Accepted Manuscript

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PII: S2210-8033(16)30078-1
DOI: http://dx.doi.org/doi:10.1016/j.hermed.2016.10.001
Reference: HERMED 154

To appear in:

Received date: 29-12-2014
Revised date: 15-9-2016
Accepted date: 5-10-2016

Please cite this article as: Nyamukuru, Antonia, Tabuti, John R.S, Lamorde, Mohammed, Kato, Benard, Sekagya, Yahaya, Aduma, Philip R., Medicinal plants and traditional treatment practices used in the management of HIV/AIDS clients in Mpigi District, Uganda.Journal of Herbal Medicine http://dx.doi.org/10.1016/j.hermed.2016.10.001

Medicinal plants and traditional treatment practices used in the management of HIV/AIDS clients in Mpigi District, Uganda

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Highlights

HIV/AIDS is a disease of global public health concern. Conventional research focuses primarily on allopathic medicine with minimal research on traditional practices. We investigated the treatment practices and diagnostic practices of traditional medicine practitioners (TMPs) of Mpigi District of Uganda. The TMPs use a large number of plant species reported here, with little overlap of species and formulations. Traditional medicine practitioners base their diagnosis of patients on already performed standard laboratory tests for HIV, client history and symptoms. There is a risk of classifying some uninfected individuals as HIV/AIDS clients.

Abstract

HIV/AIDS is a relatively modern disease that has caused extensive morbidity, mortality and suffering worldwide. Although modern laboratory methods for diagnosis and effective allopathic treatments for HIV/AIDS are available there is limited documentation on practices and treatments used by traditional medicine practitioners (TMPs) in the context of HIV/AIDS. We conducted this study to determine how TMPs of Mpigi and Butambala districts in Uganda diagnose and treat HIV/AIDS and to describe the materials they use. We used an ethnobotanical approach to interview TMPs. TMPs diagnose HIV/AIDS from patients' own disclosure, history of death of spouse or on the basis of symptoms such as chronic fever. We found that the TMPs administer widely differing herbal medicine formulations with little overlap of plant species to treat HIV/AIDS. The species used are described in this paper. Herbal medicines are prepared in mixtures averaging 20 or more species, and are administered orally and intermittently. Some herbal medicines were reported to have adverse effects and/ or contraindications and the TMPs provided advice concerning their safe use to their patients. Some patients are reported to use herbal medicines concomitantly with ARVs and the clinical consequences of this practice are poorly understood. We conclude that TMPs are experimenting with therapies for HIV/AIDS and that there is need to undertake rigorous efficacy and safety studies as well as controlled clinical studies to validate TMPs' therapeutic claims.

Key words: drug discovery, Traditional treatments, Ethnobotany; ethnomedicine

1.0 Introduction

HIV/AIDS is a pandemic with devastating impact on human health and livelihoods. Globally, 35 million people were living with HIV at the end of 2013 (UNAIDS, nd). Since the start of the epidemic, approximately 78 million people have become infected with HIV and 39 million people have died of AIDS-related illnesses. In the same report, Sub-Sahara Africa was identified as the most heavily affected region, accounting for over 69% of all people living with HIV in the world, and it is also the region with the most AIDS related deaths. In 2013, there were 24.7 million people living with HIV in sub-Saharan Africa.

There is no cure for HIV/AIDS however laboratory diagnostics and allopathic treatments have been developed to manage the condition. Widely used diagnostic methods include rapid antibody tests and other immunologic tests such as the CD4 count and virologic tests such as viral loads (World Health Organization, 2013). For treatment, life-long antiretroviral therapy (ARV) containing a combination of at least three drugs is recommended as suppressive treatment for HIV/AIDS. However, other allopathic treatments such as antibiotics are also used to manage opportunistic infections that can occur as a result of a compromised immune system in HIV/AIDS patients.

In contrast, documentation of the methods used in the diagnosis and treatment of HIV/AIDS patients by TMPs, that were conducted in 4 districts in Uganda found that only 8/25 of TMPs used laboratory test results to diagnose HIV/AIDS in clients. The majority of TMPs used a wide range of diverse symptoms that suggests that some patients could be incorrectly assigned a HIV positive status (Lamorde et al. , 2010). Also in that work, only 20% of TMPs excluded patients who were already receiving antiretroviral drugs suggesting that there is potential for co-treatment with herbal medicines and ARVs. These statistics are underpinned by the widespread popularity of herbal medicines worldwide, and in developing countries like Uganda where it is estimated that up to 60% of the population use traditional medicines for basic health needs (World Health Organization, 2002)

Although ARVs are the cornerstone for management of HIV/AIDS, the efficacy of ARVs may be compromised by the emergence of resistant HIV strains and by the occurrence of treatment-limiting drug toxicity (Mills et al., 2005). Co-treatment of ARVs and herbal medicines could result in herbal-drug interactions that could in theory affect efficacy of ARVs or lead to development of toxicities (Mills et al., 2005). In the absence of interactions, toxicities arising from herbal medicine use can be wrongly ascribed to ARVs further complicating clinical management of these patients. It is therefore necessary to document in the local setting the treatment practices of TMPs in order to facilitate appropriate care for patients.

Furthermore, efforts are in progress to discover new effective treatments for HIV/AIDS. One approach to drug discovery is to evaluate traditional knowledge and practices in order to identify phytochemicals with relevant biologic activity. Important allopathic medicines have been discovered using this approach. For example, the antimalarial drug artemisinin and its derivatives were discovered by evaluating Chinese traditional knowledge (Bilia et al. , 2014). For these reasons efforts to evaluate local knowledge and practices are justified. This study was conducted to determine the treatments and practices of the TMPs in Mpigi and Butambala districts of Uganda.

2.0 Methods

This study was conducted among healers of Buyijja Traditional Healers Association (BUTHG), a traditional medicine practitioners' organisation. The BUTHGA is broadly affiliated to PROMETRA Uganda located at Buyijja village, approximately 60 km from Kampala the capital city of Uganda. The participating TMPs were residents of Mpigi and Butambala districts, which were part of the former greater Mpigi District. These districts are some of the areas with the highest HIV/AIDS prevalence in Uganda (Ministry of Health, 2012).

We employed an ethnobotanical approach in this study, comprising of individual interviews with 60 traditional medicine practitioners (48 females and 12 males; at the time of the study this comprised 30% of the total TMPs), two key informant interviews (KIIs) and one focus group discussion (FGD) with five traditional medicine practitioners (TMPs). The TMPs were identified with the help of BK, a member of staff of PROMETRA-Uganda, and were interviewed in their homes using an open and close ended questionnaire. The main themes directing the interviews were to understand which medicinal plants were used to manage HIV/AIDS, which parts of the plants were used, how the traditional medicine is processed and administered, and which diseases associated with HIV were managed by TMPs. Socio-demographic information was also collected. During the KII and FGD we discussed issues of how diagnoses for HIV/AIDS are made and how clients are followed up to verify improvements. We also discussed known contraindications, adverse effects and toxicity effects of the preparations, and known clinical outcomes of the treatments. These interviews were facilitated by ML a physician and pharmacologist (questionnaire available on- line in supplementary data).

Voucher specimens of plants mentioned during the interviews were collected, indexed as AN, and deposited at Makerere University Herbarium (MHU) for identification and archival. Plant species scientific nomenclature follows the international database Tropicos (www.tropicos.org/). A transect walk with TMPs was undertaken to validate species identity in the field with TMPs. Data from questionnaires was summarised into frequencies. We prioritised among the species mentioned in the survey based on the frequency of mention of use among the TMPs. We searched the journals; Journal of Ethnopharmacology, East African Medical Journal, and Phytotherapy Research using the key words HIV/AIDS, herbal medicine and traditional medicine to determine corresponding uses of the species used to treat HIV/AIDS in our study area.

Clearance and approval for this study was obtained from the Uganda National Council of Science and Technology (Registration Number (NS 373). Before data collection, a sensitization meeting was held with the TMPs in which the objective of the study and methods of data collection were explained. During the same meeting, issues of Intellectual property rights related to the study including data disclosure arrangement were discussed and prior informed consent (PIC) requested. We also agreed on issues of sharing benefits from the study if any. The TMPs agreed to collaborate in the study and signed the prior informed consent agreement.

3.0 Results

3.1 Traditional medicine practitioners s' demographic and socio-economic characteristics

The traditional medicine practitioners (TMPs) who participated in this study had attained only low levels of formal education, not exceeding High school level. Only two had achieved skilled education necessary for gaining salaried employment in Uganda. The TMPs were consequently engaged in crop farming for their livelihoods (77%) (Table 1). Knowledge of practicing traditional medicine was acquired from sharing information with fellow TMPs in structured classes run by PROMETRA-Uganda (60%) or from family members (38%). The TMPs had sufficient experience in traditional medicine ranging between 5 – 20 years, with most TMPs having spent 5 – 10 years in the practice (55%).

3.2 Diagnosis and treatment of HIV/AIDS using traditional medicine

3.2.1 Disease Diagnosis

Almost all Traditional Medicine Practitioners (93%) who participated in this study were involved in treating HIV/AIDS. Some of their patients were receiving ARVs. The TMPs identify HIV/AIDS from history provided by patients with a known diagnosis. These patients reveal their HIV status to them after performing HIV tests in hospitals or laboratories. Alternatively, HIV/AIDS may be identified

based on unconfirmed suspicions arising from death of a spouse that was known to have HIV/AIDS. A history of death of a spouse increases suspicion of HIV if the living partner is ill. In other cases, TMPs receive clients who complain of signs and symptoms highly suggestive of HIV/AIDS. The TMPs mentioned that such symptoms include cough, body rash, weight loss, or long-standing fever. After identifying these signs and symptoms, the TMPs proceeds to ask the client to visit a conventional hospital and perform a laboratory test (e.g. a test for syphilis), fully aware the client would also be requested to undergo an HIV test. A rapid test is generally performed and patients receive results within a few hours. In conventional medical practice in Uganda, HIV/AIDS is usually diagnosed by a rapid serologic test for HIV. The test is widely available and offered free of charge through the national health system.

3.2.2 Traditional medicine formulation

Traditional medicine practitioners (TMPs) commonly prepare formulations from mixtures of an average of 20 species (range 10 – 110). These formulations are locally known as "Kadomolo", and are prepared as decoctions. Alternatively, the medicine may be formulated in powder form. Formulations are prepared from fresh or dried material. Plant material is dried under shade. The harvested plant parts are spread on a clean floor or a mat for 3 to 4 days. Further drying is done under direct sunshine. Medicinal baths comprising macerations of leaves from a variety of plant species are prescribed for bedridden clients or very weak clients to gain energy. Laxatives are also administered to cleanse the stomach and to remove "dead cells" from the body.

When preparing decoctions, leaves and herbs are boiled for shorter periods, while woody parts (barks and stem/root wood) are boiled longer. Boiling time ranges from 30 minutes to 8 hours depending on the species and the parts used. Barks of species like *Spathodea campanulata, Albizia coriaria* and *Erythrina abyssinica* are intentionally boiled for longer periods because they are believed to be toxic. Woody parts are boiled first before other plant parts are added.

3.2.3 Traditional medicine administration

Most formulations are administered orally in widely varying doses by different TMPs. A 3-litre jerrycan is provided to clients to be used within one week. Specifically, clients are advised to drink approximately 100 ml of the drug three times a day. The dose is reduced to 50 ml three times a day for very ill clients. Children receive half the adult dose. Patients are advised to take the medicines with food, preferably just after eating. Clients should also not drink alcohol for the duration of the treatment, while patients on ARTs are advised to take herbal formulations four hours after taking ARVs.

Herbal decoctions are administered intermittently; one week on treatment and then two weeks off (sometimes 1 – 6 months) before resuming treatment depending on the TMP, the patient's condition and response to the medicine. The duration of administration is long-term. Over time the dose may be reduced.

The TMPs mentioned some contraindications and adverse effects from use of herbal medicines. The contraindications are that the medicine should be used cautiously in pregnancy as it is feared that some plant species may induce abortions. If a woman is known to be pregnant the concoction is modified to take this into account. Indeed species believed to be toxic, such as *Spathodea campanulata,* are not administered to pregnant women and clients who are on ARVs.

Adverse effects include hunger and dizziness, particularly when the medicine is taken without food. Onset of dizziness is within 30 to 40 minutes after dosing. Some clients presenting with burning sensation on the skin were reported to develop a rash some days after taking the medicine. However, the burning of skin and subsequent rash is unlikely to be related to traditional medicine

use as the description fits closely with the natural progression of Herpes Zoster disease which occurs commonly in untreated HIV/AIDS patients (Alliegro et al. , 1996)

3.2.4 Treatment outcomes

The TMPs reported that clients taking HIV/AIDS traditional medicine report or exhibit positive improvements. The improvements are in the form of weight gain and/or alleviation of symptoms. Clients report to TMPs that they are improving and that their CD4 counts are increasing (suggesting that clients are sometimes co-enrolled in conventional HIV clinics). The TMPs reported that they maintain records of reported results, but these could not be verified as records were not onsite and physical test results are not collected. It is therefore not possible to attribute any improvements to the herbal medicines because ARVs are proven to increase CD4 counts and improve the clinical condition of patients.

3.3 Plant species used by TMPs for HIV/AIDS management

185 species were reportedly used by TMPs to treat HIV/AIDS. Seventy-four species mentioned by at least three TMPs are shown in Table 2. We noted however that even though there was some overlap in species used to treat HIV/AIDS no two TMPs mentioned the same formulations. Stem bark, leaves and whole plant are the most commonly used plant parts (Figure 1).

4.0 Discussion

4.1 Diagnosis, formulation and treatment of HIV/AIDS by TMPs

4.1.1 Diagnosis of HIV/AIDS

Diagnosis of HIV/AIDS by TMPs is made based on symptoms, or self-reporting by patients or from laboratory results. Diagnosis based only on symptoms without confirmation from laboratory testing is unreliable. For instance a chronic cough can suggest tuberculosis, *Pneumocystis carinii*, pneumonia, and bacterial pneumonia. A body rash may be caused by prurigo, or syphilis. Ongoing fever may relate to HIV itself, tuberculosis, bacterial infections, or malaria. It is therefore possible that the treatments offered to HIV/AIDS patients are for symptomatic conditions and opportunistic infections rather than for HIV/AIDS *per se*. Some patients reported that they had HIV/AIDS because a spouse had died from the condition. However, diagnoses made from partner deaths could prove inaccurate as up to 6.2% of Ugandan couples may have sero-discordant HIV status, wherein one of the spouses is HIV positive and the other tests negative for the disease (Uganda AIDS Commission, 2014).

4.1.2 Herbal medicine preparation and administration

The use of traditional medicine to treat HIV/AIDS as practiced by TMPs of Mpigi and Butambala districts is widespread in the world (Langlois-Klassen et al. , 2007, Liu et al. , 2009, Walwyn and Maitshotlo, 2010). The TMPs in this study share information about HIV/AIDS therapies in weekly seminars. But, this notwithstanding, the level of consensus on HIV/AIDS therapies is very low. There is very little overlap in what goes into the formulations by different TMPs, and no two TMPs use the same formulation even though there is some overlap of species used. Species used in ethnomedicine to treat HIV/AIDS from different regions vary significantly with little overlap. This observation suggests that TMPs are still experimenting with therapies for this relatively new disease (Lamorde, Tabuti, 2010).

Herbal medicines are sometimes administered concomitantly with ARVs. According to Mills *et al.* (2005), the simultaneous use of herbal medicines and ART carries a risk of bi-directional drug interactions that may put clients at risk of treatment failure, viral resistance or drug toxicity. The same authors conducted a study on *Hypoxis hemerocallidea* and *Sutherlandia frutescens* subspecies *microphylla* used to treat HIV/AIDS and concluded that the species might have an effect on HIV drug metabolism through their inhibitory activity on enzymes and efflux drug transporter systems. They recommended, therefore, that concurrent administration of herbal medicines with ARVs must be carried out with caution and highlighted the need for clinical studies in humans to unveil any possible drug interaction of herbal agents with ARVs.

In contrast to ARV regimens that must be administered daily indefinitely (World Health Organization, 2013), herbal medicine administration by TMPs is intermittent. According to Prof. Paul Waako (Personal communication), intermittent drug administration could beneficial to clients because it reduces the burden of taking the medicine on a daily basis. Secondly, interruption of herbal medicine administration could ensure that side effects of the treatments are mitigated. This is especially important because the traditional medicines are being administered before safety studies have been conducted.

4.1.3 Contraindications and adverse effects of therapies

In this study, some herbal medicines were contraindicated for use in pregnant women and very weak patients. In addition herbal medicines were reported to induce adverse effects of hunger and dizziness, particularly when taken without food. This may imply that some concoctions can create a state of hypoglycaemia in patients and TMPs frequently advised clients to eat food before taking the traditional medicine. It is known that food may reduce stomach irritations caused by some traditional medicines, increase absorption of traditional medicine or reduce side effects of potent agents (Ojewole, 2004).

4.1.4 Treatment outcomes

The TMPs in this study reported positive treatment outcomes of their patients. Others studies have reported similar positive effects. For example, Tshibangu et al. (2004), reported that HIV/AIDS sufferers treated with TM exhibited significant health improvement in terms of physical appearance, increased appetite, feeling of well-being, disappearance of skin marks and urogenital lesions, resumption of workplace duties, weight gain, reduction in viral loads and significant increase in CD4+ T cell counts. A meta-analysis by Liu *et al.*, concluded that TM improve health-related quality of life, but provide little antiviral benefit (Liu, Manheimer, 2009).

4.2 Plant species used by TMPs for HIV/AIDS management

All TMPs used large numbers of species for managing HIV/AIDS. Some of the species reported by TMPs in this study have been reported in other studies elsewhere in Uganda and Kenya (Table 3), and this is one indication that they could be effective in treating the disease. The use and selection of similar species for treating similar conditions is one indirect form of evidence that the species used are efficacious (Gurib-Fakim and Kasilo, 2010, Leaman et al. , 1995).

Anti-HIV-1 activity has been reported for seven of the plant species namely: *Maytenus senegalensis, Ocimum gratissimum, Persea americana*, *Hoslundia opposita, Plectranthus barbatus, Erythrina abyssinica* and *Spathodea campanulata.* In addition, the ethanolic extract of *P. barbatus* appeared to stimulate a protective immune response in vitro (see Table 4). The anti HIV activity of seeds of *E.*

abyssinica was reported at concentrations that exceeded concentrations at which significant cytotoxicity occurred (Mohammed et al. , 2012).

In our literature review we noted that few ethnobotanical studies have been conducted to inventory species used to treat HIV/AIDS, and that even fewer have been conducted to test anti-HIV efficacy of plant species. In contrast, antiretroviral drug development has flourished using mechanistic based approaches including high throughput screening using known compounds, optimization of lead compounds and rational drug design (Arts and Hazuda, 2012). With many highly efficacious compounds providing effective therapy already available from these efforts, identifying phytochemicals that are active against HIV through ethnobotanical surveys may be considered to be a less efficient approach by the pharmaceutical industry.,

Conclusions and recommendations

In addition to history of patients who had already performed standard laboratory tests for HIV, TMPs identified HIV/AIDS from patient's history and symptoms with potential to misclassify some uninfected individuals as HIV/AIDS patients. The TMPs treating HIV/AIDS in Mpigi District use widely differing formulations with an inordinately large number of species with little overlap suggesting that the TMPs are still experimenting with different species for HIV/AIDS. It could also suggest that the TMPs do not share fully the species used in the formulations despite evidence of collaboration among this particular group of TMPs. A follow up study with a smaller group of TMPs is recommended for articulating the correct dose. Some patients are reported to use herbal medicines concomitantly with ARVs and the clinical consequences of this practice are poorly understood. According to TMPs, the species used appear to improve wellbeing of their HIV/AIDS patients, however these claims need to be verified through independent observational clinical studies.

The authors declare no conflict of interest.

Acknowledgements
We are very grateful to the SIDA and VicRes for funding and coordinating this research. Makerere University provided additional logistical support. We also acknowledge with gratitude all healers who participated in this survey. Finally, we thank all our collaborators PROMETRA-U and Buyijja Traditional Healers Association (BUTHGA).

References

Ali H, König GM, Khalid SA, Wright AD, Kaminsky R. Evaluation of selected Sudanese medicinal plants for their in vitro activity against hemoflagellates, selected bacteria, HIV-1-RT and tyrosine kinase inhibitory, and for cytotoxicity. Journal of Ethnopharmacology. 2002; 83:219-28.

Alliegro MB, Dorrucci m, Pezzotti P, Rezza G, Sinicco A, Barbanera M, et al. Herpes Zoster and Progression to AIDSA in a cohort of individuals who seroconverted to human Immunodeficiency Virus. Clinical Infectious Diseases. 1996;23:990-5.

Arts EJ, Hazuda DJ. HIV-1 Antiretroviral Drug Therapy. Cold Spring Harbor Perspectives in Medicine. 2012;2.

Bilia AR, Santomauro F, Sacco C, Bergonzi MC, Donato R. Essential Oil of Artemisia annua L.: An Extraordinary Component with Numerous Antimicrobial Properties. Evidence-Based Complementary and Alternative Medicine. 2014;2014:7.

Gurib-Fakim A, Kasilo OM. Promoting African Medicinal Plants through an African Herbal Pharmacopoeia. The African Health Monitor. 2010;Special issue 14:64-7.

Kapewangolo P, Hussein AA, Meyer D. Inhibition of HIV-1 enzymes, antioxidant and anti-inflammatory activities of Plectranthus barbatus Journal of Ethnopharmacology. 2013;149:184-90.

Lamorde M, Tabuti JRS, Obua C, Kukunda CB, Lanyero H, Byakika-Kibwika P, et al. Medicinal plants used by traditional medicine practitioners for the treatment of HIV/AIDS and related ailments in Uganda. Journal of Ethnopharmacology. 2010;130:43-53.

Langlois-Klassen D, Kipp W, Jhangri GS, Rubaale T. Use of traditional herbal medicine by AIDS patients in Kabarole District, western Uganda. The American journal of tropical medicine and hygiene. 2007;77:757-63.

Leaman DJ, Arnason JT, Yusuf R, Sangat-Roemantyo H, Soedjito H, Angerhofer CK, et al. Malaria remedies of the Kenyah of the Apo Kayan, East Kalimantan, Indonesian Borneo: A quantitative assessment of local consensus as an indicator of biological efficacy. Journal of Ethnopharmacology 1995;49 1-16.

Liu JP, Manheimer E, Yang M. Herbal medicines for treating HIV infection and AIDS. Cochrane Database of Systematic Reviews 2009;Issue 3. Art. No.: CD003937.

Mills E, Cooper C, Seely D, Kanfer I. African herbal medicines in the treatment of HIV: Hypoxis and Sutherlandia. An overview of evidence and pharmacology. Nutrition Journal. 2005;4:19.

Ministry of Health. Uganda Aids Indicator Survey 2011. Ministry of Health, Kampala, Uganda; 2012.

Mohammed MMD, Ibrahim NA, Awad NE, Matloub AA, Mohamed-Ali AG, Barakat EE, et al. Anti-HIV-1 and cytotoxicity of the alkaloids of Erythrina abyssinica Lam. growing in Sudan. Natural Product Research. 2012;26:1565-75.

Mulaudzi RB, Ndhlala AR, Kulkarni MG, Finnie JF, Van Staden J. Antimicrobial properties and phenolic contents of medicinal plants used by the Venda people for conditions related to venereal diseases. Journal of Ethnopharmacology. 2011;135:330–7.

Nagata JM, Jew AR, Kimeu JM, Salmen CR, Bukusi EA, Cohen CR. Medical pluralism on Mfangano Island: Use of medicinal plants among persons living with HIV/AIDS in Suba District, Kenya. Journal of Ethnopharmacology. 2011;135:501–9.

Ojewole JA. Analgesic, antiinflammatory and hypoglycemic effects of Sutherlandia frutescens R. BR. (variety Incana E. MEY.) [Fabaceae] shoot aqueous extract. Methods and Findings in Experimental and Clinical Pharmacology. 2004;26:409–16.

Tshibangu KC, Worku ZB, De Jongh MA, Van Wyk AE, Mokwena SO, Peranovic V. Assessment of effectiveness of Traditional Herbal Medicine in managing HIV/AIDS patients in South Africa. East African Medical Journal. 2004;81:499-504.

Uganda AIDS Commission. Government of Uganda 2014. HIV and AIDS Uganda Country Progress Report 2013. Kampala: Uganda AIDS Commission; 2014.

UNAIDS. UNAIDS Fact Sheet 2014. nd;http://www.unaids.org/sites/default/files/documents/20141118_FS_WADreport_en.pdf.

Vermani K, Garg S. Herbal medicines for sexually transmitted diseases and AIDS. Journal of Ethnopharmacology. 2002;80:49-66.
Walwyn D, Maitshotlo B. The role of South African traditional health practitioners in the treatment of HIV/AIDs: a study of their practices and use of herbal medicines. The Southern African Journal of HIV medicine. 2010;11:11-7.
World Health Organization. WHO Traditional Medicine Strategy 2002–2005. Geneva: World Health Organization; 2002.
World Health Organization. Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection: recommendations for a public health approach June 2013. Geneva: World Health Organization; 2013.

Fig 1. Map of Uganda showing location of the greater Mpigi District.

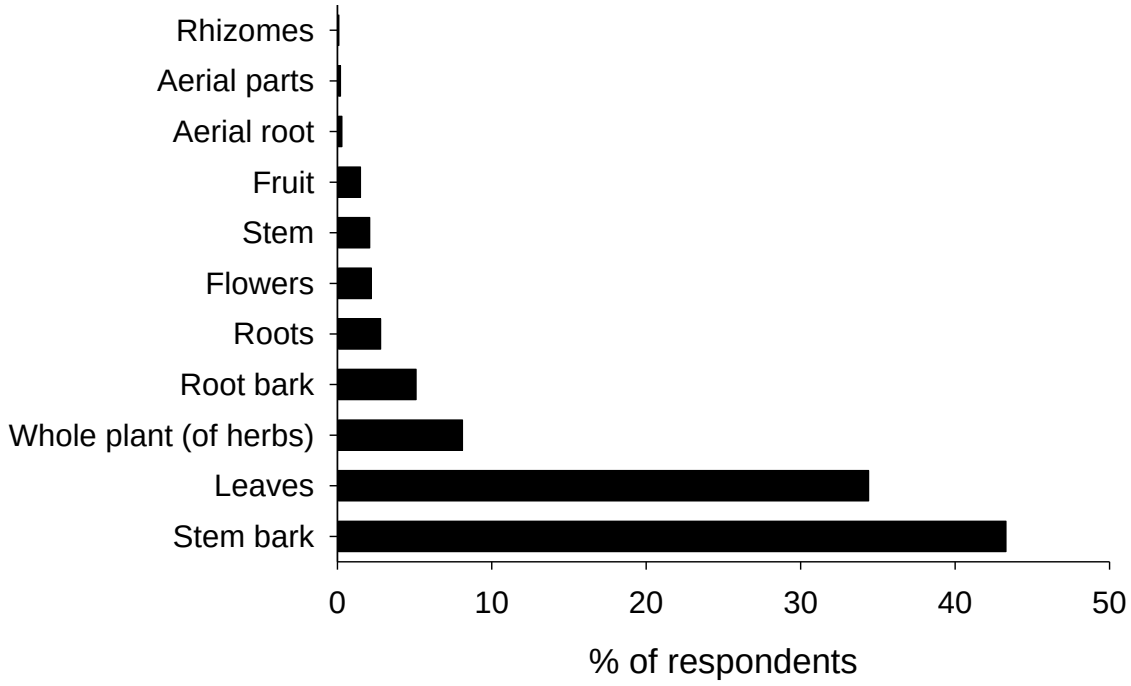

Figure 2: Distribution of plant parts used for herbal medicine used in treating HIV/AIDS by TMPs of Mpigi District.

Table 1**: Demographic and Socio-economic characteristics of TMP (n=60)**

Characteristics	%	Characteristics	%
Formal education		**Treats HIV/AIDS**	
None	7	Yes	93
Primary (P1 -P7)	60	No	7
Secondary (S1-S6)	32		
Higher education (Diploma)	2	**The means by which herbal knowledge was acquired**	
		From fellow TMPs	60
Main occupation		Family	38
Crop farming	77	Dreams	2
Salaried employment	7		
Animal farming	3	**Period of practice by TMPs**	
Business	3	Less than 5 years	12
Casual employment	2	5 - 10 years	55
Fishing	2	10 - 20 years	20
		Over 20 years	13

Table 2: Plant species used to treat HIV/AIDS. Shown are species mentioned by 3 or more TMPs. This list has species that are used for treatments aimed at lowering viral loads. The mode of preparation for all species is by decoction.

Scientific name	Family	Local name	Specimen number	Part used	Frequency
Erythrina abyssinica Lam.	Fabaceae	Jilikiti	AN 085	Stem bark, leaf	38
Spathodea campanulata P. Beauv.	Bignoniaceae	Kifabakazi	AN 063	Stem bark, leaf, root bark	32
Hoslundia opposita Vahl	Lamiaceae	Kamunye	AN 073	Stem bark, leaf, whole root, Aerial parts	28
Bidens pilosa L.	Asteraceae	Sere	AN 056	Leaf, whole root, Aerial parts, Inflorescence	27
Piptadeniastrum africanum (Hook. f.) Brenan	Fabaceae	Mpewere	AN 010	Stem bark	27
Albizia coriaria Welw. ex Oliv.	Fabaceae	Mugavu	AN 087	Stem bark, leaf	25
Prunus africana (Hook. f.) Kalkman	Rosaceae	Ntasesa/ Engwabuzito	AN 203	Stem bark, leaf	22
Centella asiatica (L.) Urb.	Apiaceae	Mbutamu/Kutukumu	AN 026	Aerial parts	20
Bridelia micrantha (Hochst.) Baill.	Phyllanthaceae	Katazamiti	AN 016	Stem bark, leaf, root bark, entire root	19
Ficus saussureana DC.	Moraceae	Muwo	AN 005	Stem bark, leaf	18
Canarium schweinfurthii Engl.	Burseraceae	Mpafu	AN 212	Stem bark, leaf	17
Entada abyssinica Steud. ex A. Rich.	Fabaceae	Mwolola	AN 072	Stem bark, leaf	17
Zanthoxylum leprieurii Guill. & Perr.	Rutaceae	Munyenye/Entale yadungu/ Ntatembwa	AN 172/214	Stem bark	16
Persea americana Mill.	Lauraceae	Ovacado	AN 057	Stem bark, leaf	15

Artocarpus heterophyllus Lam.	Moraceae	Fene	AN 001	Stem bark, root bark	13
Justicia betonica L.	Acanthaceae	Nalongo	AN 020/227	Stem bark, leaf, Aerial parts	12
Plectranthus barbatus Andrews	Lamiaceae	Kibwankulata	AN 053	Stem bark, leaf, root bark	12
Psidium guajava L.	Myrtaceae	Mapera	AN 131	Stem bark, leaf, entire stem, root bark	12
Syzygium cumini (L.) Skeels	Myrtaceae	Jambula	AN 064	Stem bark, leaf, entire stem	12
Leonotis nepetifolia (L.) R. Br.	Lamiaceae	Ekifumufumu	AN 069	Aerial parts, leaf, root bark	11
Mangifera indica L.	Anacardiaceae	Muyembe	AN 082	Stem bark, leaf	11
Microglossa angolensis Oliv. & Hiern	Asteraceae	Kafuga nkande	AN 152	Aerial parts, leaf, root bark	11
Milicia excelsa (Welw.) C.C. Berg	Moraceae	Muvule	AN 190	Stem bark	11
Combretum molle R. Br. ex G. Don	Combretaceae	Ndagi	AN 267	Stem bark, leaf	10
Psorospermum febrifugum Spach	Hypericaceae	Kanzilonzilo	AN 259	Stem bark, leaf, root bark, entire root	10
Toddalia asiatica (L.) Lam.	Rutaceae	Kawule	AN 154	Leaf, stem, root bark	10
Aloe spp.	Xanthorrhoeaceae	Kigaji	AN186	Leaf, root bark	9
Antiaris toxicaria Lesch.	Moraceae	Kilundu	AN 201	Stem bark	9
Blighia welwitschii (Hiern) Radlk.	Sapindaceae	Enkuzanyana	AN 211	Stem bark	9
Ficus natalensis Hochst	Moraceae	Mutuba	AN 111	Stem bark, leaf, aerial roots	9
Ocimum gratissimum L.	Lamiaceae	Mujaaja	AN 028	Leaf, root bark, entire root	9
Acacia hockii De Wild.	Fabaceae	Akasaana	AN 151	Stem bark, leaf, root bark, entire root	8

Albizia grandibracteata Taub.	Fabaceae	Nongo	AN 089	Stem bark, leaf	8
Sapium ellipticum (Hochst.) Pax	Euphorbiaceae	Muzanganda/Musasa/Muzanvuma	AN 083	Stem bark, leaf	8
Vernonia amygdalina Delile	Asteraceae	Mululuuza	AN 075	Stem bark, leaf, root bark, entire root	8
Cannabis sativa L.	Cannabaceae	Enjaga	AN 143	Leaf, stem	7
Carica papaya L.	Caricaceae	Papali	NC	Stem bark, leaf, root bark, entire root	7
Crassocephalum vitellinum (Benth.) S. Moore	Asteraceae	Ekitonto	AN 232	Leaf, whole plant	7
Dyschoriste radicans Nees	Acanthaceae	Manyi	AN 095	Leaf, whole plant	7
Flueggea virosa (Roxb. ex Willd.) Royle	Phyllanthaceae	Lukandwa	AN 070	Stem bark, leaf, root bark, entire root	7
Hibiscus surattensis L.	Malvaceae	Nantaitwako musota	AN 015	Aerial parts, leaf	7
Kigelia africana (Lam.) Benth.	Bignoniaceae	Omusa	AN 014	Aerial parts, leaf	7
Basilicum polystachyon (L.) Moench	Lamiaceae	Kakubajili	AN 101	Aerial parts, leaf	6
Clerodendrum capitatum (Willd.) Schumach. & Thonn.	Lamiaceae	Lusekeseke/ Ekisekeseke	AN 038	Leaf	6
Cymbopogon citratus (DC.) Stapf	Poaceae	Kisubi	AN 059	Aerial parts, leaf, roots	6
Eucalyptus spp.	Myrtaceae	Kalintusi	AN 246	Stem bark, leaf, stem	6
Pseudospondias microcarpa (A. Rich.) Engl.	Anacardiaceae	Omuzilu	AN 012	Stem bark, leaf	6
Solanum nigrum L.	Solanaceae	Ensuga	AN 137	Aerial parts, leaf	6
Alchornea cordifolia (Schumach. & Thonn.) Müll. Arg.	Euphorbiaceae	Luzibaziba	AN 049	Stem bark, leaf, root bark, fruit	5

Funtumia africana (Benth.) Stapf	Apocynaceae	Namukago	AN 045	Stem bark	5
Phyllanthus amarus Schumach. & Thonn.	Phyllanthaceae	Nakitembe	AN 113	Whole plant	5
Priva cordifolia Druce	Verbenaceae	Enkami	AN 090	Aerial parts, leaf	5
Acanthus pubescens Engl.	Acanthaceae	Matovu	NC	Leaf, root bark, root	4
Bothriocline longipes (Oliv. & Hiern) N.E. Br.	Asteraceae	Twatwa	NC	Leaf	4
Callistemon citrinus (Curtis) Skeels	Myrtaceae	Mwambala butonya	AN 163	Stem bark, leaf	4
Catharanthus roseus (L.) G. Don	Apocynaceae	Sekajja	AN 118/236	Aerial parts, leaf	4
Harungana madagascariensis Lam. ex Poir.	Hypericaceae	Mukabiila nsiko/Mulilira	AN 061/208	Stem bark, leaf, stem	4
Hibiscus sabdariffa L.	Malvaceae	Omusayi gwadezi	AN 029	Aerial parts, leaf	4
Maesa lanceolata G. Don	Primulaceae	Kiwondowondo	AN 003/19	Stem bark, leaf	4
Markhamia lutea (Benth.) K. Schum.	Bignoniaceae	Musambya	AN 126	Stem bark, leaf, root bark	4
Physalis peruviana L.	Solanaceae	Entutunu enene	AN 094	Aerial parts, leaf	4
Syzygium guineense (Willd.) DC.	Myrtaceae	Omusali omuganda	AN 216	Stem bark, leaf	4
Tetrorchidium didymostemon (Baill.) Pax & K.Hoffm.	Euphorbiaceae	Mukejje	AN 213	Stem bark	4
Tithonia diversifolia (Hemsl.) A. Gray	Asteraceae	Ekimyula	AN 035	Leaf	4
Vernonia cinerea (L.) Less.	Asteraceae	Kayayana	AN 080	Whole plant, leaf	4
Warburgia ugandensis Sprague	Canellaceae	Abasi/Omuya	NC	Stem bark	4
Acalypha bipartita Müll. Arg.	Euphorbiaceae	Jerengesa	NC	Leaf, stem bark	3

Amaranthus spinosus L.	Amaranthaceae	Doodo	AN 235	Leaf	3
Basella alba L.	Basellaceae	Enderema	AN 269	Aerial parts, leaf	3
Carissa edulis (Forssk.) Vahl	Apocynaceae	Nyonza	AN 189	Root bark	3
Chenopodium opulifolium Schrad. ex W.D.J. Koch & Ziz	Amaranthaceae	Omwetango	AN 165	Stem bark	3
Cleome gynandra L.	Cleomaceae	Jobyo	AN 107	Leaf	3
Conyza sumatrensis (Retz.) E. Walker	Asteraceae	Kafumbe		Aerial parts, leaf	3
Cymbopogon nardus (L.) Rendle	Poaceae	Teete	AN 051	Stem bark, leaf	3
Dracaena steudneri Engl.	Asparagaceae	Ekajo lyenjovu	AN 168	Stem bark, leaf	3
Erythrophleum suaveolens (Guill. & Perr.) Brenan	Fabaceae	Mumala/ Kimala	AN 249	Tuber	3
Lippia javanica (Burm f.) Spreng.	Verbenaceae	Kisumuluzo	AN 198	Leaf, root bark	3
Myrica kandtiana Engl.	Myricaceae	Enkikimbo	AN 211	Stem bark, leaf, root bark	3
Phyllanthus guineensis Pax	Phyllanthaceae	Omutulika	AN 116	Leaf	3
Physalis micrantha Link	Solanaceae	Entutunu entono	AN 224	Aerial parts, leaf	3
Polyscias fulva (Hiern) Harms	Araliaceae	Setaala	AN 043	Stem bark, leaf	3
Pseudarthria hookeri Wight & Arn.	Fabaceae	Ekikakala	AN 145	Aerial parts, leaf	3
Rhus vulgaris Meikle	Anacardiaceae	Akakwansokwanso/Tebuda	AN 084	Leaf, root bark, root	3
Rubia cordifolia L.	Rubiaceae	Kasalabakesi	AN 018	Whole plant, leaf, roots	3
Senna didymobotrya (Fresen.) H.S. Irwin & Barneby	Fabaceae	Omuchula	AN 159	Leaf	3
Siegesbeckia orientalis L.	Asteraceae	Seziwundu	AN 195	Whole plant, leaf, roots	3

Tetradenia riparia (Hochst.) Codd	Lamiaceae	Kyewamala	AN 047	Stem bark, leaf, roots	3
Unidentified		Kabajansayi	AN 160	Leaf	3
Unidentified		Kakutiya	NC	Stem bark, leaf	3

Note: NC = not collected

Table 3. Species used for treating HIV/AIDS in other parts of Uganda and other countries

Species	Comparative use elsewhere
Cymbopogon citratus	a
Tithonia diversifolia	a
Aloe spp.	a, c, d
Vernonia amygdalina	c
Mangifera indica	c
Momordica foetida	c
Psidium guajava	a, b, c, e
Maesa lanceolata	b, e
Bidens pilosa	a, b
Kigelia africana	a, b
Carica papaya	a, b
Carissa edulis	a, b
Eucalyptus spp.	b, c
Albizia coriaria	b
Piptadeniastrum africanum	b
Prunus Africana	b
Bridelia micrantha	b
Centella asiatica	b
Entada abyssinica	b
Zanthoxylum leprieurii	b
Justicia betonica	b
Sapium ellipticum	b
Combretum molle	b
Psorospermum febrifugum	b
Leonotis nepetifolia	b
Ficus natalensis	b
Markhamia lutea	b
Polyscias fulva	b
Rhus vulgaris	b
Flueggea virosa	b
Dracaena steudneri	b

a = Kenya (Nagata et al. , 2011), b = Uganda (Lamorde et al., 2010), c = Uganda (Langlois-Klassen et al. , 2007), d = South Africa (Mulaudzi et al. , 2011), e = (Vermani and Garg, 2002), f = Sudan (Ali et al. , 2002), g = Tanzania and Namibia (Kapewangolo et al. , 2013)

Table 4. Anti-HIV activity for some of the species

Species	Reported anti-HIV activity	Author
Maytenus senegalensis	Nevertheless some species mentioned by very few TMPs, such as that was mentioned by only one TMP have been evaluated and found to have some anti HIV activity	(Hussein et al. , 1999).
Ocimum gratissimum	The leaves of O. gratissimum have high antiviral indices of 110. The species works by inhibiting HIV-1 reverse transcriptase activity at EC values of 0.011 mg/ml. Aqueous extracts of the species also inhibit HIV-1 strain HTLVIII cytopathicity.	(Ayisi and Nyadedzor, 2003)
Persea americana	Leaves of the species have moderate anti-HIV-1 activity in vitro	(Wigg et al. , 1996)
Hoslundia opposita	The compound 5,7-dimethoxy-6-methylflavone isolated from H. opposita inhibited HIV 1 RT by 53%	(Mujovo, 2009)
Plectranthus barbatus	Ethanolic extracts demonstrated anti HIV-1 potential. They were active against HIV-1 protease (IC50 62 ±0.2 µg/ml). The extracts also stimulated a protective immune response in vitro.	(Kapewangolo, Hussein, 2013)
Erythrina abyssinica	Seeds of E. abyssinica have minimal anti HIV activity and its anti-HIV activity is seen at concentrations that are toxic to the body's own cells - so it is not likely be a useful HIV drug.	(Mohammed, Ibrahim, 2012)
Spathodea campanulata	The stem bark decoction has very low anti HIV activity	(Niyonzima et al. , 1999)