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Medicinal plants used by traditional medicine practitioners for the treatment of HIV/AIDS and related conditions in Uganda

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ABSTRACT

Introduction and objectives: In Uganda, there are over one million people with HIV/AIDS. When advanced, this disease is characterized by life-threatening opportunistic infections. As the formal health sector struggles to confront this epidemic, new medicines from traditional sources are needed to complement control efforts. This study was conducted to document herbal medicines used in the treatment of HIV/AIDS and related opportunistic infections, and to document the existing knowledge, attitudes and practices related to HIV/AIDS recognition, control and treatment in Sembabule, Kamuli, Kabale and Gulu districts in Uganda.
Methods: In this study, 25 traditional medicine practitioners (TMPs) were interviewed using structured questionnaires.
Results: The TMPs could recognize important signs and symptoms of HIV/AIDS and its associated opportunistic infections. The majority of practitioners treated patients who were already receiving allopathic medicines including antiretroviral drugs (ARVs) prescribed by allopathic practitioners.

There were 103 species of medicinal plants identified in this survey. Priority plants identified include *Aloe* spp., *Erythrina abyssinica*, *Sarcocephalus latifolius*, *Psorospermum febrifugum*, *Mangifera indica* and *Warburgia salutaris*. There was low consensus among TMPs on the plants used. Decoctions of multiple plant species were commonly used except in Gulu where mono-preparations were common. Plant parts frequently used were leaves (33%), stem bark (23%) and root bark (18%). About 80% of preparations were administered orally in variable doses over varied time periods. The TMP had insufficient knowledge about packaging and preservation techniques.
Conclusions: Numerous medicinal plants for treatment of HIV/AIDS patients were identified in the four districts surveyed and the role of these plants in the management of opportunistic infections warrants further investigation as these plants may have a role in Uganda's public health approach to HIV/AIDS control.

1. Introduction

About one million Ugandans are infected with HIV, a predominantly sexually transmitted virus that targets the immune system (UNAIDS and WHO, 2008). The advanced stage of the disease is known as the Acquired Immune Deficiency Syndrome (AIDS). Untreated, infected individuals develop profound suppression of the immune system and become susceptible to a wide range of infections (opportunistic infections) and certain malignancies. Consequently, the HIV/AIDS epidemic has dramatically increased the

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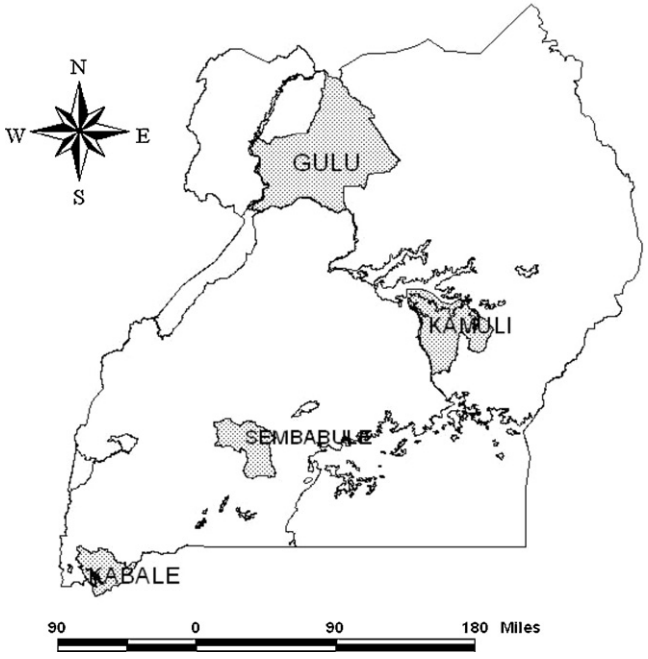

Fig. 1. Map of survey districts in Uganda.

health needs of the Ugandan population, placing great demands on the formal health sector.

Life-long therapy with antiretroviral drugs (ARVs) is the only treatment with proven efficacy against HIV (Palella et al., 1998). In recent years, free access to ARVs has increased in Uganda. However, as of 2008, it is estimated that less than 50% of the patients requiring ARVs were actually receiving treatment (UAC, 2007). Moreover, most ARV treatment sites are located in towns and urban centres whereas access to treatment in rural areas remains disproportionately low.

Uganda has a diverse and rich medicinal plant resource relative to other parts of Africa (Davis et al., 1986). Previous studies have identified numerous medicinal plants used for various diseases of public health significance such as malaria and tuberculosis in Uganda (Adjanohoun et al., 1993; Tabuti et al., 2003; Kokwaro, 1993). However, traditional medicine (TM) practice remains largely unregulated and poorly integrated into the formal health sector, and there are scarce data on medicinal plants used for HIV/AIDS treatment (Yahaya et al., 2004).

Documentation of Ugandan TM is critical to safeguard indigenous knowledge and conserve medicinal plant species, both of which are rapidly being lost (Kingdon, 1990). Importantly, documentation of TM can facilitate future research on the safety and efficacy of medicinal plants in the treatment of HIV/AIDS when used either alone or concurrently with ARVs.

The objectives of this study were to collect comprehensive data from traditional medicine practitioners (TMPs) on medicinal plants commonly used for HIV/AIDS treatment and to document the methods of preparation and administration of TM, in four rural districts of Uganda.

2. Methods

This survey employed an ethnobotanical approach comprising of TMP interviews in four Ugandan districts, Sembabule, Kamuli, Kabale and Gulu (Fig. 1). The four districts are predominantly rural districts which were selected on the basis of cultural and geographic diversity.

Ethical approval for this study was obtained from the Uganda National Council of Science and Technology (registration number HS 410). Before interviewing any respondent, the study team members explained the objectives of the study, methods and the plans for use of the data that were to be generated from the interviews. Verbal consent to conduct the interviews was sought from every respondent before the interview and was granted in every case. In preparation for the survey, semi-structured questionnaires were developed to collect data on TMP demographics, knowledge on TM and TM treatment practices. These questionnaires were pretested in a pilot survey and subsequently refined. During the actual survey, one TMP in each district was identified based on their reputation and participation in previous ethnobotanical surveys. A snowball sampling approach was used to identify other TMPs in the respective district (Tongco, 2007; Bernard, 2002). A few TMPs were identified by chance. Only TMPs who treated HIV/AIDS patients were included in the survey. A member of the study team served as an interpreter when necessary.

At the end of each interview, voucher specimens of plants mentioned by the interviewees were collected. The plants were identified by staff at Makerere University Herbarium (MHU) and named according to the Flora of Tropical East Africa (FTEA). Plant voucher specimens were processed and indexed as JRST and KCB and deposited at the MHU. The voucher specimens of commonly known plants were not indexed.

Clinical conditions treated in HIV/AIDS patients were coded using the Economic Botany Data Standard (www.kew.org/tdwguses). Questionnaire and botanical data were transferred into Excel® spreadsheets for coding and preliminary analysis. The dataset was exported to SPSS® statistical software Version 11.0 for Windows (SPSS Inc., Chicago, IL) for statistical analysis. The data were summarized in means and frequencies. Plant prioritization was based on frequency of use among TMPs and across districts. An Informant Consensus Factor (ICF) was calculated among the four study areas to determine the probability that respondents were using almost similar medicine plants (Albuquerque et al., 2006; Heinrich, 2000). The ICF was estimated by computing the difference between the number of TMPs reporting use of TM in the treatment of HIV/AIDS (n_{TMP}) and number of taxa (n_t) mentioned per district divided by the number of TMPs (n_{TMP}) minus one. The following expression was used to calculate the ICF.

$$\text{ICF} = \frac{n_{TMP} - n_t}{n_{TMP} - 1}$$

A high ICF (close to 1) suggests that the community is confident in the choice of plants, whereas a low ICF (close to 0) implies that the community is still experimenting and that the treatments may not be effective. In all cases, the calculated ICF was less than 0 and is not reported on further.

3. Results

3.1. Respondents' biographic details

We interviewed 25 TMPs, 10 from Kamuli district and five each from Sembabule, Gulu and Kabale districts. Nineteen of the interviewed TMPs were male. The median age (inter-quartile range) of respondents was 50 (43–58) years. Ten TMPs had attained post-primary formal education. Other demographic characteristics of TMPs across districts are shown in Table 1.

Twenty-four TMPs attended to male and female patients and five TMPs treated pregnant women and children as well. TMPs estimated that they received on average 29 (range, 2–250) patients each year. Most TMPs ($n = 18$) received patients who were already on treatment with allopathic medicines and 10 respondents

Table 1
Demographic characteristics of respondents.

Characteristic	Frequency
Ethnicity	
Acholi	5
Mukiga	5
Muganda	5
Munyoro-Mutooro	3
Mululi	3
Musoga	3
Munyoli	1
Religion	
Christian	16
Muslim	8
Animist	2[a]
Main occupation[b]	
TMP	17
Farmer	6
Tree nursery operator	1
Carpenter	1
Clergy	1
Other occupations	
TMP	9
Farming	13

[a] One TMP mentioned two religions.
[b] One TMP disclosed two main occupations.

reported that they received patients who were already on ARVs from ARV treatment sites (Fig. 2).

The TMPs acquired knowledge about the treatment of HIV/AIDS from interaction with colleagues in the practice ($n = 9$), from their parents ($n = 5$) and through experimentation ($n = 5$). Other sources of knowledge acquisition mentioned included books and the press.

3.2. Knowledge about HIV/AIDS

The term commonly used to refer to HIV/AIDS is *Slim* ($n = 19$). Other local terms used include *Munywenje* (Runyakitara), *Tuo jonyo* (Acholi) and *Mukenenya* (Luganda). TMPs commonly identify HIV/AIDS by a skin rash, diarrhea and other symptoms or by reviewing patients HIV laboratory test results performed at allopathic medicine centres and laboratories ($n = 8$) (Table 2). The majority of the TMPs reported that HIV is infectious and caused by unprotected sexual intercourse and the sharing sharp instruments with persons infected with HIV. However, two TMPs reported that HIV is transmitted by vectors (flies) from the wounds or fecal material of infected persons while one thought the delivery of twins resulted in HIV/AIDS.

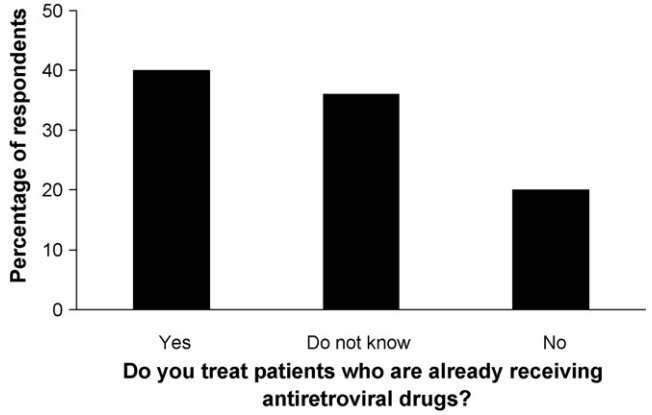

Fig. 2. Proportion of TMPs treating patients already receiving antiretroviral therapy.

Table 2
Signs and symptoms by which TMPs recognize HIV/AIDS patients.

Symptom	Frequency
Rash	13
Diarrhea	12
Cough	8
Anorexia	6
Pallor	6
Weight loss	6
Fever	5
Headache	4
Herpes zoster	4
Reddening of the lips	4
Chronic cough	3
Weakness	4
Skin ulceration	3
Vomiting	3
Abdominal pains	2
Chills	2
Constant headache	2
Difficulty swallowing	2
Painful urination	2
Genital ulcers	2
Oral ulcers	2
Sexually transmitted infections	2
Skin lesions	2
Skin pigmentation changes	2
Others[a]	15

[a] Each of the following symptoms was mentioned once by TMPs: joint pains, bad thoughts, bleeding, bone pains, divination, bitter taste in mouth, silky hair, hypertension, insomnia, Kaposi sarcoma, loss of relatives, paralysis, scalp lesions, and vaginal discharge.

3.3. Treatment practices and plant species used by TMPs for HIV/AIDS patients

The TMPs mentioned 145 plant species in the study (Table 3). Of these, 103 plant species belonging to 47 families were identified. The families Asteraceae (14%), Mimosaceae (9%) and Euphorbiaceae (7%) contributed the majority of the species. Five species mentioned by more than four or more TMPs in more than one district were prioritized as shown in Table 4. One other specie, *Psorospermum febrifugum* was mentioned by five TMPs, but from one district. The parts of the plant most frequently used were the leaves, stem bark and the root bark (Fig. 3). Specific HIV/AIDS-related conditions treated by TMPs using these medicinal plants are shown in Table 5.

3.4. Medicine preparation, administration and storage

Commonly, decoctions of plant species were prepared using water or milk. The decoctions were mono-preparations (53.8%) or mixtures of multiple plant species (46.2%). A median of six (range, 2–20) plant species were used in the mixtures. Gulu and Kabale districts reported more mono-preparations compared to the other districts.

Most medicinal preparations (80%) were orally administered in variable doses. The other routes of administration included smearing ointments, tying crushed herbs on wounds and bathing. About half of the TMPs ($n = 13$) advised their patients to take the medicinal preparations after food while others gave no advice with regard to meals. Rituals were rarely used to accompany medicinal preparations for HIV/AIDS.

Medicinal preparations were commonly prepared in small portions and prescribed for short durations (about 2–3 days). For longer storage, TMPs reported using preservation methods including making of powders, adding rock salt, *Azadirachta indica* extracts or honey, drying and burning to make ash. The medicines were commonly packaged in plastic bottles (which were washed and re-used as necessary) and plastic bags.

Table 3
Medicinal plants used to manage HIV/AIDS in Kamuli, Sembabule, Kabale and Gulu districts.

ID	Scientific name	Specimen number	Family	No. of TMPs	No. of districts	Local name (Dialect)				Habitat	Part used[a]	Habit
						Kamuli (Soga)	Sembabule (Ganda)	Kabale (Kiga)	Gulu (Acholi)			
1	*Aloe* sp.	KCB 29, 114, 70	Aloaceae	7	4	Kikaka, Kigagi	Kigagi	Rukaka	Ataka-rach	Homestead Garden, Pathside in Thicket	L, RB	Shrub
2	*Erythrina abyssinica* DC.	KCB 55	Papilionaceae	5	3	Muyirikiti		Kiko	Lucoro	Fallow	SB	Tree
3	*Sarcocephalus latifolius* (Sm) E.A. Bruce	JRST 801, KCB 64	Rubiaceae	5	2	Mutamatama			Munyu	Pathside in Thicket	RB, WR, TUBER	Shrub/Tree
4	*Psorospermum febrifugum* Spach.	JRST 797	Guttiferae	5	1	Kanziroziro					SB, WR.RB	Shrub
5	*Mangifera indica* L.	*	Anacardiaceae	4	3	Muyembe	Muyembe		Mango		SB	Tree
6	*Warburgia salutaris* (Bertol. f.) Chiov.	JRST 752	Canellaceae	4	3	Abasi	Abasi	Mwiha		Homestead compound	SB, RB	Tree
7	*Albizia coriaria* Oliv.	KCB 11, JRST 805	Mimosaceae	3	2	Musita	Omugavu			Farmland	SB	Tree
8	*Carissa edulis* (Forssk.) Vahl	KCB 10	Apocynaceae	3	2	Muyonza	Muyonza			Anthill thicket	RB, SB	Shrub
9	*Clerodendrum myricoides* (Hochst.) R.Br. ex Vatke	KCB 36	Verbenaceae	3	2		Kikonge		Okweru	Banana plantation	WR, RW	Shrub
10	*Eucalyptus* sp.	*	Myrtaceae	3	2	Kalitusi		Kalitusi			L, SB	Tree
11	*Maesa lanceolata* Forssk.	KCB 32	Myrsinaceae	3	2		Omuwanga (omuwon-dowondo)	Muhanga		Banana plantation	WR, L, RW	Shrub
12	*Maytenus senegalensis* Exell	JRST 799, KCB 1	Celastraceae	3	2	Muwaiswa (Ligwalimu)	Nabuliko			Road-side	RB, RW, SB, L	Shrub
13	*Piliostigma thonningii* (Schumach.) Milne-Redh	JRST 765	Caesalpiniaceae	3	2	Kilaama			Ugali	Road-side	RB,	Tree
14	*Plectranthus barbatus* (Andrews) Forsk.	KCB 22	Lamiaceae	3	2		Kibwankulata	Kicuncu		Banana plantation	L	Herb
15	*Acalypha villicaulis* Hochst.		Euphorbiaceae	3	1	Mugandu					WR	Herb
16	*Azadirachta indica* A. Juss.	JRST 758	Meliaceae	3	1	Neem				Home garden	WP	Tree
17	*Morella kandtiana* Engl.	*	Myricaceae	3	1		Nkikimbo				WR, SB, SW	Shrub
18	*Psidium guajava* L.	*	Myrtaceae	3	1	Mupeera					L, RB	Tree
19	*Steganotaenia araliacea* Hochst.	KCB 60	Apiaceae	3	1				Olwiru	Thicket	WR, RB	Tree
20	*Acacia seyal* Del.	KCB 12, JRST 804	Mimosaceae	2	2	kikongoito	Akasana			Road-side	SB	Tree
21	*Acacia sieberiana* DC.	KCB 13	Mimosaceae	2	2	Mufunuwanduzi	Omweramannyo			Road-side	SB	Tree
22	*Capparis tomentosa* Lam.	KCB 5, 52	Capparaceae	2	2		Kirobo omumyufu		Okuma	Banana plantation, Thicket	WR, RB	Shrub

23	*Citrus limon* (L.) Burm. f.	*	Rutaceae	2	2	Eniimu		Endiimu			L, F	Tree
24	*Securidaca longipedunculata* Fres.	JRST 715	Polygalaceae	2	2	Mukondwa	Mukondwe				RB	Tree
25	*Spathodea campanulata* Beauv.	*	Bignoniaceae	2	2	Kinalisa		Mwatashare/Kifabakazi			SB	Tree
26	*Acacia gerrardii* Benth.	KCB 25	Mimosaceae	2	1		Muwawa, Munyinya			Thicket	SB	Tree
27	*Bidens pilosa* L.	*	Asteraceae	2	1			Nyabarashana			L	Herb
28	*Capparis erythrocarpos* Isert.	KCB 26	Capparaceae	2	1		Kirobo omwelu			Thicket	WR, SB	Shrub
29	*Dracaena steudneri* Engl.	*	Dracaenaceaea	2	1		Kajolyenjovu				SB	Shrub
30	*Flueggea virosa* Voigt	KCB 4	Euphorbiaceae	2	1		Lukandwa			Banana plantation	SB, WR	Shrub
31	*Leonotis nepetifolia* (L.) W.T. Aiton	KCB 116	Lamiaceae	2	1			Kicumucumu		Homestead compound	L	Shrub
32	*Sesbania sesban* (L.) Merr.	KCB 15	Mimosaceae	2	1		Ntatembwa, Muwoganyanja			Homestead garden	L, SW	Shrub
33	*Venonia amygadalina* Del.	*	Asteraceae	2	1			Mubirizi			L, RW	Shrub
34	*Zehneria scabra* (L.f.) Sond.	KCB 113	Cucurbitaceae	2	1			Kabindizi		Road-side	L	Herb
35	*Acacia campylacantha* Hochst. ex A. Rich.	*	Mimosaceae	1	1	Kibere					SB	Tree
36	*Acacia mearnsii* De Willd.	*	Mimosaceae	1	1			Burikoti			SB	Tree
7	*Adenia cissampeloides* Harms	JRST 798	Passifloraceae	1	1	Lugelogelo					RB, SB, L	Shrub (woody climber)
38	*Ageratum conyzoides* L.	KCB 115	Asteraceae	1	1			Bukabuka		Homestead compound	L	Herb
39	*Alstonia boonei* De Wild.	*	Apocynaceae	1	1	Mubadangalabi					SB	Tree
40	*Ananas sativa* Schult. f.	*	Bromeliaceae	1	1	Enanansi					F	Herb
41	*Aspilia kotschyi* (Sch. Bip.) Oliv.	KCB 106	Asteraceae	1	1			kiterankuba		homestead garden	L	Herb
42	*Bartsia* sp.	KCB 108	Scrophulariaceae	1	1			Kanisampato		homestead garden	L	Herb
43	*Bidens* sp. (not pilosa)	*	Asteraceae	1	1	Mugosoola (Mukazi)					WR	Herb
44	*Bridelia micrantha* (Hochst.) Baill.	KCB 9	Euphorbiaceae	1	1		Katazimiti			fallow	WR	Shrub
45	*Carica papaya* L.	*	Caricaceae	1	1	Papali					L	Tree
46	*Cassia nigricans* Vahl.	KCB 53	Caesalpiniaceae	1	1				Aban ceng	pathside	L	Herb
47	*Centella asiatica* (L.) Urban	KCB 97	Apiaceae	1	1			Kutukumwe Class 1		homestead garden	L	Herb

Table 3(*Continued*)

ID	Scientific name	Specimen number	Family	No. of TMPs	No. of districts	Local name (Dialect)				Habitat	Part used[a]	Habit
						Kamuli (Soga)	Sembabule (Ganda)	Kabale (Kiga)	Gulu (Acholi)			
48	*Chenopodium opulifolium* Koch. & Ziz	KCB 118	Chenopodiaceae	1	1			Mujuma			L	Herb
49	*Coffea arabica* L.	*	Rubiaceae	1	1			Mwani			L	Shrub
50	*Combretum molle* R. Br. Ex. G. Don.	*	Combretaceae	1	1		Ndagi				SB	Tree
51	*Commelina benghalensis* L.	*	Commelinaceae	1	1			Etiija			WP	Herb
52	*C. bonariensis* (L.) Cronquist	KCB 96	Asteraceae	1	1			Wambuba		homestead garden	L	Herb
53	*Crassocephalum crepidioides* (Benth.) S. Moore	KCB 99	Asteraceae	1	1			Sununu		homestead garden	L	Herb
54	*Solanecio mannii* (Hook. f) C. Jeffrey	KCB 62	Asteraceae	1	1				Ta-lyech		RW	Shrub
55	*Crotalaria glauca* Willd.	KCB 54	Papilionaceae	1	1				Abora	garden	RB	Shrub
56	*Echinops amplexicaulis* Oliv.	KCB 67	Asteraceae	1	1				Lutikwang	elephant grass	WR	Herb
57	*Entada abyssinica* Steud. ex A. Rich.	*	Mimosaceae	1	1		Mwolola				L, SB	Tree
58	*Erythrococca bongensis* Pax.	KCB 16	Euphorbiaceae	1	1		Musonji sonji			homestead	L	Shrub
59	*Euphorbia stapfii* Berger	KCB 2	Euphorbiaceae	1	1		Lubowa			banana plantation	SAP	Shrub
60	*Ficus mucuso* Ficalho	KCB 69	Moraceae	1	1				Olam	fallow		Tree
61	*Ficus natalensis* Hochst.	*	Moraceae	1	1			Kitoma			L	Tree
62	*Grewia pubescens* Beauv.	JRST 806	Tiliaceae	1	1	Mukomakoma					RB	Shrub/Tree
63	*Guizotia scabra* (Vis) Chiov.	KCB 58	Asteraceae	1	1				Unknown	spear grass	L, SB, FL, F	Herb
64	*Helichrysum nudifolium* (L.) Less. var. *oxyphyllum* (DC.) Beentje	KCB 65	Asteraceae	1	1				Abongo-nyar	elehpant grass	WR	Herb
65	*Hydrocotyle mannii* Hook.f.	KCB 98	Apiaceae	1	1			Kutukumwe Class 3		homestead garden	WP	Herb
66	*Hygrophila auriculata* Heine	*	Acanthaceae	1	1	Unknown					L	Herb
67	*Hymenocardia acida* Tul.	*	Euphorbiaceae	1	1		Mbaluka				SB	Shrub/Tree
68	*Ipomoea hidebrandtii* Vatke	KCB 103	Convolvulaceae	1	1			Unknown		homestead garden	L	Shrub
69	*Ipomoea wightii* Choisy	KCB 18	Convolvulaceae	1	1		Lubowa			homestead garden	SAP	Herb
0	*Justicia betonica* Linn.	KCB 17	Acanthaceae	1	1		Nnalongo			homestead garden	L	Herb
1	*Justicia flava* Vahl	KCB 23	Acanthaceae	1	1		Kalaza			pond bank	L	Herb

72	*Bryophylllum pinnatum* (Lam.) Oken	*	Crassulaceae	1	1	Kisanasana						L	Herb
73	*Kigelia africana* (Lam.) Benth.	*	Bignoniaceae	1	1	Naizongwe						RB	Shrub/Tree
74	*Lonchocarpus laxiflorus* Guill. & Perr.	JRST 803	Papilionaceae	1	1	Muzugangoma						RB	Tree
75	*Markhamia lutea* K. Schum.	*	Bignoniaceae	1	1	Musambya						RB	Tree
76	*Mentha* sp. (close to *Mentha* × *piperata*)	KCB 24	Lamiaceae	1	1		Nabugira				banana plantation	L	Herb
77	*Microglossa pyrifolia* (Lam.) O. Kuntze	KCB 3	Asteraceae	1	1		Kafuga Nkande				banana plantation	WR	Shrub
78	*Moringa oleifera* Lam.	KCB 59	Moringaceae	1	1				Kakwalu		garden	L, F	Tree
79	*Musa paradisiaca* L.	*	Musaceae	1	1			Gonja				L	Tree
80	*Ocimum sauve* Willd.	*	Lamiaceae	1	1			Mujaja				L	Shrub
81	*Olea europaea* L.	*	Oleaceae	1	1				Olive oil				Tree
82	*Parsea americana* Mill.	*	Lauraceae	1	1			Vacado				SEEDS	Tree
83	*Piptadeniastrum africanum* (Hook.f.) Brenan	*	Mimosaceae	1	1		Mpewere					SB	Tree
84	*Plumbago zeylanica* L.	KCB 35	Plumbaginaceae	1	1		Musajja abanda				banana plantation	WR	Herb/Shrub
85	*Polyscias fulva* Harms.	KCB 31	Araliaceae	1	1		Setaala				banana plantation	SB	Tree
86	*Prunus africana* (Hook.f.) Kalkman.	KCB 109	Rosaceae	1	1			Muba			homestead	RB, RW	Tree
87	*Pseudocedrela kotschyi* (Schweinf.) Harms.	KCB 68	Meliaceae	1	1				Oputu		spear grassland		Tree
88	*Rauvolfia vomitoria* Afzel	*	Apocynaceae	1	1		Kawule					WR	Shrub/Tree
89	*Rhus natalensis* Bernh.	KCB 34	Anacardiaceae	1	1		Musese				banana plantation	SB	Shrub
90	*Rhus vulgaris* Meikle	KCB 7	Anacardiaceae	1	1		Tebuda (akak-wasokwanso)				homestead garden	L	Shrub
91	*Sapium ellipticum* (Hochst.) Pax	*	Euphorbiaceae	1	1	Musaasa						RB	Shrub/Tree
92	*Senna occidentalis* (L.) Link.	KCB 63	Caesalpiniaceae	1	1				Yat-Akwota (Tulala)		stream bank	L, WR	Herb
93	*Sida cuneifolia* Gray	*	Malvaceae	1	1	Keyeeyo (Kaku-mukumu)						L	Shrub
94	*Sigesbeckia orientalis* L.	KCB 33	Asteraceae	1	1		Seziwundu				banana plantation	L	Herb

Table 3(*Continued*)

ID	Scientific name	Specimen number	Family	No. of TMPs	No. of districts	Local name (Dialect)				Habitat	Part used[a]	Habit
						Kamuli (Soga)	Sembabule (Ganda)	Kabale (Kiga)	Gulu (Acholi)			
95	*Solanum incanum* L.	*	Solanaceae	1	1	Ntengotengo					RB	Shrub
96	*Terminalia glaucescens* Benth.	*	Combretaceae	1	1	Musasa					RB	Tree
97	*Tetradenia urticifolia* (Baker) Phillipson	KCB 111	Apiaceae	1	1			Muravunga		homestead garden	L	Shrub
98	*Tropaeolum majus* L.	KCB 101	Tropaeolaceae	1	1			Unknown		homestead garden	L	Herb
99	*Vernonia adoensis* Walp.	*	Asteraceae	1	1			Bijumero			L	Herb/Shrub
100	*Vitex ferruginea* Schumach. & Thonn.	KCB 61	Verbenaceae	1	1				Ana-lyech	stream bank	RB	Shrub/Tree
101	*Zanthoxylum chalybeum* Engl.	*	Rutaceae	1	1	Ntala ya irungu					SB, WR, RB, SW, RW	Shrub/Tree
102	*Zanthoxylum gillettii* (De Wild) Waterm.	*	Rutaceae	1	1		Muyenye				SB	Tree
103	*Zanthoxylum leprieurii* Guill. & Perr.	*	Rutaceae	1	1	Ntala ya irungu					SB, WR, RB, SW, RW	Tree

*Commonly known plant.

[a] Part used: L, leaves; RB, root bark; RW, root wood; SB, stem bark; WR, whole root.

Table 4
The most frequently used herbal medicine plant species in the management of HIV/AIDS in Sembabule, Kamuli, Kabale and Gulu Districts of Uganda.

Scientific name	Family	Voucher number	Part used[a]	Habit[b]	No. of TMPs	No. of districts	Condition treated
Aloe sp.	Aloaceae [JT1]	KCB 70	L, RB	H	7	4	Fever, hepatitis
Erythrina abyssinica DC	Papilionaceae	KCB 55	RW, SB, RB	T	5	3	Cough
Sarcocephalus latifolius (Sm) E.A. Bruce	Rubiaceae	JRST 801, KCB 64	RB, WR	S	5	2	Diarrhea, sexually transmitted diseases
Psorospermum febrifugum Spach.	Guttiferae	JRST 797	SB, RB, WR,	S	5	1	Skin sores
Mangifera indica L.	Anacardiaceae	JRST 785	SB, RB	T	4	3	Diarrhea, cough
Warburgia salutaris (Bertol.f.) Chiov.	Canellaceae	JRST 752, 780	SB	T	4	3	Cough

[a] Part used: L, leaves; RB, root bark; RW, root wood; SB, stem bark; WR, whole root.
[b] Habit: H, herb; T, tree; S, shrub.

The TMPs assessed patient recovery by patient feedback. According to TMPs, 84% of their patients confirmed that their condition improved following the use of medicinal preparations. However, only 48% of the TMPs interviewed kept records indicating whether or not their patients had recovered and none of the TMPs used hospital laboratory tests to confirm recovery.

4. Discussion

4.1. Traditional knowledge of HIV/AIDS treatment

HIV/AIDS is a relatively new disease—first described in Uganda in 1985 (Serwadda et al., 1985), and the practice of TM for HIV/AIDS does not appear to be well developed. Knowledge about HIV/AIDS treatment was acquired mainly from colleagues and by experimentation and there has been no opportunity for refinement of this process over generations.

In contrast to allopathic medicine—which makes the distinction between the treatment of HIV infection and the treatment of associated opportunistic infections, TMPs appeared to focus on the treatment of AIDS symptoms and opportunistic infections. This is expected because HIV infection may be asymptomatic for extended periods and patients are likely to seek treatment only at the later stages of the disease when AIDS-related symptoms and opportunistic infections occur.

4.2. Treatment practices and medicinal plants

Many plant species identified in this survey belonged to the families Asteraceae and Euphorbiaceae, which are well recognized for their medicinal value in Uganda (Hamill et al., 2000). These plants are widely distributed in nature and chances of TMPs experimenting with them are high. The disagreement (or the very low ICF) in plants reported by different TMPs may be explained by the fact that TMPs treated the AIDS conditions and opportunistic infections rather than HIV infection *per se*. For example, *Mangifera indica*, *Erythrina abyssinica*, *Warburgia salutaris* and *Eucalyptus* sp.—which were identified in this survey, are medicinal plants recognized for treatment of coughs and some opportunistic infections in HIV/AIDS present with cough (Gautam et al., 2007; Hamill et al., 2000; Tabuti et al., 2010). Alternative plants were used for treating patients presenting with other symptoms. Other factors which could have contributed to the low consensus include imperfect transfer of TM knowledge, diversity in cultural backgrounds of TMPs, high plant diversity in the study areas and declining knowledge of medicinal plants (Thomas et al., 2009).

The underlying cause of the clinical disorders seen in HIV/AIDS patients is the progressive loss of CD4 positive T-cell lymphocytes in blood. These cells are important because they mediate immune responses and their depletion is associated with opportunistic infections (Kaslow et al., 1987). In a pre-clinical study in Cuba, a stem bark extract of *Mangifera indica* was shown to prolong survival of T-cell lymphocytes by opposing T-cell activation—a significant mechanism for T-cell depletion in HIV/AIDS patients (Hernandez et al., 2006). This finding suggests that *Mangifera indica* may have beneficial effects on the immune system of HIV/AIDS patients however, its role in actual patients remains to be established.

Knowledge on the efficacy and safety of the other priority plants is derived mainly from a few *in vitro* studies. A sequiterpenoid isolated from the extract of *Warburgia salutaris* has demonstrated antibacterial activity (Rabe and van Staden, 2000) and this characteristic may be useful for bacterial infections in HIV/AIDS patients. In contrast, the extract of *Erythrina abyssinica* lacks antibacterial activity, it however may be useful in the treatment of malaria which is co-endemic with HIV/AIDS in Uganda (Wagate et al., 2010; Yenesew et al., 2003). The extract of *Erythrina abyssinica* should however be used with caution because it contains chalcones which are toxic to intestinal cells (Cui et al., 2008).

This survey provides a first view of the wide range of medicinal plants used for treatment of HIV/AIDS patients in the study districts. Conservation of these medicinal plants is critical. Medicinal plants may yield novel compounds that may be of interest for drug development and some African medicinal plants have recently

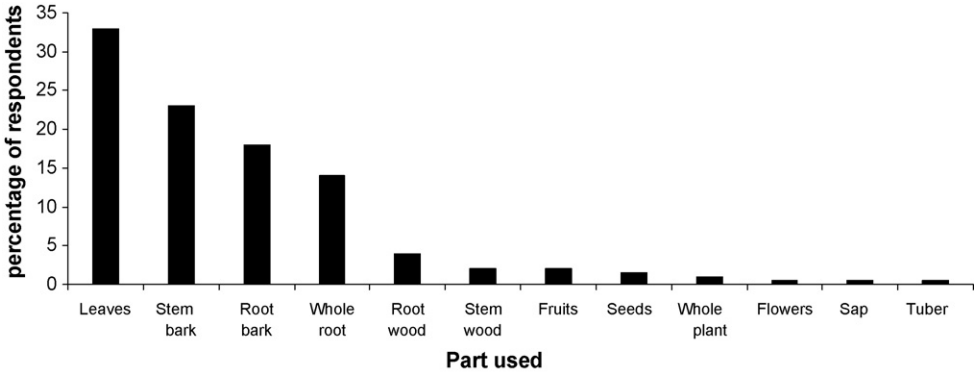

Fig. 3. Distribution of plant parts used for medicines.

Table 5
AIDS conditions and opportunistic infections treated by TMPs.

Conditions treated	Frequency	Category
Diarrhea	16	Digestive system disorders
Cough	8	Respiratory system disorders
Sores	8	Skin/subcutaneous cellular tissue disorders
Venereal diseases (non-specified)	5	Infections/infestations
Colic	4	Digestive system disorders
Carbuncles	4	Skin/subcutaneous cellular tissue disorders
Rashes	4	Skin/subcutaneous cellular tissue disorders
Appetite stimulant	3	Nutritional disorders
Chest pain	3	Pain
Dysuria	3	Genitourinary system disorders
Bleeding	3	Blood system disorders
Bloat	3	Digestive system disorders
Helminth worm infestations	2	Digestive system disorders
Malaria	2	Infections/infestations
Other pain	2	Pain
Sore throat	2	Respiratory system disorders
Tuberculosis	2	Infections/infestations
Candidiasis	2	Infections/infestations
Oedema	2	Abnormalities
Arthritis	1	Muscular–skeletal system disorders
Malignant neoplasms	1	Neoplasms
Breathlessness	1	Respiratory system disorders
Epigastric pain	1	Pain
Fever	1	Infections/infestations
Hepatitis	1	Infections/infestations
Lactation stimulant	1	Pregnancy/birth/puerperium disorders
Nasal discharge	1	Respiratory system disorders
Anaemia	1	Blood system disorders
Vomiting	1	Digestive system disorders
Malaise/fatigue	1	Ill-defined symptoms

been shown to have anti-HIV activity (Klos et al., 2009). Although the medicinal plants identified in this survey appeared to target opportunistic infections, the presence or absence of specific activity against HIV can only be established after appropriate *in vitro* studies. Record keeping among TMPs should also be improved upon to facilitate the verification of claims of the effectiveness of their preparations.

We observed that TMPs frequently advised their patients to take TM with food. Food may reduce stomach irritations caused by TM. Also, food may increase absorption of TM (and potentially increase efficacy) or decrease absorption of TM (possibly to reduce side-effects of potent agents). In addition, food may be given to increase blood glucose levels which may be reduced by some medicinal plants (Ojewole, 2004). While food intake may be desired, it is important to note that food may not always be available to patients. The chronic debilitating nature of HIV/AIDS is such that patients may be unable to work for extended periods, leading to food insufficiency. In order to minimize risks arising from non-compliance to food recommendations, clarification of the role of food during administration of the different TM preparations is needed.

Unfortunately, TM packaging and storage methods do not comply with the proposed standards of the Ugandan regulatory authorities. Re-used plastic containers and plastic bags were used, raising concerns of possible contamination of the TM preparations. In order to improve on this practice, TMP sensitization and education on safe packaging and storage of TM preparations is needed.

4.3. Role of TM in Uganda's HIV/AIDS response

With increasing access to ARVs in Uganda, an important consideration is the potential for interactions between TM and ARVs when they are administered concurrently. Some classes of ARVs have great potential for unwanted herbal–drug interactions (Lee et al., 2006; Piscitelli et al., 2002) and some African medicinal plants have shown potential for unfavorable drug–herbal interactions with ARVs in laboratory studies (Brown et al., 2008; Mills et al., 2005). Although it is recommended that clinicians collect information on TMs used by patients on ARVs (MOH, Jun 2009), patients may not know the actual medicinal plants being used or may underreport the use of TM during their ARV clinic visits. Ethnobotanical studies are therefore crucial to identify the panel of medicinal plants being used in order to facilitate pharmacologic studies to characterize the potential of these agents to affect the metabolism and activity of ARVs.

Nevertheless, positive roles have been identified for TM in Uganda's HIV/AIDS response. The Ugandan government highlights TM as a key resource for the expansion of prevention and treatment services for opportunistic infections (UAC, 2007). This is because TMPs cater to health needs of the general community and are well positioned to provide primary health care services relevant to HIV/AIDS. In order to prevent the spread of HIV/AIDS to the community, public health officials should engage TMPs in order to equip the TMPs with the skills for disseminating prevention messages to their patients. Also, improved referral systems between TMPs and ARV clinics can increase HIV/AIDS testing and treatment efforts. Furthermore, research collaborations between TMPs may promote research and development of new treatments from medicinal plant sources. In order to take advantage of these opportunities, TMPs must be reassured that their intellectual property rights will be protected during collaborations with other stakeholders. An ongoing dialogue between the Ugandan government and TMP associations is therefore needed to share information on the safety of TM, potential for interactions with ARVs and to delineate the role of TMPs in the HIV/AIDS response.

5. Conclusion

Based on the findings of this survey, TM may have a role in Uganda's public health approach to HIV/AIDS control. Many medicinal plants identified in this survey that are used to manage the numerous ailments occurring in HIV/AIDS patients, need to have their value in the therapeutic management of HIV/AIDS-related opportunistic infections investigated.

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