	Cancer (2), measles (1), constipation (2), miscarriage(4), syphilis (2), uterine pains (2) Splenomegally (1), ulcers (1), placenta expulsion (1)	Boil, or pound and add water, drink or bathe	13
Apiaceae *Steganotaenia araliacea* Hochst. Omuhanurankuba (Ru) AS115	Shrub	L/R	W/A	Convulsions (1), labor pains (3), expel placenta (2), open cervix at birth (1), headache (1)	Pound, add water sprinkle patient; boil fresh leaves drink ½ cup at onset of labor pains	6
Asteraceae *Ageratum conyzoides* L. Butabuta (Ru) AS116	Herb	L	W/A	Uterine pains (3), Splenomegally (2), cancer (1), colic (1), deworming (1), wounds (1)	Dry, add powder to water and dink 2 teaspoons 3 x daily; boil drink 1 cup daily or smear affected area	7
Bidens pilosa L. Enyabarashana (Ru), Inyabarashana (Ki) AS102	Herb	L	W/A	Colic pains (1), malaria (2), nose bleeding (2), ulcers (2), tumors (1), uterine pains(1), wounds (2), promote fertility in women (1), convulsions (1), fever in HIV patients (1)	Boil drink 1 cup daily; pound tie on wound or drop extract in nose	11
Conyza bonariensis (L.) Cronquist Nyambuba (Ru) AS090	Herb	L	W/A	Asthma (1), deworming(1), sinuses (1), tinea corporis (2), ulcers (1), wounds (1), syphilis (1)	Pound boil drink; or dry add powder to food or tea; chew bark for ulcers, add Vaseline to powder and smear skin	6
Crassoephalum bojeri (DC.) Robyns Omukunda (Ru) AS108	Herb	L/R	W/A	Constipation (1), deworming (3), ulcers (2), labor pains (1), flue (1)	Pound add water drink; add powder to tea	6
Crassocephalum vitellinum S. Moore Esuununu (Ru) AS055	Herb	L	W/A	Uterine pains (4), fever in HIV patients (2), cancer (1), Splenomegally (1), miscarriage (4), headache (1), labor pains (1) syphilis (1)	Pound add water & rock salt, boil and drink ½ cup 3x daily; or insert in birth canal for uterine pains	12
Erlangea tomentosa S. Moore Ekyoganyanja (Ru) AS056	Herb	L	W/A	Colic pains (2), stomachache (3), syphilis (2), fever (1) miscarriage (1)	Boil with rock salt and drink 1 cup daily; pound add water and dink	7
Guizotia scabra Chiov. Ekiterankuba (Ru) AS117	Herb	L/R/Fl	W/R	Burns (1), colic pains (4), convulsions (2), syphilis (2), malaria (2), wounds (1), measles (1)	Burn apply ash on burns; pound smear body or apply extract on wounds	10
Microglossa pyrifolia Kuntze Akafugankande (Ru) AS036	Shrub	L/R	W/A	Convulsions (3), malaria (4), miscarriage (1) skin allergy(1), syphilis (2), stomachache (2)	Boil, drink 1/ cup daily; apply powder in nose for convulsions	10
Vernonia amygdalina Delile Omubirizi (Ru), Umubirizi (Ki) AS062	Shrub	L/R	W/A	Burns (1), colic (1) deworming (12), malaria (25), liver problems (1), syphilis (1), ulcers(1), wounds (1), skin rash (1)	Pound, mix with banana juice, boil drink 500ml twice daily; pound smear affected area.	35
Vernonia lasiopus O. Hoffm. Omujuma (Ru) AS103	Herb	L	W/A	Constipation (1), deworming (4), malaria (8), skin allergy (1), stomachache (1)	Boil with rock salt, drink ½ cup 3xdaily; or drink 250ml of infusion	12
Capparidaceae L. *Cleome gynandra* Eshogyi (Ru) AS109	Herb	L/R	C/A	Convulsions (1), labor pains (2), High blood pressure (1), expel placenta (1), skin allergy (1), toothache (1), joint pains (2), epilepsy (1),	Chew; boil eat as vegetable; pound and massage	8
Capparaceae L. *Capparis sepiaria* Kabakura (Ru) AS098	Shrub	L/R	W/A	Cancer (1), deworming (9), skin allergy (1)	Chew or boil and drink 3 teaspoons 3 x daily before eating	9
Celastraceae (Lam.) Exell *Maytenus senegalensis* Omunyabiriko (Ru) AS098	Tree	L/R/Bk	W/C/R	Asthma (1), dysentery (1), syphilis (7), tinea capitis (1), mastitis (1) Splenomegally (1), wounds (1), malaria (1)	Boil, drink 5500 ml 3x daily or bathe	11
Crassulaceae *Kalanchoe densifolia* Rolfe Ekinyondo (Ru) AS093	Herb	L	C/R	Colic pain (1), ear infection (2), HBP (1), Splenomegally (2), stomachache (2), ulcers (1), uterine pains (1), athletes' foot (1)	Steam, apply extract on affected area, or drink extract	9
Euphorbiaceae Jaub. & Spach *Clutia abyssinica* Omubarama (Ru) AS110	Herb	L	W/A	Allergy (1), HBP (1), convulsions (1), deworming (1), miscarriage (1), Splenomegally (1) stomachache (1), uterine pains (1)	Boil add rock salt, or pound add water drink ½ glass daily; bathe	6
Fleuggea virosa (Roxb. Ex.	Shrub	L/R	W/A	Asthma (2), cancer (1), colic pain(1),	Pound, add water drink	8

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Willd) Voigt Omubweera (Ru) AS028				stomachache (4), deworming (1), gonorrhea (1)	with milk 500 ml 3x daily	
Jatropha curcas L. Omunoowe (Ru) AS010	Shrub	L/sap	C/R	Syphilis (2), tinea capitis (1), wounds (6)	Apply leaf sap on affected body part; or pound add water and bathe	7
Phyllanthus capillaris Schumach. Omuturika (Ru) AS111	Herb	L	W/A	Deworming (1), measles (4), HBP (1), uterine pains (1), malaria (1), miscarriage (1)	Boil, drink 500ml 3x daily; or pound add water bathe	7
Fabaceae *Cajanus cajan* (L.) Druce Entondeigwa (Ru) AS104	Shrub	L	C/R	Asthma(1), convulsions (1), deworming (1), eye infection (1), hemorrhoids (1), HBP (1), malaria (1), sinuses (1), Splenomegally (1), syphilis (1), tonsillitis (1)	Pound, boil drink 250ml 3x daily, and bathe	9
Erythrina abyssinica Lam. Ekiko (Ru) AS080	Tree	L/Bk/Fl/R	W/A	Colic pains (5), syphilis (3), Splenomegally (2), nausea(1), dysentery (1), HBP (1), liver pains (1), malaria (1), stomachache (1) gonorrhea (1), hiccups in HIV patients (1), liver disorders (1)	Boil, add honey drink 500ml 3xdaily; burn, lick ash or apply on incisions for splenomegally.	15
Indigofera arrecta Hochst. Ex. A. Rich Omushoroza (Ru) AS118	Herb	L/R	W/A	Bone fractures (2), cancer (2), deworming (2), convulsions (1), tonsillitis (1), Splenomegally (1), joint pains (1) skin allergy (1)	Pound, mix with jelly and smear affected area; boil add rock salt drink 1 teaspoon 3 x daily; boil use water to make porridge, drink	9.6
Rhynchosia resinosa Hochst ex. Baker Akategansi (Ru) AS014	Herb	L	W/R	Colic pain (2), syphilis (4), deworming (1), miscarriage (3), Splenomegally (1), wounds (1), malaria (1), uterine pains (1)	Boil, drink 3 teaspoons 3x a day, drink infusion	11
Senna didymobotrya (Fresen) H.S. Irmin & Barneby Omugabagaba (Ru) AS088	Tree	L/Fl	W/A	Cancer (1), constipation (3), deworming (2), colic (1), syphilis (1), Splenomegally (1), wounds (1), malaria (1)	Boil 2 spoons of powder in 500ml water, drink 2 teaspoons 3x daily	9
Flacourtiaceae *Trimeria grandifolia* (Hochst.) Warb Omwatanshare (Ru) AS112	Shrub	L	W/A	Splenomegally (7), skin allergy (1), malaria (2), deworming (1), constipation (1)	Add rock salt boil and drink; burn to ashes, apply ash on affected area	9.6
Lamiaceae *Achyrospermum axillare* E. A. Bruce Kitiinwa (Ru) AS099	Herb	L	C/R	Allergy (2), deworming (2), malaria (3), Splenomegally (1), stomachache (2)	Pound, add water drink 500ml daily	8
Hoslundia opposita Vahl. Esiteimwe (Ru) AS008	Shrub	L/Fl	W/A	Colic pain (1), enema (1), headache (1), malaria (3), miscarriage (1), Splenomegally (1), stomachache (1), syphilis (1), uterine pains (2), wounds (1)	Boil or pound, add water drink 1 cup daily; pound leaf insert in birth canal	10
Leonotis nepetifolia Ekicumucumu (Ru) AS119	Herb	L	W/A	Colic (2), convulsions (1), deworming (4), dysentery (1), miscarriage (1), uterine pains (2)	Pound add water drink 500ml 3x daily or bathe; 1 teaspoon child	9
Mentha aquatica L. Enkomanyangwa (Ru) AS089	Herb	L	W/A	Colic pains (2), convulsions (1), deworming (1), liver (1), malaria (1), miscarriage (3), Splenomegally (1), syphilis (1), uterine pains (1)	Boil or pound, add water drink 3 teaspoons 3x daily; or chew	9.6
Ocimum suave Willd. Omwenyi (Ru) AS059	Herb	L	W/A	Allergy (1), body cleanser (1), colic pain (1), constipation (1), deworming (3), flue (1), stomachache (9), uterine pains (2), headache (1), Splenomegally (1)	Boil or pound and add rock salt drink ½ cup 3 daily; or dry use powder in tea /food	17
Plectranthus barbatus Andrews Ekicuncu (Ru) AS105	Herb	L	C/A	Deworming (4), sinuses (1), UTIs (1), skin allergy (1), stomach infections (10), syphilis (1)	Boil add rock salt drink warm on empty stomach, drink 250ml daily, 1 tablespoons for child	14
Plectranthus kamerunensis Gürke Kashenda (Ru) AS114	Herb	L	C/R	Colic pains (1), deworming (1), HBP (2), stomachache (2), ulcers (2)	Steam and chew, or boil and drink ¼ cup daily	6
Tetradenia riparia (Hochst.) Codd Omuravunga (Ru), Umuravunga (Ki) AS075	Herb	L	C/A	Asthma (1), constipation (1), deworming (1), flue (2), headache (2), induce labor pains (1), malaria (1), sinuses (1), ulcers (1)	Pound, boil and drink ½ glass twice daily; apply extract in nose	9
Myricaceae *Myrica salicifolia* Hochst ex. A. Rich (Omujeeje) (Ru) AS106	Tree	L/Bk/R	W/A	Constipation (1), convulsions (1), flue (1), stomach infections (2), mastitis (1), headache (1), uterine pains (1)	Dry add powder to tea or food; use 1 teaspoon to 500ml water and drink with porridge	6.0
Myrisinaceae *Maesa lanceolata* Forssk. Omuhanga (Ru) AS020	Tree	Seeds/L/R	W/A	Athletes' foot (1), cancer (1), deworming (1), fever (2), Splenomegally (1), syphilis (1), tonsillitis (3), viagra (1)	Pound, boil 2 spoons of powder in 500ml water, drink 2 teaspoons 3 x daily, ½ teaspoon for child or chew	9.0
Polygonaceae *Rumex usambarensis* Dammer ex Peter Omufumbagyesi (Ru)	Herb	L/St	C/R	Allergy (8), colic (1), headache (1), miscarriage (1), tonsillitis (1)	Pound boil mix with millet porridge and drink; chew stem or leaf	9.6

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AS100						
Solanaceae *Physalis peruviana* L. Entuutu (Ru) AS077	Herb	L	W/C/R	HBP (1), malaria (1), menstrual pains (1), nausea (1), Splenomegally (2), stomachache (6)	Pound add water dink 1 cup daily	9.6
Verbenaceae *Clerodendrum capitatum* Hook. Ekishekashekye (Ru) AS120	Shrub	L	W/A	Deworming (3), stomachache (5)	Boil or pound, add water and drink 500ml daily	6
Lantana trifolia L. Omuhukye (Ru) AS049	Shrub	L/fruit	W/A	Asthma (1), eye infection (1), malaria (1), tonsilitis (1), typhoid (2), ulcers (1), whooping cough (1)	Macerate in hot water and drink ½ glass 3x daily	6
Vitaceae *Cyphostema adnocaule* Steud. Ex. A. Rich Omumara (Ru) AS113	Climber	L	W/A	Cancerous tumors (3), deworming (2), eye infection (1), malaria (1), miscarriage (2), paronychia (2), Splenomegally (1), syphilis (1), tonsillitis (1)	Pound add banana juice drink ½ cup 3 x daily; steam, apply juice in eyes; apply fresh leaf extract on incisions	11

*Column 1: * species identity includes family, species & local names; Ethnic language (Ru:Runyankore, Ki: Kinyarwanda), Voucher specimen code. Column 3: L-leaf, R-root, st-stem, Bk-bark, Fl- Flower; Column 4: C/A- Cultivated & abundant; W/A- Wild & abundant; C/R-cultivated and rare; W/R- wild and rare; Column 7: PRK – Percentage respondent's knowledge*

The high percentage of oral administration of remedies calls for more attention on testing for the safety, mainly toxicological properties of these herbal remedies. The recommended dosage for oral intake differs among informants for treating the same health problem. Informants indicated that the doses for liquid preparations were prescribed in terms of a full, half or one quarter of a mug or tea cup and a table spoon, depending on the age of the patient and type of disease being treated. Dosages varied between 100-500 ml (a cup) for adults; 100 – 250 ml (half a cup) for older children above 5 years; and 1 -3 tea spoons for children below 5 years. The drugs were taken 1-3 times a day for a period ranging from 1 – 30 days or until the patient's condition is improved, an anomaly that is different from the conventional therapy medicines.

Fidelity level (FL) of the commonly used plants
Fidelity level is useful for identifying the key informants' most preferred species used for treating certain ailments. The medicinal plants that are widely used by the local people have higher FL values than those that are less popular. Fidelity level shows the percentage of informants claiming the use of a certain plant species for the same major purpose [28]. This is designed to quantify the importance of the species for a given purpose [7]. For the category of deworming, *Senna occidentalis* (FL= 100) was found to be the most important species. The maximum FL for the plants indicated 100% choice of informants for treating specific ailments; an indication of their healing potential [28, 29].

Table 4. Fidelity level (FL) values of the frequently reported plants and their major uses

Plant species	Family	Therapeutic uses	No. of informants (I_p)	Total No. of informants (I_u)	Fidelity level (%)
Rumex usambarensis	Polygonaceae	Allergy	8	12	67
Senna occidentalis	Fabaceae	Deworming	7	7	100
Jatropha curcas L.	Euphorbiaceae	Wounds	6	9	67
Plectranthus barbuts	Lamiaceae	Stomach infections	11	14	78
Capparis sepiaria	Capparaceae	Deworming	9	11	82
Vernonia amygdalina	Asteraceae	Malaria	25	33	75
Aloe vera	Aloaceae	Malaria	26	38	68
Maytenus senegalensis (Lam.) Exell	Celastraceae	Syphilis	7	14	50
Trimeria grandifolia (Hochst.) Warb.	Flacourtiaceae	Splenomegally	7	13	54
Senecio hadiensis	Asteraceae	Prevent miscarriage	5	7	71

I_p =number of informants who use a species for a specific ailment; I_u = total number of informants who mentioned the plant for any other use

CONCLUSION

The study indicates that the study area has plenty of medicinal plants to treat a wide spectrum of human ailments. It is evident from the interviews that knowledge of medicinal plants is not only limited to traditional healers, herbalists and elderly persons but to all age groups and categories of people. The average informant consensus factor of 0.46 is low, indicating that different remedies were cited for different ailments and the agreement ratio was low. Harvesting of roots is a big threat to conservation of medicinal plants diversity. The plants documented have the potential of being used in drug development. The pharmaceutical importance of medicinal plants in western Uganda and documented indigenous practices can contribute to national drug development if it receives the attention it deserves. Although the respondents claimed a high level of efficacy from the herbal remedies, it is important to standardize

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the drug preparation, dosage and route of administration, so as to match western medicine procedures. The study results suggest that there is a need for validation of the reported species for their efficacy.

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