

# An Ethnobotanical Survey of Traditional Medicinal Plants used against Elephantiasis in the OR Tambo District, Eastern Cape, South Africa

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Submitted: 28-Sep-2020

Revised: 24-Feb-2021

Accepted: 22-Apr-2021

Published: 24-Jan-2022

## ABSTRACT

**Introduction:** Elephantiasis is a medical condition associated with skin thickening and excessive swelling of the lower limbs. It is caused by parasitic nematodes which are filarial in nature; hence, it is also known as lymphatic filariasis. The condition is classified into filarial and nonfilarial elephantiasis. Filarial elephantiasis is caused by infection with nematode worms which are transmitted by several genera of mosquitoes. Nonfilarial elephantiasis is a result of cases such as tuberculosis, sexually transmitted infections, leprosy, and repeated streptococcal infections, leading to elephantiasis. South African population is at risk of the disease and treating it is still a problem. This study documents medicinal plants that are used for the treatment of elephantiasis and related infections in the OR Tambo District municipality, Eastern Cape Province, South Africa.

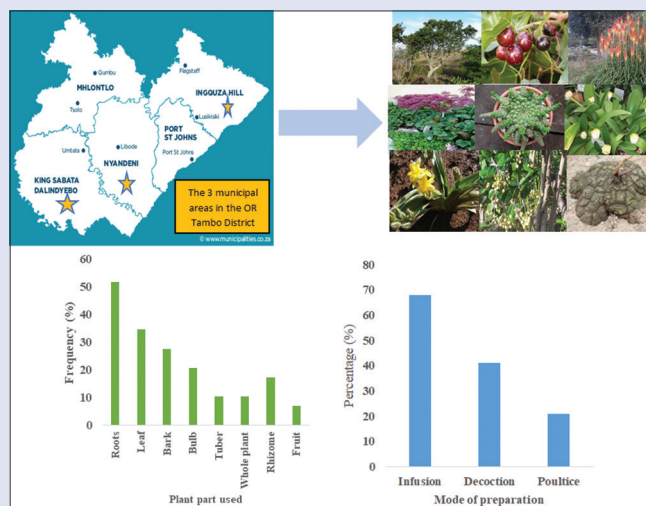
**Materials and Methods:** An ethno botanical survey of medicinal plants used against elephantiasis in King Sabata Dalindyebo, Ingquza-Hill and Nyandeni municipal areas in the OR Tambo District of the Eastern Cape Province was conducted using structured questionnaires. The information was gathered from 30 traditional healers, 4 herbalists, and 3 young people with indigenous knowledge. **Results and Discussion:** A total of 29 plant species belonging to 23 families that are used to treat elephantiasis were recorded. *Convolvulaceae* (*Ipomoea oblongata*), *Dioscoreaceae* (*Dioscorea sylvatica*), *Gunneraceae* (*Gunnera perpensa*), *Hypoxidaceae* (*Hypoxis hemerocallidea*), and *Ranunculaceae* (*Clematis brachiata*) were the most frequently mentioned in all three municipal areas. The *H. hemerocallidea* had the highest use-value (0.31), followed by *Elephantorrhiza elephantina* (0.27) and *G. perpensa* (0.24). Bark, root, rhizome and leaf decoction and infusion, as well as cooked bark or leaves are commonly used to treat elephantiasis. Some plant parts are ground into powder, mixed with water and applied on affected skin as poultice.

**Key words:** Elephantiasis, ethnobotany, lymphatic filariasis, medicinal plants, traditional healers

## SUMMARY

- The study of medicinal plants used in the treatment and management of elephantiasis in South Africa has not been explored extensively. Research is currently ongoing where the documented plants are further scientifically

tested to validate the claims that are made by the traditional healers and herbalists.



**Abbreviations used:** DEC: Diethylcarbamazine; HIV/AIDS: Human Immunodeficiency virus/Acquired immunodeficiency syndrome; UV: Use-value; SANBI: South African National Biodiversity Institute; WHO: World Health Organization.

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DOI: 10.4103/pm.pm\_434\_20

Access this article online

Website: www.phcog.com

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## INTRODUCTION

Ethnobotany is the study of relations between people and plants. It looks at how people of a particular culture and region make use of indigenous plants. Based on long-term observations, different cultures have developed their own ethnobotanical methods by making the use of their indigenous plants.<sup>[1]</sup> Worldwide, medicinal plants have been a resource for healing for thousands of years. Numerous ethnobotanical survey studies documenting different plant species and preserving the indigenous knowledge of various communities worldwide have been undertaken.<sup>[2-9]</sup> These ethnobotanical studies serve as possible leads for the discovery of effective new drugs that may be used to manage and treat illnesses

that pose a serious threat to both human and animal health. Elephantiasis is one such illness.

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Cite this article as: Adams Z, Thekiso O, Buwa-komoreng L. An ethnobotanical survey of traditional medicinal plants used against elephantiasis in the or tambo district, Eastern Cape, South Africa. Phcog Mag 2021;17:915-22.

Elephantiasis, otherwise medically known as lymphatic filariasis (LF), is a condition that is associated with excessive swelling due to lymph accumulation (lymphedema), leading to disfigurement of the affected body parts which are commonly the lower limbs, arms, breasts, and scrotum in males.<sup>[10]</sup> The condition is classified into filarial and nonfilarial elephantiasis. Filarial elephantiasis is caused by infection with nematode worms *Wuchereria bancrofti*, *Brugia malayi*, and *B. timori*, which are transmitted by several genera of mosquitoes.<sup>[11]</sup> These worms occupy the lymphatic system, including the lymph nodes and in chronic cases, they can lead to the disease elephantiasis.<sup>[12]</sup> In most areas, cases such as sexually transmitted diseases (e.g., lymphogranuloma venereum), tuberculosis, an infectious disease called leishmaniasis, repeated streptococcal infections, leprosy, and environmental factors lead to elephantiasis.<sup>[13-15]</sup>

An estimated 120 million people in 81 endemic countries are affected by the infection with approximately 40 million people having disfiguring symptoms.<sup>[11,16]</sup> Of the 40 million people, 15 million are suffering from lymphedema and 25 million showing urogenital swelling, particularly scrotal hydrocele.<sup>[16]</sup> About 30% of people at risk reside in the African region, while 65% in South-East Asia Region and the remainder in other parts of the world.<sup>[16]</sup> In the African region, elephantiasis is endemic in 39 countries with the population at risk estimated at over 400 million.<sup>[16]</sup> According to local newspapers, South Africa is also burdened by elephantiasis; however, data on its morbidity are lacking and it has been reported that about 31% of the South African population is at risk of infection.<sup>[17-19]</sup>

The Global Program to Eliminate LF was launched in the year 2000 with the aim of interrupting the transmission of parasite and reducing morbidity.<sup>[16]</sup> This could be achieved by taking annual doses of diethylcarbamazine (DEC) or ivermectin together with albendazole. These drugs are effective in reducing microfilariae counts but not effective in killing adult worms.<sup>[20,21]</sup> As a result, they provide only partial benefit to infected patients and very often are associated with adverse reactions. For example, DEC has been reported to cause side effects such as fever, gastrointestinal disturbance, headache, malaise, and skin rash that reduce patient's compliance.<sup>[22,23]</sup> According to a study that has been done, antifilarial agents should be free from toxicity, with high cure even with a low dose of the drug, effective against worms, and cost-effective. Unfortunately, the available synthetic drugs do not meet these requirements.<sup>[24]</sup>

Medicinal plant extracts may be alternative sources of antifilarial agents as they are rich in bioactive compounds. Many researchers have reported on the effectiveness of plant extracts to kill larvae.<sup>[24-27]</sup> In South Africa, herbal medicine is widely used for the treatment of various diseases and some traditional healers and herbalists have acknowledged the use of medicinal plants to treat elephantiasis and its related symptoms. Komoreng *et al.* reported on a number of medicinal plants that are used by herbalists and traditional healers from certain parts of South Africa to treat elephantiasis.<sup>[28]</sup> Plant species within the same families may be used in neighboring regions, in different geographical areas, or in other countries to treat various conditions. A study undertaken by Mbuni *et al.* on traditional uses of Kenyan medicinal plants reported on remarkable differences in used plant parts, mode of preparation and the use that has been documented in other regions.<sup>[29]</sup> It is thus possible to see some of the South African flora in the neighboring countries. Some of those plant species include *Dicoma anomala* Sond., *Gunnera perpensa* L., *Eucomis comosa* (Houtt.) Wehrh., *Euphorbia* sp., *Hypoxis hemerocallidea* Fisch., C.A.Mey. and Avé-Lall., *Elephantorrhiza elephantina* (Burch.) Skeels, *Dioscorea sylvatica* Eckl. and *Pentanisia prunelloides* (Klotzsch) Walp.<sup>[6,30-34]</sup>

This study reports on the use of medicinal plants in South Africa, particularly in the OR Tambo District municipality in the Eastern Cape Province, to treat and manage elephantiasis.

## MATERIALS AND METHODS

### Study area

The study was conducted in the Ingquza Hill, Nyandeni and King Sabata Dalindyebo Municipal areas within the OR Tambo District of the Eastern Cape Province, South Africa [Figure 1]. The Eastern Cape is the second biggest Province, covering about 13.8% of the country's total area.<sup>[35]</sup> It has the second biodiversity hotspot, known as Mapuland-Pondoland Albany, which is dominated by closed shrublands, low forests with evergreens, succulent trees, vines, and shrubs.<sup>[36]</sup> The climatic conditions are characterized by cold frosty winters and hot summer days.

OR Tambo district municipality is one of the 7 districts of the Eastern Cape province of South Africa. The main town of the area is OR Tambo is Mthatha (formerly known as Umtata). According to the 2011 Census of SA, about 94% of its 1,364,943 people speak isiXhosa.<sup>[37]</sup> It is within the Wild Coast Region. It is bordered by Alfred Nzo District Municipality to the north, the Joe Gqabi District to the Northwest, the Chris Hani District to the west and the Amathole District to the Southwest.<sup>[38]</sup> The district is formed by five municipalities, namely King Sabata Dalindyebo, Nyandeni, Mhlontlo, Port St Johns, and Ingquza Hill and covers approximately 80% of what used to be marginalized homeland in the Transkei.<sup>[38]</sup> The Nyandeni Municipality, which falls within coordinates 31.5284° S and 29.0111° E, is bordered by a 20 km stretch of the coastal belt and falls within the Grassland and Savanna biomes. The communities fall under the Sub-Escarpment Grassland and grassland biome is the second largest in the country.<sup>[39]</sup> The Ingquza Hill municipality falls within 31.2632° S and 29.6963° E. It accounts for almost a quarter of this district's geographical area. The municipality is located to the north west of the OR Tambo District and was established through the amalgamation of the former Lusikisiki and Flagstaff Transitional Local Councils and the surrounding rural areas. The Municipality has high levels of poverty and underdevelopment.<sup>[40]</sup> The King Sabata Dalindyebo municipality, which falls between 3.7074° S and 28.5798° E, is the largest of the three municipalities and accounts for a quarter of its total geographical area. The majority population of the municipality resides in the rural areas, where they still practice indigenous cultural lifestyles.<sup>[38]</sup>

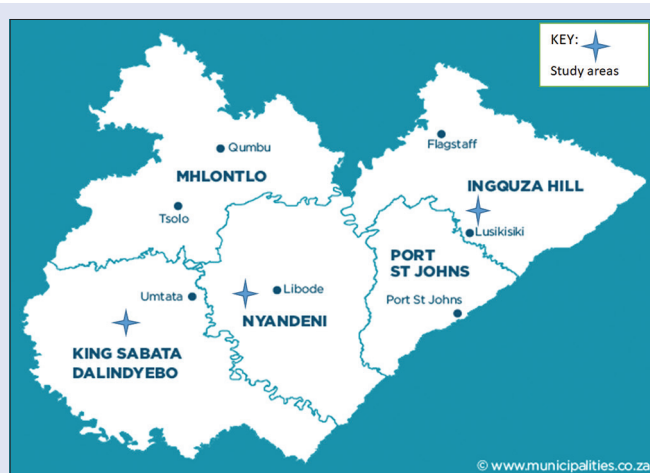


Figure 1: Map of OR Tambo District Municipality showing the study areas (Source: Municipalities.co.za)

## Data collection

Ethnobotanical surveys were conducted through semi-structured questionnaires and informal conversations with traditional healers, herbalists, and inhabitants who use medicinal plants. The interviews were conducted in isiXhosa which is the local language in all three municipalities. The recorded information included the age and gender of the informants, common names of the plants they use to treat elephantiasis and related ailments, their local uses, parts of the plants used, the mode of preparation, and forms of administration of the herbal remedies.

Plants were collected with the assistance of traditional healers and herbalists and they were identified by their common names and scientific identification was done with the help of Mrs Matitibala who has a book with both common and scientific names. Plants were later validated at the Herbarium of the University of the Free State (QwaQwa Campus) and voucher specimens were prepared and deposited at the herbarium. The data were tabulated to include the botanical name, family, local name, parts used, preparation, and application [Table 1].

## Data analysis

Use-value (UV) was used to analyze the data obtained from the questionnaires. The UV is a quantitative index that shows the virtual importance of species known locally.<sup>[41]</sup> It was calculated as follows:

$$UV = \sum U / n$$

Where  $UV$  = UV of a species;  $U$  = number of citations per species;  $n$  = number of informants.

## Intellectual property agreement/ethical approval

The aim and the purpose of the interviews were clarified to each respondent and their consent to record the shared information was obtained. Furthermore, it was verbally agreed that this research shall not be used for commercial purposes, but shall serve as enlightenment to the community about traditional medicinal plants used in the treatment and management of elephantiasis and related ailments in the Eastern Cape Province. This study shall also serve as a means of documenting and preserving South African indigenous knowledge for future use. Ethical clearance for the study was granted by the University of the Free State's Ethics Committee.

## RESULTS AND DISCUSSION

The results of the ethnobotanical survey with detailed information are presented in Table 1. A total of 37 informants, comprising 30 traditional healers, 4 herbalists and 3 young people were interviewed. Twenty-six (70%) of the informants were females and eleven (30%) were males with ages ranging between 18 and 75 years. All the informants use medicinal plants to treat and manage elephantiasis, which they commonly refer to as *Umeqo* or *Unyawo lwendlovu*.

In this study, 29 medicinal plants belonging to 25 families of Angiosperms were reported to be used in the treatment and management of elephantiasis and the common symptoms in the 3 municipal areas. The following families were reported as the most commonly used: *Apocynaceae*, *Dioscoreaceae*, *Euphorbiaceae*, *Fabaceae*, *Rubiaceae*, and *Solanaceae* with 2 species each. In another study, Hyacinthaceae family was reported to be the most prominent in the Eastern Cape Province, in Intsika Yethu and Raymond Mhlaba (formerly known as Nkonkobe municipality) municipal areas, with 4 species, followed by *Solanaceae* with 3 species and *Euphorbiaceae* with 2 species.<sup>[28]</sup> The Eastern Cape Province is known for its richness in plant species with indigenous people having a history of using traditional medicine to treat various

diseases.<sup>[42]</sup> The Xhosa people are said to use herbal medicine since they still believe in their efficacy.<sup>[43]</sup>

The majority of the reported plants are used in the treatment and management of inflammation, wounds, and pain. Among the reported species are *K. drepanophylla*, *Haemanthus albiflos*, *Pachycarpus concolor*, *Ilex mitis*, *Albuca aurea*, *Microglossa mesipilofia*, *Acorus calamus*, *Chenopodium ambrosioides*, *Ipomoea oblongata*, *Curtisia dentata*, *Elephantorrhiza elephantina*, *G. perpensa*, *Burchellia bubaline*, *Pentanisia prunelloides*, and *Withania somnifera*. Wube *et al.* reported on the knipholone anthraquinone found in *Kniphofia* species.<sup>[44]</sup> Knipholone is reported to possess antioxidant and anti-inflammatory properties which justifies the use of the species *K. drepanophylla* by traditional healers to treat pain and swelling, which are the symptoms of elephantiasis.<sup>[44]</sup> *B. bubaline*, one of the plants used by South African traditional healers to treat and manage inflammation, is reported to possess antimicrobial, antifungal, and anti-inflammatory activities.<sup>[45]</sup>

The *in vitro* screening of *C. dentata* revealed that the plant possessed good antibacterial, antifungal, and antioxidant properties which could be attributed to ursolic acid, betulinic acid lupeol, and  $\beta$ -sitosterol compounds that were isolated from the plant leaves.<sup>[46]</sup> *G. perpensa* has been reported to possess a wide range of pharmacological activities including acetylcholinesterase, anthelmintic, antibacterial, antifungal, antinociceptive, anti-inflammatory, antioxidant, antitumor, lactogenic, and uterotonic.<sup>[47]</sup> These pharmacological properties could be due to the presence of several classes of phytochemicals including alkaloids, benzoquinones, ellagic acids, flavonoids, phenols, proanthocyanidins, and tannins.<sup>[47]</sup> Tannins were reported to be useful in treating dermatitis and are known to form a protective layer on the skin and mucosa, thereby enhancing tissue regeneration.<sup>[48]</sup>

Seven of the 29 medicinal plants recorded in this study are reported by Afolayan *et al.* to be used in the management of skin disorders among the Xhosa communities of the Amathole District in the Eastern Cape Province.<sup>[49]</sup> In this study, *K. drepanophylla* and *Spirostachys africana* are the only plant species that were reported to treat skin ailments. In a study conducted by Amoo *et al.* on phytochemical constituents, antioxidant and acetylcholinesterase-inhibitory properties of stored medicinal plants, *S. africana* displayed a significantly higher phenolic content.<sup>[50]</sup>

In this study, only four plants (*A. aurea*, *Kniphofia drepanophylla*, *Rapanea melanophloes*, and *Rhoicissus tomentosa*) have been reported to expel parasites. The fruits and leaves of *R. melanophloeos* have been reported to possess anthelmintic activity and are used to treat livestock in East Africa and in South Africa.<sup>[51,52]</sup>

Of the 29 recorded plants, 28 are indigenous and one is exotic (*Chenopodium ambrosioides*). According to the red data list, *A. aurea*, *H. albiflos*, *K. drepanophylla*, and *M. mesipilofolia* are endemic to South Africa. *K. drepanophylla* is listed as vulnerable, whereas the rest of the plant species is listed as of least concern.<sup>[53]</sup> Some of the plants reported in this study are said to be poisonous, some parts of *Erythrina caffra*, for example, are said to be poisonous to animals and humans, and the parts of *Aconkanthera oblongifolia* leaves are known to be poisonous.<sup>[54,55]</sup>

As shown in Figure 2, the most frequently used plant parts reported in this study were roots (51%), followed by leaves (31%) bark (27%), bulb (20%), rhizome (17%), and fruits (6%). Roots and leaves were also reported as the commonly used plant parts.<sup>[28]</sup> According to a study that has been done, the extensive use of roots leads to complete destruction of plants, which further leads to their extinction.<sup>[49]</sup> The preference of leaves could be due to the accumulation of phytochemicals which are known to be pharmacologically active against diseases.<sup>[56,57]</sup> Plants could be used individually or in combination as a decoction and/or as

Table 1: Medicinal plants used for the treatment of elephantiasis in the Eastern Cape, South Africa

Family	Scientific name	Common name	Voucher number	Area	UV	Plant part used	Method of administration
<i>Amaryllidaceae</i>	<i>Haemanthus albidiflos</i> Jacq.	Umathunga	Adams, 10027	KSD, Nyandeni	0.10	Bulb, roots, leaf	Infusion is taken for pain
<i>Apocynaceae</i>	<i>Acoelanthera oblongifolia</i> (Hochst)	Intlungunyembe	Adams, 10014	KSD	0.17	Roots, leaves	Infusion is taken orally to drain excess fluid. Swollen feet are soaked in warm mixture
<i>Apocynaceae</i>	<i>Pachycarpus concolor</i> E.Mey	Ishongwe	Adams, 10015	KSD	0.10	Bulb, roots	Decoction and infusion are used for pain and inflammation
<i>Aquifoliaceae</i>	<i>Ilex mitis</i> (L.) Radlk	Ikimamilo	Adams, 1004	KSD, IH	0.10	Bark, leaves	Poultice is applied on sores
<i>Asparagaceae</i>	<i>Albuca aurea</i> Jacq.	Intelezi	Adams, 1007	KSD, Nyandeni	0.10	Bulb, roots	Infusion is applied on sores
<i>Asphodelaceae</i>	<i>Kniphofia drepanophylla</i> baker	IXonyo	Adams, 10016	KSD	0.17	Rhizome, roots	Used to expel worms, treat (poultice) wounds, acne and eczema
<i>Asteraceae</i>	<i>Microglossa mesipilofia</i> (less)	Ithyolo	Adams, 10028	KSD	0.10	Leaves, roots	The infusion is taken orally for pain and swelling
<i>Araceae</i>	<i>Acorus calamus</i> L.	Ikalmuzi	Adams, 10026	KSD	0.10	Roots, rhizome	Applied to treat sores and swelling
<i>Celastraceae</i>	<i>Lauridia tetragonia</i> (L.F)	Umdlavuzo	Adams, 10029	KSD	0.14	Bark, leaves	Boiled leaves and bark applied topically to treat swelling and pain and also wounds and blisters
<i>Chenopodiaceae</i>	<i>Chenopodium ambrosioides</i> L.	Untsukumbini	Adams, 1002	IH	0.10	Whole plant	Infusion used to treat swollen limbs and to reduce pain
<i>Convolvulaceae</i>	<i>Ipomoea oblongata</i> E.Mey.	Ubhoqo	Adams, 1005	KSD, Nyandeni, IH	0.10	Bulb, roots	Infusion and decoction is drank to reduce pain and also soak swollen limbs
<i>Curtisiaceae</i>	<i>Curtisia dentata</i> (Burm.f.) C.A. Sm	Uzintlwa	Adams, 1006	IH	0.17	Bark, leaves	Bark and leaf infusion is applied topically to treat wounds and infection
<i>Dioscoreaceae</i>	<i>Dioscorea dregeana</i> (Kunth) T. Durand and Schinz	Ingcolo	Adams, 10025	KSD	0.10	Rhizome, roots	Grind and boiled to soak feet and reduce swelling
<i>Dioscoreaceae</i>	<i>Dioscorea sylvatica</i> (Kunth) Eckl.	Ufudo	Adams, 1008	KSD, IH, Nyandeni	0.17	Bulb, roots	Infusion and decoction is used to treat pain and inflammation
<i>Euphorbiaceae</i>	<i>Euphorbia gorgonis</i> Berger.	Nkalmasane	Adams, 10017	KSD	0.14	Whole plant	Infusion is used to treat pain and swelling and crushed plant is applied topically on wounds and sores
<i>Euphorbiaceae</i>	<i>Spirostachys africana</i> Sond.	Umthombothi	Adams, 10023	KSD	0.14	Bark	The infusion is used to soak swollen limbs and also to treat skin problems and wounds by applying on skin as poultice
<i>Fabaceae</i>	<i>Erythrina caffra</i> Thunb.	Umsintsi	Adams, 1009	KSD, IH, Nyandeni	0.06	Bark	Bark and leaf infusion is used to treat sores, wounds, abscesses and arthritis
<i>Fabaceae</i>	<i>Elephantorrhiza elephantina</i> (Burch)	Intolwane	Adams, 10011	KSD	0.27	Rhizome, roots	The infusion is applied topically and root powder is applied on wounds and sores
<i>Gunneraceae</i>	<i>Gunnera perpensa</i> (L.)	Iphuzi	Adams, 1003	KSD, IH, Nyandeni	0.24	Rhizome, roots	Infusion and decoction taken to drain excess water and dry powder mixed with water is applied on sores and wounds
<i>Hyacinthaceae</i>	<i>Albuca setosa</i> Jacq.	Inqwebaba	Adams, 10022	KSD	0.10	Leaves, bulb	Decoction is taken to treat pain and inflammation
<i>Hypoxidaceae</i>	<i>Hypoxis hemerocallidea</i> Fisch., C.A. Mey. and Avé-Lall.	Inongwe, Ilabatheka	Adams, 10010	KSD, IH, Nyandeni	0.31	Tuber	Weak infusion or decoction is taken orally to reduce swelling and pain and to cleanse the blood
<i>Melanthaceae</i>	<i>Bersama lysonia</i> Oliv.	Isibhara	Adams, 10018	KSD	0.13	Bark	Infusion is used to treat pain and venereal diseases and poultice is applied topically to treat sores
<i>Myrsinaceae</i>	<i>Rapanea melanophloes</i> (L.) Mez	Umaphipha	Adams, 10012	KSD	0.17	Bark, leaves, fruit	Decoction is drank for pain and worms and infusion is used to soak on sores
<i>Ranunculaceae</i>	<i>Clematis brachiata</i> Thunb.	Umvuthuza	Adams, 1001	KSD, IH, Nyandeni	0.10	Whole plant	Infusion or decoction is taken to reduce pain and inflammation
<i>Rubiaceae</i>	<i>Burchellia bubalina</i> (L.f.) Sims.	Ithobankomo	Adams, 10019	IH	0.13	Bark, roots	Root and bark cold infusions are used in body wash to reduce pain and inflammation
<i>Rubiaceae</i>	<i>Pentanisia prunelloides</i> (Klotzsch ex Eckl. and Zeyh.) Walp.	Ikimamilo	Adams, 10013	KSD, IH	0.17	Tuber, roots	Root decoctions are taken orally or as enemas and also applied externally for sores and wounds
<i>Solanaceae</i>	<i>Lycium ferocissimum</i> Miers.	Umbovu, Idywadi	Adams, 10021	KSD	0.10	Leaves, roots	Decoction is applied topically to reduce pain and inflammation or inhaled to reduce pain

Contid...

Table 1: Contd...

Family	Scientific name	Common name	Voucher number	Area	UV	Plant part used	Method of administration
<i>Solanaceae</i>	<i>Withania somnifera</i> (L.)	Ubushwa, Ubuvimba	Adams, 10020	KSD, IH	0.13	Leaves, roots	The infusion is drank to heal inflammation and swelling and wounds or soaking the affected areas
<i>Vitaceae</i>	<i>Rhoicissus tomentosa</i> (Lam.) Wild and R.B. Drumm.	Isaqoni, Uchitibhunga	Adams, 10024	KSD, IH	0.13	Root tuber	Roots are boiled in milk and given to calves to expel intestinal worms and the plant is also used to reduce inflammation

KSD: King Sabata Dalindyebo; IH: Ingquza-Hill; UV: Use-value

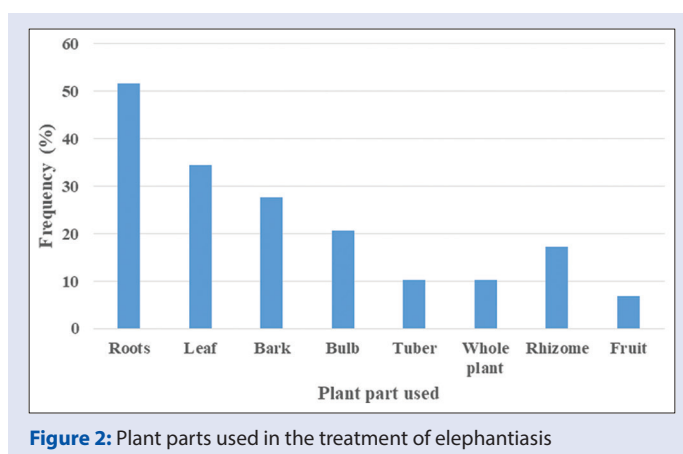


Figure 2: Plant parts used in the treatment of elephantiasis

infusion to prepare the medicine. One traditional healer mentioned that she uses equal portions of boiled powdered *C. ambrosioides* and *G. perpensa* mixed with *krampdruppels* (crampdrops), *rooi poeier* (red powder), entress drops, and camphor blocks in equal proportions in 2 l of water. The mixture is reported to help with improving blood circulation in the veins. A traditional healer from the Eastern Cape was reported to use equal portions of *E. comosa*, *Euphorbia clavarioides*, and *Rumex obtusifolius* to treat elephantiasis.<sup>[28]</sup> Infusion and decoction were reported as the most commonly used methods of preparation [Figure 3]. Herbal medicines are most applied externally. According to studies undertaken by Yaseen *et al.*<sup>[58]</sup> and Tshikalange *et al.*,<sup>[59]</sup> infusion and decoction with water as a solvent are the most common preparation methods that are used by traditional healers.

Analytical tools were also used to determine the use-value of the plant species to verify the ethnobotanical information about the use of plants in the treatment of elephantiasis and its common symptoms. The overall usefulness of the mentioned medicinal plants was calculated based on the index of a common tool that is used to quantify qualitative data in the biological sciences and other sciences known as the “use value.”<sup>[60-63]</sup>

*H. hemerocallidea* (*Hyppoxidaceae*) was the plant with the highest UV (0.31) [Table 1]. According to a survey on plants that are used as home medicine by families in the Eastern Cape, the plant is used in the treatment of human immunodeficiency virus acquired immunodeficiency syndrome infections, for blood purification, sunburns, as an antibiotic, septic sores, headaches, as a purgative, as an antioxidant, flu, cancer, acne, diarrhea, urinary tract infections, testicular tumors, arthritis, diabetes, prostate gland enlargement, and infertility.<sup>[64]</sup> Furthermore, the plant is used for healing dizziness, for bladder and urinary disease, as a tonic and for burns.<sup>[65]</sup> The plant was one of many plants that were screened for genotoxic effects and was among those that did not show positive results after screening.<sup>[65]</sup> The plant has been recorded in one of the 16 South African traditional medicines that have been partly or fully developed as commercial crops and products and its plant parts are used in traditional medicine as a traditional tonic and for benign prostate hyperplasia include rhizome, tuber or bulb.<sup>[66]</sup>

The species with the second highest UV (0.27) was *E. elephantina* (*Fabaceae*), locally known as *Intolwane* [Table 1]. It is used in South Africa as a traditional remedy for a wide range of ailments both in humans and livestock.<sup>[67]</sup> Zulus take an infusion of the inner parts of the roots and administer it as an enema for dysentery and diarrhoea and root decoctions are also taken for diarrhea.<sup>[67,68]</sup> The roots of *E. elephantina* are reddish and in the Sotho culture, “red medicines” are associated with blood and good health.<sup>[69]</sup> The San people use red

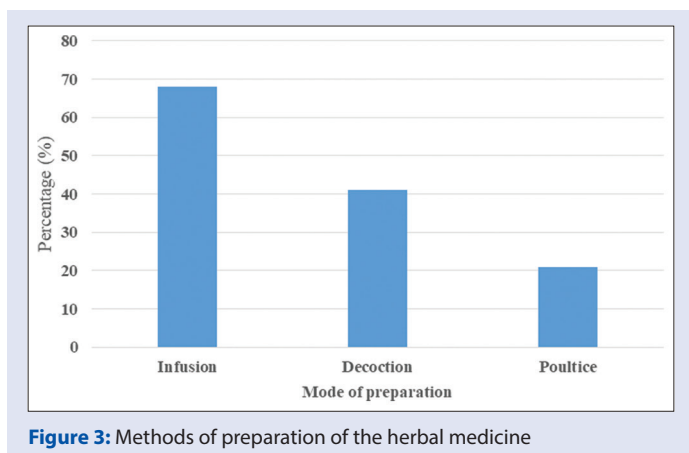


Figure 3: Methods of preparation of the herbal medicine

plant parts to treat anemia, weakness, and to cure fever.<sup>[69,70]</sup> Animals such as goats are given a decoction from a handful (about 50 g) of root powder mixed with 2 l of water to treat helminthiasis.<sup>[69]</sup> The plant also showed anthelmintic activity *in vitro* of crude aqueous extracts against *Haemonchus contortus*.<sup>[71]</sup> The following phytochemicals in certain tissues were found to be present, catechins in rhizomes, which indicated the presence of condensed tannins, as well as flavonoids and other phenolic substances.<sup>[72]</sup> Tannins were reported to be useful in treating dermatitis and are known to form a protective layer on the skin and mucosa, thereby enhancing tissue regeneration.<sup>[73]</sup>

The plant with the third highest UV (0.24) was *G. perpensa*. This plant is widely used by the rural population in South Africa for the treatment of several diseases, including dysmenorrhea.<sup>[74]</sup> It has large rounded leaves hence its common name “river pumpkin.”<sup>[75,76]</sup> Aqueous decoctions of this plant, relieve rheumatoid pain, facilitate childbirth and are believed to treat female infertility.<sup>[68,74]</sup> Its use in rheumatoid pain treatment supports its use in the treatment of pain and inflammation as mentioned by the traditional healers. A decoction of *G. perpensa* rhizome is also applied on the affected areas to treat wounds and psoriasis.<sup>[42,66,68,77]</sup> Nkomo *et al.* reported on its antinociceptive and anti-inflammatory properties.<sup>[74]</sup> Previous studies have shown that *G. perpensa* demonstrated good antibacterial activity, antioxidant properties, and stimulated fibroblast growth in wound healing.<sup>[78-80]</sup> The leaves are used by the Zulus as an emetic and the stems can be eaten when fresh.<sup>[76]</sup> Two active compounds, 1,4-benzoquinones and a benzopyran-6-ol, were isolated from the leaves and stems of *G. perpensa* dichloromethane extract and phytol was isolated from the methanol extract. The two benzoquinones and the benzopyran were further examined for antimicrobial properties together with the crude stem, leaf and root extracts.<sup>[76]</sup>

The plants which had the UV of 0.17, being the fourth highest, were *A. oblongifolia*, *C. dentata*, *D. sylvatica*, *K. drepanophylla*, *P. prunelloides*, and *R. melanophloes*. Three of these plants (*C. dentata*, *K. drepanophylla* and *R. melanophloes*) have been reported to possess anthelmintic activity.<sup>[64,81,82]</sup> *Kniphofia drepanophylla* is reported to be used for stomach ache, loss of appetite, and gastric worms/parasites.<sup>[64]</sup> The acetone and dichloromethane extracts and compounds isolated from *C. dentata* leaves were investigated for anthelmintic activity *in vitro* against *Trichostrongylus colubriformis*, *H. contortus*, and *Caenorhabditis elegans* and were found to be active against all nematodes at 160 µg/ml.<sup>[82]</sup> In Southern Africa, concoctions of the bark of *R. melanophloes* have been reported to be used for wounds, blood purification, muscular pain, and as an anthelmintic and emetic.<sup>[73,82]</sup> In another study, *R. melanophloes* was reported to possess anthelmintic activity against

nematodes.<sup>[82]</sup> *D. sylvatica* is also used for treating skin problems and rheumatism, like *G. perpensa* in Zimbabwean traditional medicine. The rubbing of fresh peeled rhizome on the skin supports its use for pain and inflammation.<sup>[83,84]</sup>

## CONCLUSION

The study documented significant botanical information on medicinal plants that the people of King Sabata Dalindyebo, Nyandeni and Ingquza-Hill municipalities in the Eastern Cape use to treat and manage elephantiasis and its symptoms. The study documented 29 medicinal plants distributed to 23 families that are used to treat and manage elephantiasis and its symptoms. The families *Apocynaceae*, *Dioscoreaceae*, *Euphorbiaceae*, *Fabaceae*, *Rubiaceae*, and *Solanaceae* were reported as the most commonly used plants represented by two species each. The majority of plants are used to treat and manage inflammation, wounds and pain. Roots, leaves, bark, and bulbs were reported to as the most preferred plant parts. Plants could be used individually or in combination as a decoction or infusion to prepare herbal medicine. *H. hemerocallidea* had the highest UV, followed by *E. elephantina* and *G. perpensa*. The UV is related to their use in the treatment and management of elephantiasis and its related ailments. Work is underway to extensively screen the recorded plants for potential pharmacological activities and for isolation of bioactive compounds.

## Acknowledgements

The authors are most grateful to the herbalists, traditional healers and the 3 young people for being part of the study and for sharing their valued time and information.

## Financial support and sponsorship

This project was financially supported by Thuthuka grant [grant number U113516] and Block grant [grant number SFH180531337969] of the National Research Foundation, South Africa awarded to L. Komoreng and Z. Adams.

## Conflicts of interest

There are no conflicts of interest.

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