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Abstract

Background: Plants are important sources of medicines. Herbal medicines in Lesotho are exposed to excessive exploitation and habitat destruction. Comprehensive information to promote proper use and conservation of these herbal medicines is lacking. This study described the uses of medicinal plants in Lesotho with comparative reference between practice and the literature, highlighting important ethno-medicinal information and conservation status of the plants. Additionally, the study established a repository and monograph for the herbal medicines in Lesotho.

Materials and Methods: Medicinal plant samples and information on their uses were obtained from herbalists in four districts of Lesotho between January and May 2014 through questionnaire-based interviews. Samples consisted of roots, bark, stems or leaves and/or combinations. Voucher samples were processed into powders, labelled, and stored in a repository. Information on the uses, plant parts used, geographical distribution, known phytochemical components and conservation status of each plant was recorded in a Microsoft Access database.

Results: Seventy-eight local herbalists were interviewed and men (about 84%) dominated the practice of traditional medicine. Fifty-four herbal medicine samples were collected and stored in a recently established Lesotho Herbal Medicines Repository (LHMR). The herbal medicines were from 54 medicinal plant species and 46 genera belonging to 29 plant families. Asteraceae (about 20%) was the most common plant family. Overall, 46% (n=54) of the prescriptions by local herbalists were similar to prescriptions in the literature at least in part. However, traditional medicinal uses for 9% of the plant samples could not be confirmed from the literature. Local herbalists use different parts of medicinal plants with roots being the most frequently (57%) used part. Twenty percent of the plants were threatened with extinction while the conservation status of 7% of the plants was undocumented.

Conclusion: Training of local herbalists on sustainable harvesting and safe use of medicinal plants is recommended. The repository and monograph is a useful reference and source of herbal medicine samples for researchers, which need to be expanded to include more medicinal plants in Lesotho. Local herbalists in Lesotho have valuable indigenous information on medicinal plants that needs to be documented.

Key words: conservation status, herbal medicine, Lesotho, monograph, repository, sustainable use

Introduction

Plant products continue to be exploited for treating various ailments in developing and developed countries (Smith-Hall et al., 2012; Sasidharan et al., 2011). More than 80% of rural populations in the developing world depend on herbal products as their main source of primary health care (World Health Organization (WHO), 1978). However, various communities use medicinal plants for different purposes (Katerere et al., 2008). In addition, trade in herbal products is a multi-million dollar business, which is a major driver for rural economies (Katerere et al., 2008). Some people use herbal products because they consider them to have fewer side effects and to be natural (Eloff et al., 2011) while others consider them to be more accessible and affordable (Fennell et al., 2004).

The global demand for herbal medicines is accompanied by a dwindling supply of medicinal plants due to over-harvesting, habitat loss and agricultural encroachment. However, sustainable use of medicinal plant resources compliments local public health prevention efforts and may lead to poverty reduction (Epstein et al., 2003). As millions of rural households use plants for self-medication, community involvement in monitoring the use of plant species and their conservation status can contribute to effective strategies for sustainable use (Bodeker, 2005).

Lesotho is one of the Southern African countries that have abundant medicinal plant resources. The majority of the medicinal plants are found mainly in the highlands and foothill ecological regions of the country (Moyo & Van Staden, 2014). The use of herbal products by people in Lesotho, including those with the human immunodeficiency virus (HIV), is believed to be widespread, but insufficiently documented. The use and sale of medicinal herbs is rampant in cities and towns in Lesotho. The herbs are most commonly sold in Maseru City and Mafeteng Town as well as Mapotsoe and Maseru border posts (Masupha et al., 2012). However, traditional healers in Lesotho admit that they are faced with serious declining resources for traditional medicines (Masupha et al., 2012). The decline has been attributed to the rampant uprooting of whole medicinal plants by herbalists from the urban areas (Masupha et al., 2012). This overexploitation as a result of excessive commercialization and habitat destruction leads to the extinction of the medicinal plants in the country, hence requires immediate sustainable conservation measures (Singh, 2011).

There is no formal assessment of the impact of poor harvesting on medicinal plants in Lesotho (Masupha et al., 2012) and the activities of herbalists are not regulated by law (Mugomeri et al., 2014). No systematic guidelines for collecting herbs in Lesotho exist so as to sustain the medicinal plant collection. Plants are usually rooted out by the herbalists during collection (Masupha et al., 2012). Currently, permits are only required for the harvesting, transportation and exporting of the herbal medicines. However, poor management of the permit system has resulted

in few permits being issued (Newton et al., 2008). The Lesotho Environment Act of 2008 that aims at protecting the environment, particularly the endangered species, is not well enforced since there are reports that some herd boys uproot and burn the vegetation including the medicinal plants (Bodeker, 2005).

Different parts of plants are harvested and used by herbalists for various ailments. However, there is a strong relationship between the plant part being harvested, the impact on the plant, and the degree of disturbance to the plant population (Cunningham, 1988). The removal of bulbs, roots, bark and whole plants has a more immediate and damaging effect than the harvesting of leaves and fruits (Cunningham, 1988). High frequency of harvesting the medicinal plants has also been identified as a cause of local population decline of the medicinal plants (Bhat et al., 2013). A study in Zimbabwe by Maroyi (2013) reports that harvesting of roots of herbaceous plants for medicinal purposes is not sustainable as it threatens the survival of the plants. The possibility of future growth and regeneration is doomed if plants are uprooted before seeding (Sheldon et al., 1997). The same study suggests that sustainability of these plants can be achieved through the formation of community botanic gardens.

A few studies have documented information on medicinal plants in Lesotho (Masupha et al., 2012; Moteetee & Van Wyk, 2011; Mugomeri et al., 2014). However, documentation of these medicinal plants has not been exhaustive and the idea of formulating a physical repository of the plant specimens has not been explored. A medicinal plant repository preserves plant specimens including threatened and endangered species in dried form (IHST, 2014). Comprehensive information on herbal medicines in Lesotho including sustainable harvesting methods, indications, dosages, appropriate storage conditions, mode of actions, side effects, expiry dates, contraindications and drug interactions is required (Burford et al., 2000).

Safety of herbal products is a major health concern in Lesotho. Ingredients, dosages, side effects and contraindications of these traditional medicines sold in Lesotho are usually not listed or are improperly labelled (Mugomeri et al., 2014). The same study also reports that most of the herbal products have multiple indications on the label. Herbal products can pose a risk of toxicity when inappropriately used as a result of the wrong prescription and/or inappropriate labelling (Phua et al., 2009).

The risk of toxicity associated with traditional herbal medicine is potentially high since herbalists do not necessarily screen for the specific phytochemicals when identifying plants of medicinal value. Crude plant extracts which contain an arsenal of potentially harmful substances are usually used in high doses. Additionally, information on herbal medicines is passed down family lines through oral tradition. This method of passing information increases the chances of wrong identification and misuse of some medicinal plants (Khan & Smillie, 2012). Medicinal plants contain non-nutritive, diversified plant chemicals known as phytochemicals. The common phytochemicals of medicinal value include alkaloids, flavonoids, saponins, glycosides, tannins, terpenes and amino acids (Sasidharan et al., 2011). However, medicinal value of these phytochemicals depends on the specific nature of molecules making up the phytochemical (Kar & Roy, 2012). Some phytochemicals have disease preventive or curative properties, while others are toxic.

The importance of a repository of herbal medicines has been highlighted by the Institute of Health Sciences and Technology (IHST) in India. A repository may help authenticate the identity of medicinal plants and promote conservation as well as provide samples for research (IHST, 2014). Such an important facility is needed in Lesotho.

This study investigated the uses of medicinal plants in Lesotho by local herbalists and compared the information with those documented in literature. The phytochemical components and conservation status of the medicinal plants were also explored. The samples collected and the information gathered was used to establish a Lesotho Herbal Medicines Repository (LHMR) and monograph housed in the Department of Pharmacy at the National University of Lesotho.

Methods

Study Setting

Lesotho is a small landlocked mountainous country of about 1.8 million people which is completely surrounded by South Africa (BOS, 2007). The country is divided into 10 administrative districts with the capital city, Maseru, in Maseru District. Notably, the entire country lies above 1,400 metres above sea level which gives it a continental climate that is cooler than the surrounding areas at the same latitude (Adams et al., 1999). Lesotho is mainly characterised by grassland biome with a few trees which are confined to river valleys. In addition, the country covers about 70% of the Drakensberg Maloti mountain area which is globally recognised biodiversity hotspot known for high species endemism (Adams et al., 1999). The area is characterised by high altitude flora and the vegetation of these mountains is divided into two types, the Afro-montane and Afro-alpine (United Nations Development Programme, 1995). About 30% of the approximated 1,750 plant species is endemic to the mountains (United Nations Development Programme, 1995).

Use of medicinal herbs to cure illnesses is common in Lesotho. Medicinal plants are taken as decoctions in water, water infusions or in the form of powdered snuff. Other forms include smoke inhalation from a burning medicinal herb and inhalation of vapour from a freshly crushed medicinal herb (Moteetee & Van Wyk, 2011).

Collection of Herbal Medicines from Herbalists

Medicinal plant samples were obtained from herbalists in four districts of Lesotho, namely Leribe, Berea, Maseru, and Mafeteng between January and May 2014. The study used a predesigned questionnaire to collect information on medicinal plants and their uses in Lesotho. The questionnaire designed by the researchers was pilot-tested with 10 herbalists in Maseru District. The questionnaire was then used to interview local practising herbalists who were willing to participate in the study. Information from the herbalists in the pilot study was not included in the final analysis. Only those herbalists who indicated that they had harvested medicinal plants themselves were interviewed. Non-practising and foreign herbalists were excluded. Medicinal plants with incomplete information were also excluded from the study. In addition, the study also excluded herbal medicines from outside Lesotho as well as non-plant-preparations and multiple-plant species concoctions. Samples consisted of roots, bark, stems, leaves and/or combinations. Scientific names of the plants, based on vernacular names and plant samples supplied, were identified by a botanist from the National University of Lesotho. The identification of the plant samples was based on the plant sample itself and the *Sotho* vernacular name.

The study received ethics approval from the Ministry of Health of Lesotho (ID21-2014). The respondents were provided with information on the background of the study. They were also informed that their participation was voluntary, that they could decline to answer certain questions and that they could withdraw their participation at any time. No information on respondents' identities was collected. In

addition, confidentiality of their information was also assured. Subsequently, each respondent signed a written consent form and was asked to complete a predesigned questionnaire in privacy.

Processing of Herbal Medicines

The collected samples were photographed, weighed, cleaned with cold tap water, sliced and cut into smaller pieces using a sharp knife. The pieces were dried at room temperature by placing them on a newspaper on the floor for 14 days. Drying of the samples was done in the dark to avoid photo-degradation. The dried samples were ground to powders using a mortar and a pestle. The powders were sieved through a 0.1 mm pore size sieve in order to remove larger particles. The sieved powders were weighed before being packaged in small plastic bottles that were labelled by herb name, weight, uses in Lesotho, and date of packaging.

Protocol for the Herbal Repository and Monograph

The Lesotho Herbal Medicines Repository (LHMR) and LHMR monograph were established in the Department of Pharmacy at the National University of Lesotho. Herbal medicine samples sealed in plastic bottles were stored on shelves at room temperature in a dark room. The powdered herbal medicines on the shelves were placed in chronological order of their codes. Each herbal product in the repository was labelled with vernacular (*Sotho*) and herbal botanical names, a designated code, pharmacological use, indications from herbalists, and weight. This information was captured in the LHMR monograph. Photographs, uses in Lesotho and/or in the literature, source of herb, plant part used, conservation status, geographical distribution, and known phytochemical components were also captured in the LHMR monograph. Medicinal plant phytochemical components, uses in literature, conservation status and geographical distribution for each plant included were systematically searched from literature using predetermined keywords and covering up to 2014. Uses of medicinal plants reported by the herbalists in Lesotho were compared to the uses reported in the literature.

Results

Collection and Use of Herbal Medicines by Herbalists

Seventy-eight local herbalists were interviewed and men (about 84%) dominated the practice of traditional medicine in Lesotho. The ages of the herbalists ranged from 35 to 72 years with a median age of 56 years. The 51-60 age group constituted about 43% of the herbalists. A total of 54 herbal medicines were collected from the four districts of Lesotho. The herbal medicines were from 54 medicinal plant species from 46 genera belonging to 29 plant families. Asteraceae (about 20%) and Asphodelaceae (about 7%) were the most represented plant families. The voucher samples were coded and deposited into a repository at the National University of Lesotho. The study found out that many herbalists in Lesotho collect and prescribe herbs without having proper training. Local herbalists in Lesotho use different parts of medicinal plants with roots being the most frequently (57%) used parts of the plants (Figure 1).

The LHMR and Monograph

Table 1 presents an excerpt on the information recorded in the LHMR, which includes herbal vernacular (*Sotho*) and botanical names, uses in Lesotho and in the literature, plant part(s) used, medicinal components from literature, geographical distribution and conservation status of medicinal plants. Overall, 46% (n=54) of the prescriptions by local herbalists in Lesotho concurred with prescriptions in the literature at least in part. However, medicinal uses of 9% of the plants in this study could not be confirmed from the literature. In addition, medicinal components of 35% (n=54) of the plants used by herbalists in Lesotho could not be identified from the literature. About 20% (n=54) of the plants assessed in this study are threatened with extinction while the conservation status of 7% (n=54) of the plants was undocumented.

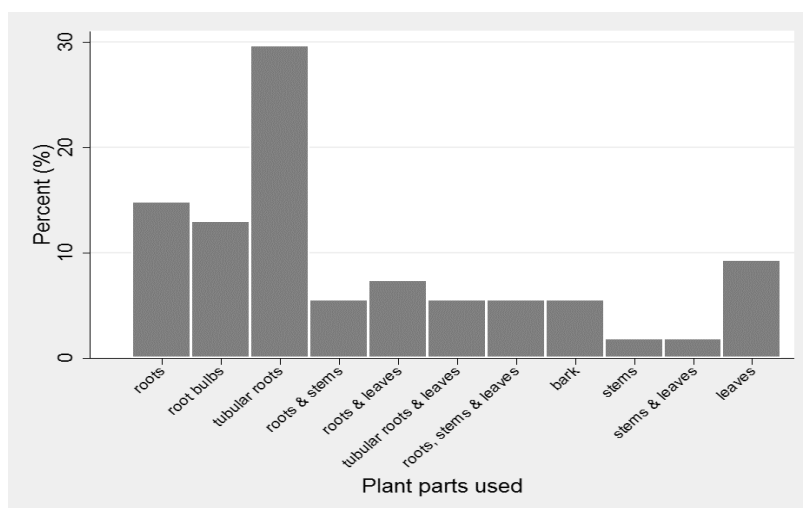


Figure 1: Frequency of use of the different parts of medicinal plants used by local herbalists in Lesotho (n=54)

Table 1: Comparative uses of medicinal plants in Lesotho and in the literature in terms of their plant part(s) used, medicinal components, geographical distribution and conservational status

Botanic name & (family)	Vernacular name (Sotho)	Sample Code	Envisaged use by herbalists in Lesotho	Use in literature	Plant parts used	Method of preparation	Medicinal components from literature	Geographical distribution	Conservation Status
<i>Agapanthus campanulatu</i> F.M. Leight (Alliaceae)	<i>Leleta la phofu</i>	P26	Bathe newborn babies to make them strong; used to treat cradle cap in infants.	Cardiac ailments, stomach-ache (Pooley, 1998); ensure strength in newborns (Watt & Breyer-Brandwijk, 1962)	Tubular roots	Crush & add water	Saponins, saponinins (Hutchings et al., 1996); chalconoids (Kamara et al., 2005)	South Africa, Lesotho (Pooley, 2003)*	Least Concern (Raimondo et al., 2009)
<i>Ajuga ophrydis</i> Burch. ex Benth. (Lamiaceae)	<i>Senyarela</i>	P09	Painful menstruation, female sterility	Medicine for female sterility & painful menstruation (Moffett, 2010)	Leaves; stems; roots	Boil	–	South Africa, Lesotho, Swaziland (Raimondo et al., 2009; Raimondo, 2009)	Least Concern (Raimondo et al., 2009)
<i>Alepidea amatymbica</i> Eckl. & Zeyh. (Apiaceae)	<i>Lesoko</i>	P13	Cough and colds	Colds and flu, asthma, chest pain, rheumatism, wash divining bones; abdominal cramps (Pujol, 1990)	Root bulb	Boil powder	–	South Africa, Zimbabwe, Kenya, Ethiopia, Lesotho (van Wyk & Gericke, 2000)	Vulnerable (Raimondo et al., 2009)
<i>Aloe ferox</i> Mill. (Aloaceae)	<i>Lekhala la quthing</i>	H05	Heartburn and laxative	Laxative, arthritis, cosmetics wound healing antiseptic (Bornman & Hardy, 1971)	Leaves	Mix juice extracts with water	Peptides (Bornman & Hardy, 1971)	Lesotho, South Africa, Botswana, America (Bornman & Hardy, 1971)	Least Concern (Raimondo et al., 2009)
<i>Aloe saponaria</i> (Aiton) Haw. (Aloaceae)	<i>leli</i>	H22	Repairs bones, bone fractures and pimples	Ringworm, wound and boil dressing, intestinal worms (FAO, 1988)	Leaves	Crush & add water; apply dry powder	Glycosides, anthraquinones (Duke, 1993)	Lesotho, South Africa, Zimbabwe, Botswana, USA (Quattrocchi, 2012)	Threatened (CITES appendix 11)
<i>Aloe striatula</i> Haw. (Aloaceae)	<i>Seholobe</i>	H19	Stomachache and heartburn	Wounds, gastritis, diabetes, cancer, headache, arthritis, laxative (Moteetee & Van Wyk, 2011)	Leaves	Add powder to water	Peptides, glycosides, anthraquinones (Moteetee & Van Wyk, 2011)	Lesotho, Botswana, South Africa (Smith & Van Wyk, 2008)	Threatened (CITES Appendix 11)
<i>Asparagus asparagoides</i> (L.) W.Wight (Asparagaceae)	<i>Makholela</i>	H11	Genital warts and ulcers, excessive sweating with unpleasant smell	Diuretic and urinary tract infection, kidney stone, urinary stone (Chen et al., 2014)	Roots	Crush & boil	Peptides (Chen et al., 2014)	Widespread in Southern Africa including Lesotho, Swaziland, South Africa (Kriticos et al., 2010)	Least concern (Raimondo et al., 2009)
<i>Asparagus larycinus</i> Burch. (Asparagaceae)	<i>Lerara tau</i>	H08	Syphilis, Waist pain (lower abdominal pains), joint pains, hands, feet and knees	Antibacterial and antioxidant (sores, tuberculosis, uterine infection) and has anticancer property (Negi et al., 2010)	Roots; stems	Crush & boil	Glycosides, steroids, alkaloids, saponins, terpernoids (Negi et al., 2010)	Lesotho, South Africa, Swaziland, Botswana, Namibia (Ambrose, 2007)	Least concern (Raimondo et al., 2009)
<i>Aster bakerianus</i>	<i>Phoaa</i>	H18	Chronic headache,	Lower back pain and epileptic	Roots	Crush & add	–	Lesotho, South Africa	Not evaluated

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<http://dx.doi.org/10.4314/ajtcam.v13i1.20>

Burt Davy ex C.A.Sm. (Asteraceae)			Stomachache, bloating	fits (Goldblatt & Manning, 2000; Zukulu et al., 2012)		water			(Blom, 2012)*	(SANBI, 2014)
<i>Berkheya setifera</i> DC. (Asteraceae)	<i>Leleme la khomo</i>	P20	Itching skin; rash	Blood detoxification agent; relieve menstrual pains (Zukulu et al., 2012)	Roots; leaves	Crush, add water & apply	–		Mozambique, Zimbabwe, Lesotho, South Africa, Swaziland (Pope, 1992)	Least Concern (Raimondo et al., 2009)
<i>Brunsvigia radulosa</i> Herb. (Amaryllidaceae)	<i>Lematla</i>	P05	Boosts the immune system	Antimalarial; antineoplastic activity, inhibits cell growth and division (Watt & Breyer- Brandwijk, 1962)	Root bulb	Crush & add water		Alkaloids (Watt & Breyer- Brandwijk, 1962)	South Africa, Swaziland, Lesotho, Botswana (Hutchings et al., 1996)	Least Concern (Raimondo et al., 2009)
<i>Bulbine narcissifolia</i> Salm-Dyck (Asphodelaceae)	<i>Khomo-ea-balisa</i>	H03	Cleanses kidney, digestive problems, bloating, heartburn, cleanses blood, dilates blood vessels, promotes diuresis, burning urine	Wound healing and mild laxative, antidiabetic, antihaemorrhoids (Qhotsokoane- Lusunzi & Karuso, 2001)	Roots	Crush & boil		Saponins, flavonoids, glycosides, phenolics (Qhotsokoane- Lusunzi & Karuso, 2001)	Lesotho, South Africa, Botswana, Ethiopia (van Wyk & Gericke, 2000)	Least concern (SANBI, 2014)
<i>Cucumis zeyheri</i> Sond. (Cucurbitaceae)	<i>Marakana</i>	P30	Weaning babies	Fruit pulp is used as a laxative (Watt & Breyer-Brandwijk, 1962); Roots are used for abdominal pain, convulsions and to induce abortion in Zimbabwe (Gelfand et al., 1985)	Tubular roots	Apply powder		Cucumin (Watt & Breyer- Brandwijk, 1962)	Swaziland, South Africa, Zambia, Zimbabwe and Lesotho (Hutchings et al., 1996)	Least Concern (Raimondo et al., 2009)
<i>Cussonia paniculata</i> Eckl. & Zeyh. (Araliaceae)	<i>Mots'et'se</i>	H16	Cleanses blood, anaemia, blood, cardiovascular problems, clear phlegm, intestinal worms, pellagra, wounds	Anti-malarial, antiinflammatory, antipain and antibacterial (Acocks, 1988; Adedapo et al., 2008)	Bark	Boil powder		Glycosides (Acocks, 1988); Flavonoids, terpenoids (Adedapo et al., 2008)	Lesotho, South Africa, Botswana, Madagascar (Adedapo et al., 2008)	Least Concern (SANBI, 2014)
<i>Dicoma anomala</i> Sond. (Asteraceae)	<i>Hloenya</i>	P36	General body pains, diarrhoea, colic, rheumatism and fevers	Enema, colic, intestinal worm purgative, toothache, haemorrhoids, fevers, ulcers, dermatosis, venereal diseases, labour pains, antidiarrhoea, antihypertension, antidiabetes, menstrual period pains, pneumonia, backache, wounds, sores (Moteetee & Van Wyk, 2011; Maliehe, 1997)	Tubular roots	Add powder to water		Alkaloids, flavonoids, terpenes (Becker et al., 2011)	Sub-Saharan Africa, south Africa, Lesotho (Hutchings et al., 1996)	Least Concern (Raimondo et al., 2009)
<i>Eucalyptus sideroxylon</i> A.Cunn.	<i>Boloukomobots'o</i>	P15	Diarrhoea	Lung diseases and fever (Bellakhdar et al., 1991)	Bark	Breathe fumes		Phenolics, glycosides, catechins,	New South Wales, Australia, New Zealand, Indonesia, New Guinea,	Not evaluated (SANBI, 2014)

(Myrtaceae)									cumarin (Vent et al., 1987)	China, India, Tasmania, Philippines (Hutchings et al., 1996)	
<i>Euclea coriacea</i> A.DC. (Ebenaceae)	<i>Monna-motso</i>	H13	Vaginal discharge, constipation, heartburn	axative; heartburn (Johnson, 1998; Zhang et al., 2005)	Roots	Crush & add	–	–	–	Lesotho, Zambia, Botswana, South Africa (Ambrose, 2007)	Least concern (Raimondo et al., 2009)
<i>Eucomis autumnalis</i> (Mill.) Chitt. (Hyacinthaceae)	<i>Mathethebane</i>	P28	Haemorrhoids, syphilis, gonorrhoea	Backache, assist in post-operative recovery, healing fractures, urinary diseases, stomachache, fevers, colic, flatulence, syphilis, facilitate childbirth (Reyneke, 1980)	Tubular roots	Crush & add	Flavonoids, Terpenoids (Reyneke, 1980; van Wyk & Gericke, 2000)	–	–	South Africa, Swaziland, Lesotho, Botswana, Zimbabwe, Malawi (Reyneke, 1980)	Declining (Raimondo et al., 2009)
<i>Euphorbia clavarioides</i> Boiss. (Euphorbiaceae)	<i>Sehlele/Sehloko</i>	P01	Pain and sedation	Skin rashes, painful feet (Moteetee & Van Wyk, 2011)	Tubular roots	boil	–	–	–	South Africa, Lesotho (Raimondo et al., 2009)	Threatened (Raimondo et al., 2009).
<i>Garuleum woodii</i> Schinz (Asteraceae)	<i>Mahloko a linoha</i>	H10	Hypertension, cardiovascular diseases	Antibacterial, antifungal (Ashafa & Umebese, 2012)	Leaves; Roots; stems	Crush & boil	Flavonoids, steroids, saponins (Ashafa & Umebese, 2012)	–	–	Widespread in Southern Africa including Lesotho, South Africa (Swelankomo, 2013)	Least concern (Raimondo et al., 2009)
<i>Gazania krebsiana</i> Less. (Asteraceae)	<i>Tsikilana</i>	H23	Croup in children, fever	Earache, sterility, antibacterial, antifungal (Kommidi et al., 2014); Emetic (Bhat, 1998)	Roots	Crush & boil	Terpenoids, gazaniolides (Glasby, 2002)	–	–	Lesotho, South Africa, Namibia (Goldblatt & Manning, 2000)	Threatened (Magee et al., 2011)
<i>Gnidia kraussiana</i> Meisn. (Thymelaeaceae)	<i>Thobeha/Thoopa</i>	P11	Bone fractures and injuries	Bathe wounds and bruises; remedy for snakebites and sore throats (Watt & Breyer-Brandwijk, 1962); Bone fractures and injuries; abortifacient (Gelfand et al., 1985)	Tubular roots	Crush & boil	Terpene, and cumarins (van Wyk & Gericke, 2000)	–	–	Southern Africa including Lesotho, South Africa, Zimbabwe, Malawi (van Wyk & Gericke, 2000)	Least Concern (Raimondo et al., 2009)
<i>Gunnera perpensa</i> L. (Gunneraceae)	<i>Qobo</i>	P34	Heart diseases; hypertension	Induce labour, expel the placenta, relieve menstrual pains, as antenatal medication to tone uterus, treat stomachache, rheumatic fever, swelling and stomach bleeding. (van Wyk & Gericke, 2000; Ngwenya et al., 2003; Von Ahlenfeldt et al., 2003)	Root bulb	Crush & boil	Alkaloids, flavonoids, steroids, saponins, tannins and glycosides (Simelane et al., 2010)	–	–	Southern Africa, Madagascar, New Zealand, Tasmania, Indonesia, Hawaii, Mexico, Central & Southern America, Sudan, Uganda, Zaire, Rwanda, Kenya, Tanzania, Lesotho, Swaziland (Bergman et al., 1992)	Declining (Raimondo et al., 2009)
<i>Haplocarpha scaposa</i> Harv. (Asteraceae)	<i>Papetloana</i>	P12	Stress and depression	Used during menstruation, also used by traditional healers when consulting their divining bones (Pooley, 1998)	Tubular roots	boil	–	–	–	Eastern Africa, Southern Africa excluding Namibia & Botswana, (Pooley, 1998)	Not threatened (Pooley, 1998)

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<http://dx.doi.org/10.4314/ajtcam.v13i1.20>

<i>Helichrysum caespitium</i> (DC.) Sond. (Asteraceae)	<i>Phate-ea-ngaka</i>	P02	Cough and colds	Against aches and pains (van Wyk & Gericke, 2000); Treatment of cough, flu and common cold, antimicrobial activity (Dekker et al., 1983)	Tubular roots; leaves	Crush & boil	Caespitiate (Dekker et al., 1983; Mathekga et al., 2000)	Zimbabwe, Lesotho, Swaziland, South Africa, Madagascar, Australasia, Earasia (Dekker et al., 1983; Mathekga et al., 2000)	Least concern (Raimondo et al., 2009)
<i>Helichrysum odoratissimum</i> Sweet (Asteraceae)	<i>Phefo</i>	H17	Insomnia, cough and colds	Insomnia, cough and colds, paste treat acne and pimples, Analgesic, anti-inflammatory, antimicrobial, anti-infective (Swelankomo, 2004)	Leaves; roots; stems	Crush & boil	Terpenoids (Swelankomo, 2004; Asekun et al., 2007)	Lesotho, Swaziland, South Africa, Mozambique, Zimbabwe, Malawi (Van Wyk & Van Wyk, 1997)	Least concern (Raimondo et al., 2009)
<i>Hermannia depressa</i> N.E.Br. (Sterculiaceae)	<i>Seletjane</i>	P10	Stomachache	Cough and whooping coughs (Bhat, 2013) stomachache (Watt & Breyer-Brandwijk, 1962)	Tubular roots	Boil powder	Alkaloids (Watt & Breyer-Brandwijk, 1962)	Zimbabwe, South Africa, Lesotho, Swaziland, Botswana, Namibia (SANBI, 2012)	Least Concern (Raimondo et al., 2009)
<i>Hypoxis hemerocallidea</i> Fisch., C.A.Mey. & Avé-Lall. (Hypoxidaceae)	<i>Moli (African potato)</i>	P06	Chronic wounds and boosting the immune system	Boost immunity in HIV/AIDS patients, delirium (Snijman, 2000; Watt & Breyer-Brandwijk, 1962)	Tubular roots	Boil powder	Steroids, (Watt & Breyer-Brandwijk, 1962; Drewes et al., 1984)	South Africa, Lesotho, Botswana, Swaziland (Van Wyk & Van Wyk, 1997)	Threatened (Snijman, 2000)
<i>Ipomoea oblongata</i> E.Mey. ex Choisy. (Convolvulaceae)	<i>Mothokho</i>	H15	Asthma, exuding wounds	Used for divination during initiation ceremonies, hallucinogen (Sobiecki, 2008); Arthritis, cancer (Polori et al., 2013)	Roots	Add water to dry powder	Alkaloids (Polori et al., 2013)	Lesotho, South Africa (Polori et al., 2013)*	Least concern (Raimondo et al., 2009)
<i>Kedrostis capensis</i> (Sond.) A.Meeuse (Cucurbitaceae)	<i>Sesepa sa linoha</i>	H21	Hypertension, stomachache, cough and colds	Antioxidant (Ram, 2009); Asthma, colic, chest pain and urinary tract infections, diarrhoea, small pox, skin diseases and snake bite (Nirmala & Pandian, 2013; Johnson, 1998)	Tubular roots; leaves	Boil	–	sotho (Johnson, 1998)*	Threatened (Nirmala & Pandian, 2013)
<i>Kniphofia caulescens</i> Baker. (Asphodelaceae)	<i>Leloele</i>	P24	Treatment of headache, painful eyes and fatigue	–	Root bulb	Crush & add water	–	South Africa, Lesotho (Worboys et al., 2010)*	Least Concern (Raimondo et al., 2009)
<i>Kniphofia northiae</i> Baker. (Asphodelaceae)	<i>Lelutla</i>	H06	Prolonged periods in women, period pains waist and back pain	–	Stems	Crush & boil	–	Lesotho, South Africa (Botanical Society of South Africa, 1986) (Manning & Paterson-Jones, 2004)	Least Concern (Raimondo et al., 2009)
<i>Ledebouria cooperi</i> (Hook.f.) Jessop. (Hyacinthaceae)	<i>Letjoetlane</i>	H09	Constipation in children, abdominal pains, Meconium, phlegm	Used during child birth, anti-inflammatory agent during traditional circumcision (Koorbanally, 2000)	Root bulb	Crush & boil	Flavonoids, Terpenoids (Koorbanally, 2000)	Lesotho, Swaziland, South Africa (Brickell, 2003)	Least concern (Raimondo et al., 2009)

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<i>Ledebouria marginata</i> (Baker) Jessop. (Hyacinthaceae)	<i>Bokhoe</i>	P04	Urinary tract infections and painful waist	Soothing pain in fourth month of pregnancy (Watt & Breyer-Brandwijk, 1962); Pregnancy, diarrhoea, influenza, backache, skin irritations, wounds and lumbago (Venter, 2008)	Root bulb	Boil	–	Sub-Saharan Madagascar, (Venter, 2008)	Africa, India	Least Concern (Raimondo et al., 2009)
<i>Leucosidea sericea</i> Eckl. & Zeyh. (Rosaceae)	<i>Cheche</i>	H01	Asthma, aspiration of mucus (phlegm)	Antimicrobial against <i>Staphylococcus aureus</i> , <i>Bacillus subtilis</i> and <i>candida</i> (Nair et al., 2012)	Stems; leaves	Crush & boil	Alkaloids, phenolics, saponins, tannins (Nair et al., 2012)	Lesotho, South Africa, Swaziland, Zimbabwe (Van Wyk & Van Wyk, 1997)		Least Concern (Raimondo et al., 2009)
<i>Lotononis foliosa</i> Bolus. (Leguminosae)	<i>Khonathi</i>	H04	Stomach poisoning, regurgitation, hiccups	–	Roots	Boil	Alkaloids (Bisby, 1994)	Lesotho, South Africa (Bisby, 1994)	Swaziland (Bisby, 1994)	Not threatened (Bisby, 1994) Least concern (Raimondo et al., 2009)
<i>Malva parviflora</i> L. (Malvaceae)	<i>Mosala supping</i>	P33	Cleanses the blood	Cleaning wounds and sores (Watt & Breyer-Brandwijk, 1962)	Tubular roots	Boil	–	Northern Africa, Asia (Hutchings et al., 1996)	Europe,	Not threatened (Raimondo et al., 2009)
<i>Metalsia muricata</i> R.Br. (Asteraceae)	<i>Tee eathaba</i>	P35	Used as a healing tea	Healing tea (Pooley, 1993)	Leaves	Crush & boil	–	Southern Africa, (Pooley, 1993)	Lesotho	Least Concern (Raimondo et al., 2009)
<i>Pelargonium sidoides</i> (L.) L'Hér. (Geraniaceae)	<i>Khoara</i>	H02	Vomiting, diarrhoea, supplement in anaemia	Acute bronchitis, common colds and sore throat (Matthys et al., 2003)	Tubular roots	Boil powder	Flavonoids, alkaloids, peptides, essential oils (Kuetze, 2013)	Endemic to South Africa (Van der Walt et al., 1977)	Lesotho;	Threatened in Lesotho; Not endangered in SA (SANBI, 2014)
<i>Pelargonium betulinum</i> DC. (Geraniaceae)	<i>Pitsa ea lets'ollo</i>	H25	Diarrhoea, colic, stomach disorders and dysentery	Upper respiratory tract infections (Van Wyk & Van Wyk, 1997); coughs, upper respiratory tract irritations and gastrointestinal conditions (Maree, 2009)	Tubular roots	Crush & boil	Phenolics, flavonoids, gallic acid, cumarins (Bhat, 2013)	Endemic to South Africa, Lesotho (Van der Walt et al., 1977)		Threatened (Raimondo et al., 2009)
<i>Pentanisia prunelloides</i> Walp. (Rubiaceae)	<i>Setima-mollo (Wild verbena)</i>	P14	Burns, wounds, sores, snakebites and boils	Burns, swellings, rheumatism, heartburn, vomiting, fever, tooth ache, tuberculosis, snakebite, haemorrhoids; ease childbirth and expel placenta (van Wyk & Gericke, 2000; Pooley, 1998)	Tubular roots	Apply powder	Palmitic acid (Rai et al., 2011)	Lesotho, South Africa (Pooley, 1998)*		Least Concern (Raimondo et al., 2009)
<i>Plectranthus grallatus</i> Briq. (Lamiaceae)	<i>Lephele- phele</i>	H07	Diabetes mellitus, Dyslipidaemia, fatigue and weakness	Used as a general purpose medicine to relieve sickness (Lukhoba et al., 2006)	Tubular roots	Crush & boil	Terpenoids, phenolics (Gibbs Russell et al., 1987)	Lesotho, South Africa, Swaziland (SANBI, 2012)		Least Concern (Raimondo et al., 2009)

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<i>Raphionacme sp.</i> Harv. (Asclepiadaceae)	<i>Lesapo</i>	P32	Mends broken bones	–	Tubular roots	Crush & boil	–	Lesotho, South Africa, Zimbabwe, Zambia, Mozambique, Botswana, Malawi (Raimondo et al., 2009)	–
<i>Rhus erosa</i> Drege ex C.Presl (Anacardiaceae)	<i>Tsilabelo</i>	P23	Treatment of uterus cancer, diabetes mellitus and gout	Diarrhoea (Van Wyk & Van Wyk, 1997)	Leaves	Boil	–	South Africa, Lesotho (Van Wyk & Van Wyk, 1997)*	Not threatened (Van Wyk & Van Wyk, 1997)
<i>Salvia stenophylla</i> Burch. ex Benth. (Lamiaceae)	<i>Mosisili</i>	H14	Genital warts, boils, fever	Digestive problem, cough, chest congestion, antibacterial, anti-inflammatory, sores, antimalarial, anti-cancer (Kamatou et al., 2005; Musarurwa et al., 2010)	Roots	Add water to powder	Essential oils, terpenoids (Brunke & Hammerschmidt, 1985; Musarurwa et al., 2010)	Lesotho, South Africa, Namibia, Botswana (Kamatou et al., 2005; Germishuizen et al., 2006)	–
<i>Scabiosa columbaria</i> L. (Dipsacaceae)	<i>umi</i>	H20	Prolonged menstrual periods, dysmenorrhoea, abdominal pains	Skin rash and allergic reaction, infertility, dysmenorrhoea (Steenkamp, 2003); Colic and heartburn, flatulence (Moteetee & Van Wyk, 2011; Diederichs, 2006; Watt & Breyer-Brandwijk, 1962)	Roots; stems	Add water to powder	–	Lesotho, Western Europe, Western Asia, North Africa (Pooley, 1998)	Least Concern (SANBI, 2014)
<i>Senecio harveianus</i> L. (Asteraceae)	<i>Khotolia</i>	P21	Diarrhoea and increase appetite	–	Leaves; roots	Crush & add water	–	Swaziland, Lesotho, South Africa (Lafuma et al., 2003)	Least concern (Raimondo et al., 2009)
<i>Senecio asperulus</i> DC. (Asteraceae)	<i>Mofere-ferere</i>	P17	Back pain and swollen feet	Treatment of wounds, chest pain, swollen gums, antiemetic, anti-inflammatory and as vasodilating agents (Maliehe, 1997)	Roots; leaves	Crush & add water	–	Lesotho, South Africa (Raimondo et al., 2009)*	Least Concern (Raimondo et al., 2009)
<i>Solanum tomentosum</i> L. (Solanaceae)	<i>Thoola</i>	P16	Toothache	Syphilis (Schmelzer, 2008); sore throat, angina, stomachache, colic, headache, painful menstruation, liver pain and pain caused by onchocerciasis, pleurisy, pneumonia and rheumatism (Maliehe, 1997)	Roots; stems	Add water to powder	Solasodine, alkaloids (Hutchings et al., 1996)	Across Africa including South Africa and Lesotho (Schmelzer, 2008)	Least Concern (Raimondo et al., 2009)
<i>Tephrosia semiglabra</i> Sond. (Leguminosae)	<i>Pelo li maroba</i>	P31	Heart problems e.g. tachycardia	Inhibits human platelet aggregation (Jonathan et al., 1990); Tonic, laxative, and diuretic, treatment of bronchitis, cancer, bilious febrile attack, boils, pimples, and haemorrhoids (Hegazy et al., 2009)	Roots; leaves	Crush & add water	Flavonoids (Jonathan et al., 1990)	Botswana, Lesotho, South Africa, Malawi (Raimondo et al., 2009)	Least Concern (Raimondo et al., 2009)

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<i>Trachyandra asperata</i> Kunth. (Asphodelaceae)	<i>Tsila tsila</i>	H24	Internal and external wounds, shoulder pain,	Antibacterial on newborn's navel (Long, 2005)	Tubular roots	Apply powder	–	Lesotho, South Africa, Botswana (Hutchings et al., 1996)	Least Concern (Raimondo et al., 2009)
<i>Withania somnifera</i> (L.) Dunal. (Solanaceae)	<i>Mofera-ngope</i>	P19	Anticancer, strengthening blood circulation, shorten long menstruation periods	Tumours, tubular glands, carbuncles, ulcers, cancer, stress, anti-aging and anti-stress (Watt & Breyer-Brandwijk, 1962); Constipation, increases libido (Mishra et al., 2000)	Tubular roots; leaves	Crush & boil	Alkaloids and steroids withanolides (Kumar et al., 2011)	India, Lesotho, Tropical Africa, South Africa, Arabia, Europe, Namibia, Botswana, Swaziland (Hepper, 1991)	Least Concern (Raimondo et al., 2009)
<i>Xysmalobium undulatum</i> R.Br. (Asclepiadaceae)	<i>Pohots'ehla</i>	P08	Headache and stress	Treatment of hysteria, headaches, wounds, diarrhoea, painful menstrual cramps (Watt, 1935; Pujol, 1990)	Bark	Boil powder	Cumarins, glycosides (Watt & Breyer-Brandwijk, 1962); Saponins (Hutchings et al., 1996)	Kenya, Tanzania, Angola, Malawi, Mozambique, Zambia, Botswana, Lesotho, South Africa, Swaziland (Hutchings et al., 1996)	Least Concern (Raimondo et al., 2009)
<i>Zantedeschia albomaculata</i> Baill. (Araceae)	<i>Mohalalitoe</i>	P27	Alleviation of sore throat, mouth ulcers and peptic ulcers	Prevent repeated miscarriages; prevent giving birth to small weak babies, bathe newborn babies to make them strong (Watt & Breyer-Brandwijk, 1962)	Root bulb	Boil	Flavonoids (Martens et al., 2003)	South Africa, Lesotho, Swaziland, Zimbabwe, Malawi, Zambia, Angola; South-central Africa (Letty, 1973)	Least concern (SANBI, 2014)

*Plant may be found in other countries; (–) **information not found**; CITES = Convention on International Trade in Endangered Species of Wild Fauna and Flora, SANBI = South African National Biodiversity Institute; Herb Codes P and H stand for storage locations on the shelves in the repository. Authorities of plant taxa and families were obtained from the International Plant Names Index (2014).

Discussion**Collection and Use of Herbal Medicines by Herbalists**

The plant family Asteraceae had the highest number of species used as herbal medicines in the study. Notably, Asteraceae is the dominant endemic plant family in the Drakensburg-Maloti Mountains (United Nations Development Programme, 1995). This implies that unsustainable exploitation of this plant family may lead to the extinction of these endemic plants.

This study also indicates that the most commonly used part of plants for medicinal purposes by local herbalists in Lesotho are the roots. For instance, 57% of herbal concoctions were prepared from root components only (Figure 1). In addition, other concoctions used roots in combination with other parts of the plants. The use of roots has devastating effects since it usually involves uprooting whole plants. The use of whole plants, bulbs, roots or bark has a more immediate and damaging effect than the harvesting of leaves and fruits (Cunningham, 1988). Furthermore, some herd-boys in Lesotho uproot and burn vegetation as part of their cattle-herding activities (Bodeker, 2005). Therefore, habitat destruction, improper harvesting practices and overexploitation of medicinal plants in Lesotho pose a serious threat to the survival of many threatened plant species and those endemic to Lesotho.

The LHMR and Monograph

The study revealed that 46% (n=54) of the prescriptions by herbalists in Lesotho concurred with prescriptions in the literature at least in part (Table 1). The 54% that did not concur with literature may indicate that herbalists in Lesotho have some unique and valuable information on medicinal plants which has not been reported. However, this also highlights that communities differ in the way they use medicinal plants (Katerere et al., 2008). More and detailed studies on the use of medicinal plants in Lesotho are therefore needed. Similarities between prescriptions by the herbalists and those in the literature imply that medicinal plant remedies preventive and curative roles in many geographic locations. However, the uses of 9% of the plants could not be confirmed from literature in this study. This reflects that these plants may have medicinal uses that are unique to Lesotho. This may also highlight that the medicinal value of these plants has not been studied.

A number of studies report important phytochemical components in various medicinal plants (Becker et al., 2011; Chen et al., 2014; Kumar et al., 2011; Maroyi, 2013; Mugomeri et al., 2014; Nair et al., 2012). However, studies that evaluate pharmacological activities of these medicinal plants are scarce. In Table 1, medicinal components of 35% (n=54) of the plants used by local herbalists in Lesotho could not be identified. This indicates that there is a need for phytochemical screening of these plants from Lesotho that are considered to have medicinal properties. Plants are a rich source of medicinal phytochemicals but may contain a myriad of chemicals, some of which can be harmful to human health. The majority of plants in the developing world are used as concoctions and this increases the chances of poisoning (Phua et al., 2009). Conservation of plants remains a key issue in the sustainability of traditional medicines. For instance, 20% (n=54) of the plants assessed in this study are threatened with extinction. There is therefore need for increasing awareness about the sustainable use of these medicinal plants by adopting and ratifying regulations that promote conservation of these plants. The activities of herbalists in Lesotho are not regulated by law (Mugomeri et al., 2014). However, another challenge in Lesotho is of plants whose conservation status is not known (7%; n=54). Some of the plants whose conservation status is not known may be under threat of extinction.

Poor harvesting practices and the threat of extinction of medicinal plants may lead to the disappearance of these plants. Proper harvesting of these plants can be achieved through the formation of community botanic gardens (Sheldon et al., 1997). Therefore, plant repositories are a good starting point in the identification of the plants to be included in the botanical gardens. This study established an herbal medicines repository and monograph in the Department of Pharmacy at the National University of Lesotho where the plant samples can also be sourced and/or be further analysed for medicinal properties.

Conclusion

The extinction of medicinal plants and the loss of the associated knowledge about herbal medicines will have an adverse effect on the existing health care system in Lesotho. Proper training of local herbalists on harvesting and use of medicinal plants is necessary for the sustainability and improvement of herbalists' awareness of the safety of herbal medicines. The existing regulations on harvesting, transporting and exporting of herbal medicines need to be strengthened and new regulations on selling of the medicines on the informal public market be introduced.

The LHMR and monograph need to be expanded to cover more medicinal plants in all the districts of Lesotho and has to be updated continually. The LHMR and monograph can be used as a useful reference and source of herbal medicines for researchers. Moreover, the LHMR can also preserve herbal medicines in case the source plant becomes extinct. Local herbalists in Lesotho may have some valuable information on medicinal plants which requires further studies. Herbal medicines from outside Lesotho, non-plant-based and multiple-plant species concoctions used by herbalists in Lesotho need to be studied. Furthermore, there is need to expand the phytochemical screening and pharmacological testing to cover a wider spectrum of medicinal plants in Lesotho.

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