An Ethnobotanical Study of Medicinal Plants used in the Management of Dermatological Disorders in Buyende and Kayunga Districts, Uganda

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Authors’ contributions

This work was carried out in collaboration among all authors. Authors JN, AL and SA wrote the protocol, designed the study, participated in the field survey. Authors JN and SA analysed the data and drafted the manuscript under the supervision of Author BR. All authors read and approved the final manuscript.

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ABSTRACT

This study was done to document medicinal plants used in the management of dermatological disorders. Documentation of plants is important for conservation especially of rare and endangered plant species. The study was done in Buyende and Kayunga districts in Uganda, between April and July 2017. Data was obtained using semi-structured questionnaires and group discussions, performed on 63 respondents (33 females; 30 males) who were purposively selected because of their expertise in plant use. The study recorded 111 plant species that belong to 46 plant families for treatment of 30 skin disorders. The dominant life form was herb (41%), while leaves were the most used parts (59%). Majority of plants (72%) were harvested from their natural habitats. Family Fabaceae contributed the highest number of species (20). Milicia excelsa was recorded to be threatened with extinction. The most cited diseases were skin rash (14%), wounds (12%), syphilis.
in managing skin disorders, it is evident that medicinal plants have been found to play a role in management of various skin infections because they are rare and are assumed not to be life-threatening [4]. A study by [4] reported a high prevalence of 21-87% in developing countries especially in children than in adults. In Uganda, skin conditions are one of the common problems in local communities [5].

In many developing countries, community members depend on their local flora for treating diverse ailments including skin disorders. Skin disorders account for approximately 34% of all occupational diseases [6], and occur in people of all ages [7], causing harm in a number of ways. Sometimes people may develop diseases that affect the skin including herpes, cancer (cancerous wounds), measles or syphilis. Non-communicable diseases, including skin diseases, contribute to about 32.9% of total deaths in Uganda [8]. Skin infections such as allergy, boils, ringworm, scabies, leprosy among others are caused various microorganisms [9]. Traditional herbal medicines have been found to play a major role in management of various skin disorders [8]. According to research done across the world, it is evident that medicinal plants contribute significantly to primary health care and in managing skin diseases effectively [6,9,10,7].

In some parts of the world, skin diseases have been associated with HIV/AIDS [6,9]. Plants have been used in medicines and cosmetics for centuries because they have great potential to cure and manage different kinds of skin conditions [11,3]. Their potential to treat different skin diseases, to adorn and improve skin appearance is well known and well documented [12,13,14]. Much effort has been devoted to identifying plants that are used traditionally to treat different kinds of dermatological disorders and as cosmetics. This is because the demand for herbal medicines has increased as a result of perceived lack of side effects and thought to enrich the body with nutrients and other minerals [11].

This study therefore, reports the use of medicinal plants in the management of dermatological disorders and other related conditions by residents in some villages of Kayunga and Buyende districts. These areas have been found to have the highest number of albinos who are mostly affected by ultraviolet radiations due to their skin condition [15]. This work may serve as a platform of information for scientific research that can lead to formulations of effective drugs, skin care products, or standardized extracts for improved traditional herbal medicine. This study is the first of its kind in the two study areas to document medicinal plants for skin disorders. The authors were encouraged to study plants for skin disorders due to a documentary that featured a household of normal parents with six albino children.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted from April to July 2017 in Buyende district in eastern Uganda and Kayunga district in central Uganda respectively.

Keywords: Ethnobotanical; Medicinal plants; dermatological disorders; conservation; Uganda.
(Fig. 1). Buyende district (1°09’60.00” N 33°09’60.00” E) is located approximately 100 kilometres (62 mi) from Jinja City, and about 170 kilometres (105 mi) from the Capital, Kampala. In Buyende district, the study was done in Nabuuku and Kagulu parishes in Kagulu Sub County (Budiope East). Buyende district lies on an average altitude of about 1050 m above sea level. The climate is tropical savannah, with annual rainfall ranges between 35 and 145 mm. Temperatures are moderate and do not fluctuate much over the year. The mean maximum temperature is 26°C and the mean minimum temperature is 18°C. The human population living in the area was approximately 323,067 [16]. The local people are mainly of the Bantu ethnic group of the Basoga, Bagwere and Baganda tribes [16]. Kayunga district (0°42’9.00”N 32°53’19.00” E) is approximately 74 kilometers (46 mi) northeast of Kampala. In Kayunga, the study was done in four sub-counties of Busana, Kayonza, Nazigo, and Kayunga Town council. Kayunga district lies on an average altitude of 1000-1200m above sea level. The climate is tropical savannah with two rainy seasons and two dry seasons. The two rainfall peak months are April and October. The annual rainfall ranges between 35 and 150 mm. Temperatures are moderate and do not fluctuate much over the year. The mean minimum and maximum temperature ranges between 18°C and 24°C. With a population of 368,062 people, the Bantu ethnic groups inhabit with majorly the Baganda, Bagisu, Basoga and Bakene tribes [16].

### 2.2 Data Collection Methods

The research team first reported to the local council administrators who helped in identifying key informants. These informants were purposively selected [17] based on skills, knowledge and experience in medicinal plants usage. Informants who agreed to be interviewed were also involved in group discussions for detailed information as well as collection of plant voucher specimens. Data on medicinal plants were obtained from traditional medical practitioners and other knowledgeable men and women. Semi structured questionnaires were used to undertake interviews in addition to group discussions, which were conducted in the local languages of Luganda and Lusoga mainly spoken in the study areas. A questionnaire was designed to obtain such as information as locality, socio-demographic information (age, gender, education background, and religious affiliation), plant names, parts used, preparation and administration methods. Some plants were identified in the field and voucher specimens collected and taken to the national herbarium at Makerere University for authentication. The international plant name index (www.ipni.org) and the Royal Botanic Garden Kew (www.theplantlist.org) were used to validate plant scientific names, families and authorities.

### 3. RESULTS AND DISCUSSION

#### 3.1 Factors that Influence Traditional Medicinal Plant Knowledge and Use

The study explains how medicinal plant knowledge varies with socio-economic as well as demographic factors. The research team worked with 63 respondents; 22 in Kayunga and 41 in Buyende respectively. Buyende had more respondents because they were willing to participate in the study, given the fact that most traditional healers generally are very secretive with their knowledge due to intellectual property rights issues. Of the 63 respondents, 33 were females (52%) and 30 were males (48%). In many communities across the world, traditional healing is a gender-based practice where both men and women participate in traditional healing practices. Similarly, in this study, traditional knowledge on medicinal plant use was found to be common among both females and males, cutting across all ages (Fig. 2). However, women are commonly known to be more knowledgeable than men considering their role as domestic health care givers. About 76% were subsistence farmers, while the rest were herbalists (7%) and business people (motor cycle riders, musicians, tailors and vehicle mechanics). All the respondents acquired indigenous knowledge of medicinal plants orally through experience and observation from mothers, fathers, grand fathers, fellow traditional medicine practitioners and spiritual insight as well as workshop / seminar trainings.

#### 3.1.1 Age and plant knowledge

Majority of respondents (62%) in this study were in the age range of 20 to 40 years (Fig. 2). For a long time, research has shown that old people are the greatest custodians of traditional knowledge of medicinal plant use than the young [18,19,20,21,22,23,24,25,26,27]. The present study however was found to be inconsistent with other studies by showing that the youth are now engaging in utilization and commercialization of medicinal plants. It has been reported that
knowledge increases with age, given the fact that knowledge transfer from generation to another is a gradual process [28]. However, in another study, age had no influence on traditional knowledge unlike gender and education level [29].

3.1.2 Education and plant knowledge

In this study, none of the respondents obtained medicinal plants knowledge through formal training, despite the majority (78%) having attained primary / elementary level of education. Traditional knowledge of medicinal plants is usually transferred by word of mouth, hence, documentation of this knowledge (IK) is important for building data bases and controlling its loss. Over the years, research has shown that most custodians of traditional medicinal knowledge are less educated or illiterate. This could also be the reason why the youth are now engaging in this practice because of large numbers having failed to attain high levels of education due to lack of tuition, and other reasons leading to many school dropouts. However, research shows that literacy levels of people determined the mode of treatment [30]; the less educated preferred traditional methods of treatment where as the well educated preferred modern methods of health care. Research over the years has shown low literacy levels among research respondents: [31,32,33,26].

3.1.3 Ethnicity and plant knowledge

In this study, we encountered different ethnic groups of which Basoga (62 %) and Baganda (16 %) were the most dominant (Fig. 3). The use of herbal medicines has increased over the years; an indication of the need to understand how different social /ethnic groups use and define these medicines [34].

This is because the use and definition of herbal medicine differs by ethnicity. In this study, most similar plant species were used by more than one ethnic group, though some plants are known by different names but treating either similar or different ailments. Research shows that a lot has been done to document the uses of herbal medicines but not much has been done to determine peoples' perceptions toward herbal medicine [34]. Traditional medicine is a form of holistic health care system where health care services are based on culture /ethnicity, religious background, knowledge, attitudes and beliefs that are common in many communities. Traditional medicine was always known to be primitive because of cultural attachments and practices by western professionals. However, through scientific investigations it has proved to be cheap, easily available, effective and to possess potential therapeutic activities such that many pharmaceuticals have been modeled on phytochemicals derived from plants [35]. Traditional medicine is also able to manage such ailments as measles, skin rashes, ringworm, cuts and wounds better than western medicine.

3.1.4 Religion and plant knowledge

Christians formed the largest percentage (83%) of the respondents (Fig. 4). For a long time, African traditional medicine (ATM) was condemned as evil because it is commonly associated with witchcraft, hence, pertaining to the devil [36]. African traditional medicine (ATM) had been grossly misinterpreted by the western missionaries, who did not recognize African traditional religion as of equal status with Christianity. However, this has changed over time, due to changes in lifestyles such as variations in living standards where majority of people, for instance, live below the poverty line, hence, cannot afford the high cost of western medicine and opt for herbal remedies. In addition to this, research shows that it’s not only herbal medicine that heals, but also prayers in a Christian sense that plays an important role in people’s beliefs regarding treatment of ailments [18] However, this Christian healing does not involve doctors or administration of drugs. True Christianity is a medicine of prayer, fasting, anointing and laying on of hands; a common practice in the Catholic and Pentecostal (Born-again) domains [37]. For example, it was reported that patients who are Christians preferred seeking medical services from Faith healers than from African Traditional religion [38]. Despite the demonization of traditional medicine by some Christians, World Health Organisation, Scientists and indigenous societies appreciate the value of traditional medicine and the role of traditional healers in not only healing physical illnesses but also as being custodians of traditional knowledge, as well as educators about traditional culture and spirituality [39]. In a similar way, other researchers have reported Christians participating more in ethnobotanical surveys: [22,33].
Fig. 1. Geographical location of Study areas
Fig. 2. Age distribution of the respondents in Kayunga & Buyende

Christianity and traditional beliefs are some of the systems that have shaped traditional medicine to what it has become today [40,41]. While Christianity revolves around the aspect of God, the Son, Jesus, and the Holy Spirit; traditional beliefs include things such as the existence of spirits of ancestors (‘ba jaja’ among the Buganda and Basoga cultures), taboos, charms, and fate. Rituals performed have come to include aspects of Christianity while keeping
grounded in the roots of traditional beliefs. For example, in Antananarivo, a woman named Mama Zafy is given an opportunity to pray for patients after a church service [41]. In Uganda, some healers say God gives them the gifts to heal through dreams by showing them the plant species for healing certain ailments. Others say they use the bible, and also ancestral spirits (the ‘jajas’) give them powers and knowledge to heal. The invocation of God in herbal medicine use is a way of dealing with not only the physical but also the spiritual aspect: which is a holistic approach to traditional health care.

Similarly, in Islam, healing and wellness is promoted physically by use of drugs and spiritually by soul healing through prayer [40,42]. It is mentioned that the Quran (Holy Moslem scripture), illustrates the importance of plants for medicinal benefits [42]. Therefore, prayer is an essential ingredient in traditional healing practices among many societies [31] in addition to use of herbal remedies.

### 3.2 Medicinal Plant Species Used to Treat Dermatological Disorders

In this study, 111 plant species belonging to 46 families were recorded for the management of 30 different dermatological disorders. People with albinism tend to have skin burns due to ultraviolet rays or too much heat. Family Fabaceae contributed the highest number of plant species (20 species), followed by Asteraceae (13), Euphorbiaceae (9), Lamiaceae and Solanaceae with 6 plant species each (Table 1). The high numbers of plants in Fabaceae, Asteraceae and Euphorbiaceae in treating several diseases may be due to the bioactivities of the phytochemicals that have been reported to exist in plants from these families [43]. In Kenya, a study [44] reported a number of plants used for skin ailments some of which included Vernonia lasiopus and Senna didymobotrya that were reported in this research. Albizia coriaria has also been reported for the treatment of skin infections [45]. Similarly the use of these plants in different countries indicates that these plants are traditionally important and could be potential sources of pharmacological leads that can be used in the treatment of dermatological disorders. With the rampant clearing of bushes and forests for economic purposes, there is fear that even the common plants may be threatened. The results of this information are very important in the campaigns towards conservation of medicinal plants.

Hoslundia opposita and Bidens pilosa were mentioned by 82% and 76% of respondents for treating wounds respectively, while Carica papaya was reported by 56% of respondents for treating skin rash (Table 1). The potential of Hoslundia opposita to treat various skin conditions and infections particularly wounds, has been supported by in vivo studies where methanol extracts showed significant antibacterial activity with MIC ranging between 64-256 μg/ml, in addition to possession of potent antioxidant activity [46]. A study on the bioactivity and phytochemical activities of Carica papaya showed antibacterial, anti-inflammatory and antifungal properties, and the leaf extracts contained saponins, glycosides, alkaloids and vitamins [47]. This supports the use of C. papaya in the management of ringworm and scabies. In this study, about 55% of respondents used Jatropha curcas to treat wounds. Pharmacological studies on J. curcas supported its uses for inflammation and wound healing. Crude extracts and isolated compounds from J. curcas showed a wide range of pharmacological activities, such as anti-inflammatory, antioxidant, antimicrobial, antiviral, anticancer, anti-diabetic, anticoagulant, hepatoprotective, analgesic and abortifacient effects [48,49]. Bidens pilosa has also been found to have anti-inflammatory, antimicrobial properties, and compounds that help in the wound healing process [50,51,52]. Several isolated constituents of Bidens pilosa which have anti-inflammatory, antimicrobial and antifungal properties have been studied [53]. Aloe vera gel has been used for thousands of years to treat wounds, burns, and other skin conditions because studies have shown potent antimicrobial, anti-inflammatory and antioxidant activities, all of which are essential for keeping a healthy skin [54,55]. Wound healing effects are accelerated by anti-inflammatory, antioxidant and antibacterial activities of phytochemical contents of a medicinal plant [56,57]. This is reflected in the treatment of burns and wounds using 16.7% of the total medicinal plants in the study area. The other conditions brought about by syphilis, allergies, scabies, burns, tumours, warts and albino skin indicates their prevalence in these areas. Ten plant species were implicated for use on the Albino skin burns including Albizia coriaria and Azadirachta indica all of which have been found to possess significant antioxidant activities [48,58,59,60,61,62]. The use of these plants to treat skin disorders may be attributed to the existence of phytochemicals such as vitamins (vitamin C, vitamin E), flavonoids, and phenolic acids which compounds counteract the effect of...
Results of this survey also indicated similarity in the use of plant parts. The high usage of leaves compared to other plant parts may be an indication of their potency and effectiveness due to synergistic effects of plant compounds. Plants such as Aloe vera were used to treat more than one skin infection using one or more different plant parts. Except drinking a decoction, the modes of administration of the herbal medicine in the treatment of skin infections in the study area were similar. They involved directly applying the prepared remedy onto the affected skin area, using a given medium (Table 1). The majority of plants (79%) recorded in this study grow in their natural habitats/wild (Table 1). More than 50% of plants growing in the wild (natural habitats such as forests, bushes, etc.), means that activities mainly farming are a potential threat to these species. *Milicia excelsa* was mentioned to be threatened with extinction (not easily available). This plant has also been reported to be threatened in other parts of Uganda [69]. This calls for domestication of such key plant species that are threatened with extinction. The habitat, disease treated, parts used, frequency of mention, mode of preparation and administration of each plant are described in the Table 1.
Table 1. Medicinal plants used for dermatological disorders

| Plant Family | Taxonomic name; Voucher number | Plant Local name | Habit | Status | Part used | Disease (s) | Preparation and administration | Frequency of mention | PRK (N=63) |
|--------------|---------------------------------|------------------|-------|--------|----------|-------------|-------------------------------|---------------------|-----------|
| Acanthaceae. | Asystasia mysorensis (Roth) T. Andersson JN01 | "" Makaayi (Lug); Einante (Lus) | Herb | WA | L/R | Burns, scabies | Mix powder with jelly and smear | 3 | 4.8 |
|              | Thunbergia alata Bojer ex Sims JN02 | "" Matamivu (Lug) | Climb | WA | L | Tumors | Apply fresh leaf extract | 2 | 3.2 |
|              |                                  | "" L | Herbs | WA | Wp | Body odour | Infusion bathed | 8 | 12.7 |
|              |                                  | "" L | Herbs | WA | WR | Ringworm | Mix powder with jelly and smear | 3 | 4.8 |
|              |                                  | "" L | Shrubs | CA | L | Skin rash, wounds | Apply powder with jelly / fresh extract | 1 | 3.2 |
|              |                                  | "" L | Herbs | CR | L | Skin rash | Mix with leaves of Solanum qilo, add salt and apply | 2 | 3.2 |
| Anacardiaceae | Lannea schweinfurthii Engl. JN05 | "" Omusingabakari (Lug) | Tree | WA | L | Measles, Skin allergy | Boil & drink or bathe | 2 | 3.2 |
|              |                                  | "" L | Trees | WA | L | Skin allergy | Mix powder with jelly and smear | 1 | 1.6 |
| Annonaceae   | Annona muricata L. JN06 | "" Ekitaferi (Lug) | Tree | CR | L/R | Measles, syphilis, Cancerous wounds | Decoction drunk or bathed | 1 | 3.2 |
|              |                                  | "" L | Trees | CR | Sd | Cancerous wounds | Powder applied | 1 | 1.6 |
| Apliaceae    | Centella asiatica L.Urb. | "" Kutukumu (Lug) | Herb | WA | L | Wounds | Apply fresh leaf extract | 3 | 4.8 |

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| Plant Family | Plant Scientific name; Voucher number | Plant Local name | Habit | Status | Part used | Disease(s) | Preparation and administration | Frequency of mention | PRK (N=6) |
|--------------|---------------------------------------|------------------|-------|--------|-----------|-----------|--------------------------------|----------------------|-----------|
| Apocynaceae  | Plumeria rubra L. JN08                | Musikamooli (Lug) | Tree  | CA     | L/Fl     | Albino skin burns | Add powder to jelly and smear | 1                    | 1.6       |
|              |                                       |                  |       |        |          | Wounds     | Apply fresh leaf extract     | 1                    | 1.6       |
|              | Secamone africana (Oliv.) Bullock JN09 | Akatakula (Lug)  | Herb  | WA     | L        | Skin rash   | Bathe decoction             | 5                    | 8.0       |
| Asparagaceae. | Asparagus africanus L. JN10          | Kakirakango (Lus) | Herb  | WA     | L        | Vertigo    | Mix powder with leaves of Bredelia micrantha, add to jelly and smear | 1                    | 1.6       |
| Araceae      | Caladium bicolor (Alton.) Vent JN11  | Akayuni akatono (Lus) | Herb  | CA     | Tu / Sp  | Tumors, allergy | Apply leaf extract / sap | 3                    | 4.8       |
|             |                                       |                  |       |        | Tu       | Chicken pox | Add powder in jelly and smear | 4                    | 6.3       |
| Asteraceae   | Acanthoacpermum hispidum DC. JN13     | Enkenge ennene (Lus) | Herb  | WA     | Tu/L     | Tumors     | Pound, add kerosene and apply | 3                    | 4.8       |
|              | Ageratum conyzoides (L.) L. JN14      | Namirembe (Lug)  | Herb  | WA     | L        | Skin rash   | Squeeze in water, bathe     | 3                    | 4.8       |
|              | Bidens pilosa L. JN15                 | Ssere (Lug), Bukaala (Lus) | Herb  | WA     | L        | Skin allergy Wounds | Squeeze in water, bathe | 1                    | 1.6       |
|              | Conyza sumatrensis (S. F. Blake) Pruski & G. Sancho JN16 | Kafumbe (Lug) | Herb  | WA     | L        | Tumors, herpes Ringworm | Squeeze and apply extract | 2                    | 3.2       |
|              | Conyza floribunda Kunth. K. JN17      | Katikati (Lus)   | Herb  | WA     | L        | Ringworm   | Squeeze, add kerosene, smear | 6                    | 9.5       |
| Plant Family       | Plant Scientific name; Voucher number | Plant Local name | Habit | Status | Part used | Disease(s)          | Preparation and administration                                                                 | Frequency of mention | PRK (N=63) |
|-------------------|---------------------------------------|------------------|-------|--------|----------|---------------------|-----------------------------------------------------------------------------------------------|----------------------|------------|
| Microglossa densiflora Hook. f. JN18 | Kafugankande (Lug)                       | Shrub WA L       | Skin allergy | Squeeze in water and bathe | 5 | 8.0 |
| Senecio discifolius Oliv. JN19 | Mukasa (Lug)                             | Herb WA L       | Skin rash | Decoction bathed | 2 | 3.2 |
| Sagesbeckia orientalis L. JN20 | Sseziwundu (Lug)                         | Herb WR Fl       | Wounds | Crush & tie on the cut | 14 | 22.2 |
| Solanecio angulatus (Vahl) C. Jeffery. JN21 | Kizimyamuliro (Lus)                     | Herb WA Fl       | Burns | Apply powder on wound | 1 | 1.6 |
| Senecio discifolius Oliv. JN19 | Kafugankande (Lug)                       | Shrub WA L       | Skin allergy | Squeeze in water and bathe | 5 | 8.0 |
| Senecio discifolius Oliv. JN19 | Mukasa (Lug)                             | Herb WA L       | Skin rash | Decoction bathed | 2 | 3.2 |
| Sagesbeckia orientalis L. JN20 | Sseziwundu (Lug)                         | Herb WR Fl       | Wounds | Crush & tie on the cut | 14 | 22.2 |
| Solanecio angulatus (Vahl) C. Jeffery. JN21 | Kizimyamuliro (Lus)                     | Herb WA Fl       | Burns | Apply powder on wound | 1 | 1.6 |
| Tridax procumbens (L.) L. JN23 | Kimaka (Lug)                             | Herb WA L       | Syphilis Cancerous wounds | Boil and drink decoction | 1 | 1.6 |
| Vernonia amygdalina Del. JN24 | Omuluuluza (Lug), Lubirizi (Lus)         | Shrub WA L       | Burns | Crush and apply the liquid | 29 | 46.0 |
| Vernonia lasiopus O. Hoffm. JN25 | Akabirizi akatono (Lus)                  | Herb WR L       | Chicken pox; Measles; Warts; Wounds | Put powder in jelly and smear | 1 | 1.6 |
| Vernonia lasiopus O. Hoffm. JN25 | Akabirizi akatono (Lus)                  | Herb WR L       | Chicken pox; Measles; Warts; Wounds | Add leaves of Momordica foetida, boil and bathe | 1 | 1.6 |
| Vernonia lasiopus O. Hoffm. JN25 | Akabirizi akatono (Lus)                  | Herb WR L       | Chicken pox; Measles; Warts; Wounds | Apply powder | 1 | 1.6 |

**Asparagaceae**

| Dracaena steudneri Engl. JN50 | Kajolyenjovu (Lug)                      | Tree WA SB / Fl | Skin rash; syphilis | Decoction bathed, drunk | 2 | 3.2 |
| Plant Family | Plant Scientific name; Voucher number | Plant Local name | Habit | Status | Part used | Disease(s) | Preparation and administration | Frequency of mention | PRK (N=63) |
|--------------|--------------------------------------|-----------------|-------|--------|-----------|-----------|-------------------------------|----------------------|------------|
| Brassicaceae | *Cardamine trichocarpa Hochst. ex. A. Rich. | K Mageregankonko (Lug). | Herb | WR | L | Ringworm | Squeeze fresh leaves, add kerosene, apply | 16 | 29.4 |
| Caricaceae | *Carica papaya L. JN29; **Epapaili (Lug) | Tree | CA | SB/L/R | Skin rash | Decoction bathed | 35 | 56 |
| Celastraceae | *Maytenus senegalensis (Lam.) Exell. JN35 | Tree | WR | R | Syphilis | Fresh or powder, add to water, drink and bathe | 1 | 1.6 |
| Cleomaceae | *Cleome gynandra L. JN30 | Herb | WCA | Fl | Scabies | Squeeze, add kerosene to jelly and apply | 23 | 36.5 |
| Combretaceae | *Terminalia schimperiana Hosch. ex Delile JN39 Combretum Collinum Fresen JN40 | Tree | WR | R | Syphilis | Grind, boil and drink | 2 | 3.2 |
| | *Omosasa (Lus) | Tree | WR | R | Ringworm | Mix roots of Lantana camara, pound smear | 1 | 1.6 |
| | *Omunokolakola (Lus) | Tree | WR | R | Syphilis | Decoction drunk | 1 | 1.6 |
| Plant Family | Plant Scientific name | Plant Local name | Habit | Status | Part used | Disease (s) | Preparation and administration | Frequency of mention | PRK (N=6 3) |
|--------------|-----------------------|------------------|-------|--------|-----------|-------------|-----------------------------|---------------------|-------------|
| Commelinaceae | Commelina benghalensis L. | Enanda (Lus) | Herb | WA | L | Herpes | Add powder to jelly and smear | 2 | 3.2 |
|              |                       |                  |       |       |           |             |                             |                     |             |
|              |                       |                  |       |       |           |             |                             |                     |             |
|              |                       |                  |       |       |           |             |                             |                     |             |
|              |                       |                  |       |       |           |             |                             |                     |             |
| Convolvulaceae | Evolvulus alsinoides (L.) L. | Kaluluma (Lus) | Herb | WR | L | Skin allergy | Powder applied | 1 | 1.6 |
|              | Ipomoea cordofana Choisy. JN43 | Kasenyanaku (Lug) | Climb | WR | L | Skin allergy | Powder applied | 1 | 1.6 |
|              |                       |                  |       |       |           |             |                             |                     |             |
|              |                       |                  |       |       |           |             |                             |                     |             |
|              |                       |                  |       |       |           |             |                             |                     |             |
| Crassulaceae | Kalanchoe glauescens Britten JN44 | Kiyondo eyeru (Lug) | Shrub | WR | L | Wounds | Roast, squeeze and apply | 22 | 35.0 |
| Cucurbitaceae | Diplocyclos palmatus (L.) C. Jeffrey JN45 | ^ Kanawolovu (Lug) | Climb | WA | Wp | Skin rash | Boil and bathe | 9 | 14.3 |
|              | Cucurbita pepo L JN46 | ^ Eisusa (Lus) | Climb | WA | L | Ringworm | Squeeze, add kerosene and apply | 1 | 1.6 |
|              | Momordica foetida Schumach. JN47 | ^,^ Ebombo(Lug), Ebombo (Lus) | Climb | WA | L | Body odor | Squeeze and use as sponge | 10 | 16 |
|              | Zehneria scabra Sond. JN48 | ^ Kasunsa (Lug) | Climb | WA | L | Measles | Apply fresh leaf extract | 5 | 8.0 |
|              | Luffa acutangula (L.) Roxb. JN49 | ^ Ekyangwe (Lus) | Climb | CA | L | Skin rash | Infusion bathed | 1 | 1.6 |
|              |                       |                  |       |       |           |             |                             |                     |             |
|              |                       |                  |       |       |           |             |                             |                     |             |
|              |                       |                  |       |       |           |             |                             |                     |             |
|              |                       |                  |       |       |           |             |                             |                     |             |
| Ebenaceae. | Euclia divinorum Hiern JN52 | Omudha (Lus) | Shrub | WR | L/R | Ringworm | Add powder to jelly and smear | 4 | 6.3 |

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| Plant Family | Plant Scientific name; Voucher number | Plant Local name | Habit | Status | Part used | Disease (s) | Preparation and administration | Frequency of mention | PRK (N=63) |
|-------------|--------------------------------------|------------------|-------|--------|-----------|------------|-------------------------------|----------------------|------------|
| Euphorbiaceae | Euphorbia heterophylla L. JN53 | Kafadanga (Lus) | Herb | WA | Sp | Warts, wounds | Drop sap on the affected area | 4 | 6.4 |
| | Euphorbia tirucalli L. JN55 | Lukone (Lus,Lug) | Shrub | WA | Sp | Chicken pox | Infusion bathed | 1 | 1.6 |
| | | | | | | Scabies | Drop sap on the affected area | 1 | 1.6 |
| | Jatropha curcas L. JN56 | Ekirowa (Lus) | Shrub | WCA | Sp | Warts | Drop sap on the affected area | 17 | 27 |
| | | | | | Wounds, warts | Apply sap | 36 | 57.2 |
| | Manihot esculenta Crantz. JN57 Phyllanthus guineensis Pax JN58 | Muwogo (Lug) | Shrub | CA | L | Skin rash | Infusion bathed | 1 | 1.6 |
| | | | | | Scabies | Add powder to jelly and smear | 4 | 6.3 |
| | | Mutulika (Lug) | Herb | WA | SB | Measles | Decoction bathed | 5 | 8.0 |
| | Rivin communis L. JN59 Sapium ellipticum (Hochst.) Pax JN60 | Naogasoga (Lug) | Tree | WCA | L | Warts | Apply sap | 2 | 3.2 |
| | | Mukukulu (Lus) | | | | | |
| | | Musasa (Lus) | Tree | WA | SB | Tumors | Mix with bark of Tylosoema fassolentis, Erythrina abyssinica, pound and apply powder | 1 | 1.6 |
| | | Musasa (Lus) | | | | | |
| | | Tragia brevipes Pax JN61 | Kamyu (Lug) | Climb | WA | L | Boils | Boil with leaves Vermonia amygdalina, apply | 1 | 1.6 |
| Fabaceae | Abrus canescens Baker JN75 | Oluaitisiti (Lus) | Climb | WR | R | Syphilis | Add to Tylosoema fassolentis flowers, Erythrina abyssinica stem bark, Boil and drink and/or bath | 1 | 1.6 |
| | Acacia hockii | Akasaana | Tree | WA | L | Herpes | Apply powder mixed with jelly | 3 | 4.8 |
| Plant Family | Plant Scientific name, Voucher number | Plant Local name | Habit | Status | Part used | Disease (s) | Preparation and administration | Frequency of mention | PRK (N=63) |
|--------------|--------------------------------------|------------------|-------|--------|-----------|------------|---------------------------------|----------------------|-----------|
| De Wild. JN84 | (Lug), Kasone (Lus) | a | Tree WA | L/Tu | Burns, warts | Apply powder on affected area | 4 | 6.4 |
| Acacia Senegal (L.) Wild. JN85 | a | Tree WA | R/L | Skin rash | Apply powder mixed with jelly | 1 | 1.6 |
| Acacia sieberiana DC. JN86 | a | Shrub WA | Th | Warts | Prick the wart | 1 | 1.6 |
| Albizia coriaria Oliv. JN70 | a, b, Mugavu (Lug), Musita (Lus) | Tree WA | L | Skin rash | Apply powder, mixed with jelly | 19 | 30.2 |
| Albizia grandibracteata Taub JN71 | a | Tree WA | L | Albino skin burns | Mix bark powders of Albizia coriaria, Solanum nigrum, with jelly & smear | 1 | 1.6 |
| Albizia grandibracteata Taub JN71 | a | Akalongorongo. (Lus) | Tree WA | L | Albino skin burns | Mix bark powders of Albizia grandibracteata, leaves of Solanum nigrum, add to jelly and smear | 1 | 1.6 |
| Crotalaria spinosa Benth. JN79 | a | Kasambandege (Lus) | Herb WA | L | Skin allergy | Powder and smear on affected area | 15 | 23.8 |
| Entada abyssinica A. Rich. JN80 | a | Mwolola (Lug) | Tree WA | SB | Skin rash | Powder decoction bathed | 9 | 14.3 |
| Erythrina abyssinica DC. JN72 | a, b | Ejirikiti (Lug) Ekiyirikiti (Lus) | Tree WA | SB | Burns | Powder mixed with jelly applied | 1 | 1.6 |
| | | | | | | Decoction drunk | 1 | 1.6 |
| | | | | | | Powder mixed with jelly applied | 1 | 1.6 |
| | | | | | | Add Tylosea fassogeri, Sapium ellipticum crush separately, add water, bathe | 1 | 1.6 |
| | | | | | | Powder mixed with jelly applied | 2 | 3.2 |
| Plant Family       | Plant Scientific name, Voucher number | Habit | Status | Part used | Disease (s) | Preparation and administration                      | Frequency of mention | PRK (N=63) |
|-------------------|---------------------------------------|-------|--------|-----------|-------------|-------------------------------------------------------|----------------------|------------|
| Indigofera        | fulvopilosa Brean. JN73 a Lweto olusadha (Lus) Herb WA SB + R Wp Skin allergy Boil and drink Powder mixed with jelly applied 11 17.5 |
| Pilostigma        | thronningii (Schum.) Milne-Redh JN31 a Kilama (Lus) Tree WR L Chicken-pox Powder mixed with jelly applied 1 1.6 |
| Senna didymobotrya | Fresen. H. S. Irwin & Barneby JN32 a Omuvuvumira (Lus) Tree WCA L R/SB Wounds Ringworm Powder applied Powder mixed with jelly applied 1 1.6 |
| Senna             | occidentalis (L.) Link JN33 a Kasasisasi/mwitanjoka (Lam.) H. S. Irwin & Barneby JN34 a Lukooge (Lus) Tree WR L Wounds Ringworm Powder mixed with jelly applied 2 3.2 |
| Sesbania          | pachycarpa DC. JN76 a Entonanto (Lus) Shrub WA Sp Warts, acne Sap applied 2 3.2 |
| Tephrosia         | linearia (Willd.) Pers. JN77 a Lweyo yeyo (Lus) Herb WA L Burns, ringworms Powder mixed with jelly applied 3 4.8 |
| Tephrosia         | nana Schweinf. JN81 a Kawuliza akanene (Lus) Tree WA R Syphilis Decoction drunk 1 1.6 |
| Tylosema          | fassoglensis (Schweinf) a Ekiyugeyuge (Lus) Climber WA L Sp Warts, acne Sap applied 2 3.2 |

**Note:** PRK denotes the number of patients treated with each plant. The table lists the plants used in the study, their parts used, diseases treated, and the frequency of mention.
| Plant Family | Plant Scientific name; Voucher number | Plant Local name | Habit | Status | Part used | Disease (s)          | Preparation and administration                  | Frequency of mention | PRK (N=6 3) |
|--------------|--------------------------------------|------------------|-------|--------|----------|----------------------|------------------------------------------------|----------------------|-------------|
| Torre & Hill JN74 |                                      | R                | Syphilis | Crush, add to water and bathe | 1 | 1.6 |
| Vigna vexillata (L.) A. Rich JN62 | . Kibowabowa (Lug) | Herb WA Wp | Leprosy, Skin rash | Pound and drink; decoction bathed | 2 | 1.6 |
| Zornia glochidiata DC. JN78 | . Kasatira (Lus) | L L | Plague, Ringworms, Acne | Powder mixed with jelly applied | 1 | 1.6 |
| PRK (N=6 3) |                                      | R                | Syphilis | Fresh or powder, drink and bathe | 1 | 1.6 |
| Vigna vexillata (L.) A. Rich JN62 | . Kibowabowa (Lug) | Herb WA Wp | Leprosy, Skin rash | Pound and drink; decoction bathed | 2 | 1.6 |
| Zornia glochidiata DC. JN78 | . Kasatira (Lus) | L L | Plague, Ringworms, Acne | Powder mixed with jelly applied | 2 | 3.2 |
| Vigna vexillata (L.) A. Rich JN62 | . Kibowabowa (Lug) | Herb WA Wp | Leprosy, Skin rash | Pound and drink; decoction bathed | 2 | 1.6 |
| Zornia glochidiata DC. JN78 | . Kasatira (Lus) | L L | Plague, Ringworms, Acne | Powder mixed with jelly applied | 2 | 3.2 |
| Vigna vexillata (L.) A. Rich JN62 | . Kibowabowa (Lug) | Herb WA Wp | Leprosy, Skin rash | Pound and drink; decoction bathed | 2 | 1.6 |
| Zornia glochidiata DC. JN78 | . Kasatira (Lus) | L L | Plague, Ringworms, Acne | Powder mixed with jelly applied | 2 | 3.2 |
| Hypericaceae | Psorospermum febrifugum (Lug) JN38 | Shrub WA L | Wounds | Pound, apply on affected area | 17 | 27 |
| Lamiaceae. | Clerodendrum umbellatum Poir JN63 | Shrub WA R | Syphilis | Crush the roots, boil and drink | 1 | 1.6 |
| Hoslundia opposita Vahl. JN64 | . Kamunya (Lug) | Shrub WCA L | Chicken pox, Albino skin burns | Powder mixed with jelly applied | 1 | 1.6 |
| Leonotis nepetifolia (L.) R. Br. JN65 | . Kilumufumu (Lug) | Herb WA L | Pimples | Add powder to petroleum jelly and smear | 4 | 6.3 |
| Lamiaceae. | Clerodendrum umbellatum Poir JN63 | Shrub WA R | Syphilis | Crush the roots, boil and drink | 1 | 1.6 |
| Hoslundia opposita Vahl. JN64 | . Kamunya (Lug) | Shrub WCA L | Chicken pox, Albino skin burns | Powder mixed with jelly applied | 1 | 1.6 |
| Leonotis nepetifolia (L.) R. Br. JN65 | . Kilumufumu (Lug) | Herb WA L | Pimples | Add powder to petroleum jelly and smear | 4 | 6.3 |
| Lamiaceae. | Clerodendrum umbellatum Poir JN63 | Shrub WA R | Syphilis | Crush the roots, boil and drink | 1 | 1.6 |
| Hoslundia opposita Vahl. JN64 | . Kamunya (Lug) | Shrub WCA L | Chicken pox, Albino skin burns | Powder mixed with jelly applied | 1 | 1.6 |
| Leonotis nepetifolia (L.) R. Br. JN65 | . Kilumufumu (Lug) | Herb WA L | Pimples | Add powder to petroleum jelly and smear | 4 | 6.3 |
| Lamiaceae. | Clerodendrum umbellatum Poir JN63 | Shrub WA R | Syphilis | Crush the roots, boil and drink | 1 | 1.6 |
| Hoslundia opposita Vahl. JN64 | . Kamunya (Lug) | Shrub WCA L | Chicken pox, Albino skin burns | Powder mixed with jelly applied | 1 | 1.6 |
| Leonotis nepetifolia (L.) R. Br. JN65 | . Kilumufumu (Lug) | Herb WA L | Pimples | Add powder to petroleum jelly and smear | 4 | 6.3 |

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| Plant Family | Plant Scientific name; Voucher number | Plant Local name | Habit | Status | Part used | Disease (s) | Preparation and administration | Frequency of mention | PRK (N=63) |
|--------------|--------------------------------------|------------------|-------|--------|----------|------------|-------------------------------|---------------------|-----------|
| Lauraceae    | *Persea americana* Mill. var. americana JN69 | *Ovacado* (Lug, Eng) | Tree | CA     | L        | Cracked soles of feet | Peel ripe fruit, smear | 10                   | 16       |
| Malvaceae    | *Grewia trichocarpa* Hochst. ex A. Rich. JN108 | *Omukomakoma* (Lug) | Shrub | WA     | R        | Burns | Crush and smear on the wound | 1                   | 1.6      |
| Moraceae.    | *Azadirachta indica* A. Juss JN82 | *Neem tree* Leera (Lug), (Eng) | Tree | CR     | L        | Albino skin burns | Crush dried leaves, add to vaseline, smear | 10                  | 16       |
|              |                                       |                  |      |        |          | Skin allergy | Crush, add kerosene, apply | 1                   | 1.6      |
|              |                                       |                  |      |        |          | Acne | Squeeze and smear | 1                   | 1.6      |
|              |                                       |                  |      |        |          | Scabies | Grind and smear | 1                   | 1.6      |
| Menispermaceae | *Clisampelos mucronata* A. Rich. JN83 | *Akavamagombe* (Lug) | Climb er | WA    | F/L     | Herpes | Squeeze/Pound with *Clerodendrum mucronata*, apply | 3                   | 4.8      |
| Moraceae     | *Milicia excelsa* (Welw.) C. C. | *Muvule* (Lug) | Tree | WT     | Sp      | Boils | Apply on affected area | 14                  | 22.2     |

Note: PRK (N=63) indicates the number of participants or samples used in the study.
| Plant Family | Plant Scientific name; Voucher number | Plant Local name | Habit | Status | Part used | Disease (s) | Preparation and administration | Frequency of mention | PRK (N=63) |
|--------------|---------------------------------------|------------------|-------|--------|-----------|-------------|---------------------------------|---------------------|----------|
| **Namukobe et al.; EJMP, 32(2): 15-40, 2021; Article no.EJMP.66158** |                         |                  |       |        |           |             |                                 |                     |          |
| **Moringaceae** | *Moringa oleifera* Lam. JN91 | Mutuba (Lug) | Tree | WCA | SB | Burns | Mix with rabbit hair, apply | 11 | 17.5 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Ficus natalensis Hochst. JN87** |                         | Mutuba (Lug) | Tree | WCA | SB | Skin rash | Decoction bathed | 1 | 1.6 |
| **Ficus mucuso Welw. Ex Ficalho. JN89** |                          | Omusenoseno (Lus) | Tree | WA | SP | Scabies | Apply leaf extract | 1 | 1.6 |
| **Ficus ovata Vahl JN90** |                          | Mukoko (Lus) | Tree | WA | LB | Skin allergy | Squeeze and smear | 1 | 1.6 |
| **Musa paradisiaca L. JN92** | *Ekigogo (Lus)* | Herb | CA | FL | SB | Burns | Apply sap | 1 | 1.6 |
| **Psidium guajava (L.) JN93** | Mapera (Lug) | Tree | CA | L | SB | Skin rash | Boil and bathe | 7 | 11.1 |
| **Cycnium herzfeldianum (Vatke.) Engl. JN101** | Tusangala (Lus) | Herb | WA | WP | SB | Skin allergy | Pound into dry fine powder, add to oil and smear | 1 | 1.6 |
| **Pennisetum glaucum (L.) R. Br. JN94** | Obulo (Lus) | Grass | WA | Sd | SB | Burns | Roast, grind and apply the powder | 2 | 3.2 |
| **Digitaria abyssinica (A. Rich.) Stapf. JN96** | Olumbu (Lug) | Grass | WA | L | SB | Wounds | Squeeze and apply | 5 | 8.0 |
| **Adenia cissampeloide** | Lugerogero (Lus) | Climber | WA | SB | SB | Skin allergy | Boil & bathe | 1 | 1.6 |
| Plant Family | Plant Scientific name; Voucher number | Plant Local name | Habit | Status | Part used | Disease (s) | Preparation and administration | Frequency of mention | PRK (N=63) |
|--------------|--------------------------------------|------------------|-------|--------|-----------|-------------|--------------------------------|---------------------|-----------|
| Phyllanthaceae | Flueggea virosa (Roxb.ex Wild.) Royle. JN54 | *Lukandwa* (Lus) | Shrub | WA     | SB Syphilis | Boil and drink fluid thrice a day | 5                   | 8.0       |
| Polygonaceae. | Oxygonum sinuatum (Hochst. & Steud ex Meisn.) Dammer JN97 | *Kafumitabageng* (Lus) | Herb | WR     | L Tumors | Tie in banana leaves together with *Asystasia mysorensis* roast and apply. | 1                   | 1.6       |
| Rubiaceae.   | Spermacoce princeae (K. Schum.) Verdc JN99 | *Musanvuma or Enkokoma enkazi* (Lug) | Tree | WA     | L Ringworm | Pound, add oil, smear | 2                   | 3.2       |
| Rutaceae.    | Citrus limon L. Osbeck JN100 | *Ennimu* (Lug,Lus) | Tree | CA     | Fr Wrinkles | Squeeze and apply | 2                   | 3.2       |
| Plant Family | Plant Scientific name; Voucher number | Plant Local name | Habit | Status | Part used | Disease (s) | Preparation and administration | Frequency of mention | PRK (N=63) |
|-------------|--------------------------------------|------------------|-------|--------|-----------|-------------|-------------------------------|----------------------|------------|
| Solanaceae  | Nicotiana tabacum L. JN102           | Endaaye (Lus)    | Herb  | CR     | L         | Tumors      | Wrap in banana leaves, roast and apply | 1                    | 1.6        |
|             | Solanum anguivi Lam. JN103           | Entula (Lug),    | Herb  | CA     | L         | Skin rash   | Add leaves of Solanum lycopersicum, crush and smear on affected area | 14                   | 22.2       |
|             | Solanum Incanum L. JN104             | Ntengotengo (Lus) | Herb  | CA     | Fr        | Tumors      | Squeeze to release fluid and apply once daily | 1                    | 1.6        |
|             | Solanum lycopersicum L JN105         | Nyanja. (Lug)    | Herb  | CA     | Fr        | Pimples     | Crush, apply on face | 4                    | 6.3        |
|             | Solanum nigrum L. JN106              | Ensuga (Lug),    | Herb  | WCA    | L/Fr      | Warts, tumors | Squeeze and apply | 6                    | 2.4        |
|             | Solanum dasyphyllum Schumach. & Thonn. JN107 | Entulatula (Lus) | Herb  | WA     | L         | Albino skin burns | Crush separately Albizia grandibracteata, Albizia coriaria, to fine powders, mix, add to jelly, smear | 1                    | 1.6        |
| Talinaceae  | Talinum portulacifolium (Forsk.) Aschex. Schweinf. JN98 | Empozza (Lus)    | Herb  | WR     | L         | Skin allergy / rash | Pound in water, sprinkle on patient /bathe | 2                    | 3.2        |
| Verbenaceae | Lantana camara L. JN110              | Kapanga (Lus),   | Shrub  | WA     | R/L       | Ringworm    | Crush, mix in kerosene, apply until it clears | 3                    | 4.8        |
|             |                                     | Kayukiukyi (Lug) |       | L       | L         | Scabies     | Squeeze, add sheep dung, apply | 8                    | 12.7       |
|             |                                     |                  |       | L       |           | Wounds      | Crush and apply | 1                    | 1.6        |
| Vitaceae    | Cissus Oliveri (Engl.) Gilg ex. Engl. JN111 | Kinya kikazi (Lus) | Climb er | WA     | L         | Wounds      | Plant extract applied | 1                    | 1.6        |
|             | Cyphostemma adenosacule (Steed ex A. K.B) | Akabombo akatono (Lus, Lug) | Climb er | CA     | Wp        | Skin rash   | Decoction bathed | 17                   | 27         |
| Plant Family | Plant Scientific name; Voucher number | Plant Local name | Habit Status | Part used | Disease(s) | Preparation and administration | Frequency of mention | PRK (N=6 3) |
|--------------|---------------------------------------|------------------|--------------|-----------|------------|---------------------------------|----------------------|-------------|
| Xanthorrhoeaceae | Aloe Vera (L.) Burm. f. JN12 | Kigajj (Lug), Kikaka (Lus) | Shrub | CA | L | Scabies, warts | Powder mixed with vaseline applied | 4 | 6.4 |
| | | | | | | | 1 | 1.6 |

| | L | Syphilis | Infusion bathed | 1 | 1.6 |
| | L | Vertigo, warts | Powder mixed with vaseline applied | 4 | 6.4 |

Key: Column 3: "Kayunga" ; " [Buyende]; Column 3: Lug (Luganda dialect); Lus (Lusoga dialect); Column 5: W- wild; C- Cultivated; R- Rare; T- Threatened ; Column 6: L- Leaf; R- root; Wp- whole plant; Sd- seed; Fl- flower; Tu- Tuber; Sp- sap; Sh- shoot; SB- stem bark; Fr- fruit; Th- Thorn; Column 10: PRK- Percent respondent Knowledge.
4. CONCLUSIONS

There is diverse knowledge of medicinal plants recorded in this study used by local communities in Buyende and Kayunga districts, for the treatment of dermatological disorders. *Hoslundia opposita* and *Bidens pilosa* were ranked highest in effectiveness to treat wounds. Fabaceae contributed a large number of plant species used for medicine. This study creates a basis for more research to evaluate the pharmacological activities of the commonly used plants that have not been evaluated. These medicinal plants are very useful especially to people who cannot afford modern medical care products. With more than 50% of plant species useful for treating skin diseases growing in the wild (natural habitats such as forests, bushes, etc), is not sustainable and it means that activities like farming may pose a serious threat to these species. There is need for conservation (outside their natural habitats) and preservation of the plant species with the help of local participation and extensive research in this respect to broaden the prospects of herbal drugs in skin disease treatment.

CONSENT AND ETHICAL APPROVAL

In accordance with the ethical standards of Makerere University, all participants were allowed to consent before commencement of field study interviews, and they also gave consent for publication. The objective of the study was clearly stated to be for academic purposes not commercial. Confidentiality was assured, their knowledge to be protected and research findings shared with them as custodians of the knowledge.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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