Use of herbal formulations for the treatment of circumcision wounds in Eastern and Southern Africa

Alfred Maroyi
Department of Botany, University of Fort Hare, Private Bag X1314, Sovenga 0727, South Africa
*Email: amaroyi@ufh.ac.za

ARTICLE HISTORY
Received: 07 February 2021
Accepted: 08 April 2021
Available online: 01 July 2021

KEYWORDS
Eastern and Southern Africa
Ethnopharmacology
Indigenous knowledge
Medicinal plants
Traditional male circumcision

ABSTRACT
Medicinal plants used to treat and manage circumcision wounds have remained an integral part of traditional practice in Eastern and Southern Africa. This study reviews the traditional usage of medicinal plants to treat and manage circumcision wounds in Eastern and Southern Africa. Drawing on data from Kenya, Namibia, South Africa and Tanzania, information was collected from different sources including books, theses and electronic scientific search engines such as Scopus, Science Direct, PubMed, SciFinder and Google Scholar. A literature search was also undertaken focusing on medicinal plants used against circumcision wounds that demonstrated antibacterial and anti-inflammatory activities in vitro studies. Twenty-eight medicinal plants from 15 families are recorded as traditional therapies for circumcision wounds following an extensive literature search. These species used to treat and manage circumcision wounds, and as dressing after circumcision to prevent serious inflammation are mainly (64.3%) members of Amaryllidaceae, Asparagaceae, Asteraceae, Euphorbiaceae and Fabaceae families. Three quarters (75.0%) of these species including Acalypha ornata, Aschryanthas aspera, Asparagus africanus, Boophone disticha, Brunsvigia grandiflora, Burkea africana, Colophospermum mopane, Datura stramonium, Dichrostachys cinerea, Helichrysum appendiculatum, H. foetidum, H. longifolium, H. nudifolium, H. pedunculatum, Lippia javanica, Maesa lanceolata, Ptaeroxylon obliquum, Ricinus communis, Searsia natalensis, Triumfetta rhomboidea and Vachellia nilotica have shown antibacterial and anti-inflammatory effects in a set of in vitro models. Further studies are needed such as isolation of phytochemical compounds, in vivo activities, clinical and toxicological studies.

Introduction
Traditional male circumcision is an important cultural ritual in Eastern and Southern Africa. Male circumcision is carried out for cultural reasons, as an initiation ritual and a rite of passage or transition from boyhood to manhood (1-4). Generally, boys would be taken away from their homes with or without the permission of the head of the families and kept in a secluded place where they will be circumcised and kept for a period of two to four weeks to allow the healing process (1). In Eastern and Southern Africa, traditional male circumcision is seen as a sacred cultural practice, rationalised as a mechanism for the maintenance of social order, associated with ascribed cultural teachings and performance of sexual rites that are sanctioned by society (4, 6, 7). Approximately 15% of the males aged 15 years or older in Kenya, Namibia, South Africa and Tanzania are circumcised (8-10). However, an estimated 84% of all Kenyan men are circumcised but the percentage is much lower among the Luo and Turkana ethnic groups with 17% and 40%, respectively (10). In South Africa, several ethnic groups practice male circumcision as a rite of passage from boyhood to manhood and these include Ndebele, Pedi, Sotho, Tsonga, Venda and Xhosa (7, 11). The traditional male circumcision procedure is usually performed in a non-clinical setting by a traditional provider with no formal medical training. When carried out as a rite of passage into manhood, traditional male circumcision is mainly performed on adolescents or in early adult life as a shift to puberty, adulthood or marriage (12-15). Male circumcision is one of the oldest surgical procedures known, and ritual circumcision is the act of severance of the foreskin without anaesthesia (11, 16-18). Once the foreskin is cut off, the wound is not stitched but bound in traditional medicines to help in the healing process (19-23). Therefore, traditional male circumcision procedure relies heavily on traditional medicines to...
prevent microbial infections, ameliorate swelling and pains, and accelerate wound healing.

Research into medicinal uses, phytochemistry and pharmacological properties of medicinal plants used to treat and manage circumcision wounds offers tremendous potential for developing new pharmaceutical health products and drugs. Although conventional medical circumcision is popular in some urban African cities as the World Health Organisation (WHO) recommended male circumcision as part of a comprehensive programme for preventing human immunodeficiency virus (HIV) transmission in areas with high endemic rates (24-31), traditional male circumcision is still widely practised in Eastern and Southern Africa (1-4). Studies are there (29) arguing that the emergence of HIV has brought the ancient traditional male circumcision on spot light as a result of recent studies which have demonstrated that it does not only reduce the rate of HIV infection but the ancient procedure also reduces penile cancer and cervical cancer. This has led to massive male circumcision campaigns in areas with low prevalence of circumcision. However, utilization of traditional medicines will continue to be an important approach to male circumcision in peri-urban, rural and marginalized areas characterized by limited conventional medical services. Moreover, research (32) revealed that medicinal plants are an important component of the daily lives of many people and an important part of the African cultural heritage, and 50% of pharmaceutical drugs and health products in clinical use in the world are derived from natural products isolated from plants. Some of these examples include aspirin derived from a compound called salicin isolated from Salix alba L., artemisin from Artemisia annua L., opium obtained from Papaver somniferum L., paclitaxel from Taxus brevifolia Nutt., quinine, an alkaloid obtained from Cinchona pubescens Vahl and silymarin from Silybum marianum (L.) Gaertn. (32). The ongoing screening of ethnopharmacological properties of Eastern and Southern African plants generated active principles that have great potential in the fight against several global health problems (33-38). This study, therefore, was aimed at reviewing the traditional usage of medicinal plants to treat and manage circumcision wounds in Eastern and Southern Africa focusing on Kenya, Namibia, South Africa and Tanzania.

Materials and Methods

A systematic search for medicinal plants used to treat and manage circumcision wounds in Kenya, Namibia, South Africa and Tanzania (Fig. 1) was undertaken using a variety ethnobotanical and ethnopharmacological books (32, 40-45) and other ethnobotanical pre-electronic sources such as book chapters, journal articles and scientific publications obtained from the University of Fort Hare library. The research articles were searched using Scopus, Science Direct, PubMed, SciFinder and Google Scholar using the following terms as filters, and were searched both alone and as combinations: “circumcision”, “circumcision wounds”, “ethnobotany”, “medicinal plant”, “Kenya”, “Namibia”, “South Africa”, “Tanzania” and “traditional medicine”. Each plant species identified by this initial search was subjected to a further literature review to establish its antibacterial and anti-inflammatory activities in in vitro studies. All filtered articles were appraised to determine whether they contain any validated in vitro antibacterial and anti-inflammatory models. Where possible, the common and vernacular names were collected, and all scientific names were confirmed or updated using the Plant List website (http://www.theplantlist.org/). A total of 176 articles published between 1938 and 2021 matched the inclusion criteria and were included in this review (Fig. 2).

Results and Discussion

Medicinal plant diversity

Twenty-eight medicinal plant species from 15 families are recorded as traditional therapies for circumcision wounds in Kenya, Namibia, South Africa and Tanzania.

Fig. 1. Geographical location of the study area-Kenya, Namibia, South Africa and Tanzania.

Fig. 2. Flow diagram with the number of selected articles.
Africa and Tanzania following an extensive literature search (Table 1). The preparation methods and application of these species are well documented in the common ethnobotanical literature (32, 39, 40, 44, 45). Generally, the use of these medicinal plants in traditional medicine among ethnic groups in the region is well-known. Only two species, *Datura stramonium* L. and *Ricinus communis* L. are exotic in the region and naturalized as weeds (46). These results imply that local communities in Eastern and Southern Africa have enriched their indigenous pharmacopoeia through utilization of exotic and weedy plant species as traditional medicines for circumcision wounds. Previous research on exotic plant species showed that these species are utilized as medicinal plants throughout the world (47-52). Exotic plants are used as traditional medicines due to their use-versatility applications (53). The majority of medicinal plants (64.3%) used against circumcision wounds are from five families (Fig. 3), and these are

Table 1. Medicinal plants used traditionally to treat circumcision wounds in Kenya, Namibia, South Africa and Tanzania. An asterisk (*) indicates that the species is known or believed to be exotic and naturalized in the region (46).

| Scientific name and family | Common name(s) | Country | Used for | Reference(s) |
|---------------------------|---------------|---------|----------|--------------|
| *Acalypha arnottiana* Hochst. ex A. Rich. (Euphorbiaceae) | *Mfulwe* (Bondet), *mfulwe, msindo* (Sambaa, Zigua), buhanga (Sukuma), mchacha (Swahili), lushete (Tongwe). | Tanzania | Leaf powder applied on circumcision wounds | (42) |
| *Achyranthes aspera* L. (Amaranthaceae) | *Devil’s horsewhip* (English), *kianda* (Sambaa), pulule, turura (Swahili) | Tanzania | Leaves used as dressing after circumcision | (54) |
| *Antieria pedunculosa* C.B. Clarke (Commelinaceae) | *Mukengeria* (Kikuyu) | Kenya | Leaves used as dressing after circumcision | (43) |
| *Anthoxanthum ecklonii* (Nees ex Trin.) Stapf (Poaceae) | *Sweet vernal and sweet vernal grass* (English) | South Africa | Whole plant used as dressing after circumcision | (44) |
| *Asparagus africanus* Lam. (Asparagaceae) | *Haakdoring*, kadoring, wag-n-bietjie (Afrikaans), African asparagus, bush asparagus, climbing asparagus fern, ornamental asparagus, sparrow grass, wild asparagus (English), emmere-epapa, olomei (Maasai), kelala-tau-le-lehelo, leunyele (Sotho), ubulawu umbuhlope, umathunga, umunzi (Xhosa), isigoba, isigolo (Zulu) | Kenya and South Africa | Root powder inserted into scarifications on legs to give strength and fearlessness while leaves and roots are used to clean circumcision wounds | (40,41,45,55,56) |
| *Boophone disticha* (L.) Herb. (Amaryllidaeae) | *Boesmangif*, *gibol*, kopenserbloem, perdespoek, seeroogbloem (Afrikaans), bushman poison bulb, century plant, poison bulb, sore-eye flower (English), *kwutsana-yanaha*, leshoma, motlatsisa (Sotho) lehloha Tswana), icwandi, icincho (Xhosa, Zulu), ihade (Zulu) | South Africa | Outer scales of the bulb and leaves used as dressing after circumcision | (21,32,39,40,57-63) |
| *Brunsvia grandiflora* Lindl. (Amaryllidaeae) | *Kandelaarblom* (Afrikaans), giant candelabra flower (English), Ishwe (Xhosa), umqhele-wenkunzi (Zulu) | South Africa | Leaves as a bandage and outer bulb scales used for dressing after circumcision for rapid healing | (40,62,64-66) |
| *Burkea africana* Hook. (Fabaceae) | *Wildesiering* (Afrikaans), wild seringa (English), *mpulu* (Tsonga), *monato* (Sotho, Tswana), mufhulu (Venda) | South Africa | Leaf maceration applied on wounds | (67,68) |
| *Colophospermum mopane* (J. Kirk ex Benth.) J. Kirk ex J. Léonard (Fabaceae) | *Mopani* (Afrikaans, Silolo), /gais (Ju Hoan), /gais, tsaurahais (Khoekhoegowab), kana (Xkoe), umutati (OtjiHerero), mupanyi (Thimbukushu) | Namibia | Leaf fibre chewed and applied on wounds | (69,70) |
| *Crossyene guttata* (L.) D. Müll.-Doblies & U. Müll.-Doblies (Amaryllidaeae) | *Sambreblomblom* (Afrikaans), *Ioor* feet lily, parasol lily (English) | South Africa | Bulb powder applied topically after circumcision riles, stitches deep cuts and draws out puss | (71) |
| *Datura stramonium* L. (Solanaceae) | *D. Müll.-Doblies & U. Müll.-Doblies* (Amaryllidaeae) | South Africa | Bulb powder applied topically after circumcision riles, stitches deep cuts and draws out puss | (71) |
| *Dicrastachys cinerea* (L.) Wight & Arn. (Fabaceae) | *Stinkblaar* (Afrikaans), stinkwenned, thorn apple (English), lechoe, lethesowe (Sotho), zaba-zaba (Swahili). *Ilori*, umhlabavuthwa (Xhosa), ilogi, ilori (Zulu) | South Africa | Leaves used as a bandage and to soothe the pain and swelling and as antiseptic after circumcision | (72) |
| *Drimia capensis* (Burm.f.) Wijnands (Asparagaceae) | *Maerman* (Afrikaans) | South Africa | Bulb powder applied topically after circumcision riles, stitches deep cuts and draws out puss | (45,73) |
| *Gymnosporia heterophylla* (Eckl. & Zeyh.) Loes. (Celastraceae) | *Common spike-thorn bush* (English), muthuthi (Kikuyu), olaimoronyai, olaimurunyaai (Maasai), mdungu-mdeewe (Swahili), ekalamoran (Turkana) | Kenya | Bark, roots, stems and twigs powder applied topically after circumcision riles | (41,56) |
| *Helichrysum appendiculatum* Less. (Asteraceae) | *Skaaipoorhossie* (Afrikaans), sheep’s ears everlasting (English), senkotoana (Sotho), ibode, indlebeeyemvu (Zulu) | South Africa | Fresh leaves used as antiseptic to induce fast healing after circumcision to prevent external inflammation | (57,58,74-76) |
Asparagaceae and Euphorbiaceae (2 species each), Amaryllidaceae and Fabaceae *sensu lato* (4 species each) and Asteraceae (6 species). The rest of the families are represented by only one species (Fig. 3).

| Family                                      | Species in South Africa                                                                 | Leaves used as a dressing                     |
|---------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------|
| **Helichrysum crispum** (L.) D. Don (Asteraceae) | Hotnotskooiged, hotnotskoiged, hottentotskooiged, hottentot's beddinig (English)       | South Africa                                   |
| **Helichrysum foetidum** Moench (Asteraceae)   | Geelseweeaartjie, muishondblaar, vleiseweeyaartjie (Afrikaans), stinking strawflower, stinking yellow everlasting (English), isicwe (Zulu) | South Africa                                   |
| **Helichrysum longifolium** DC. (Asteraceae)   | Kooiged (Afrikaans), Everlasting (English)                                             | South Africa                                   |
| **Helichrysum nudifolium** (L.) Less. (Asteraceae) | Hottentotskooiged, kooiged (Afrikaans), everlasting (English), isicwe, indiebe zebhokwe, undleni (Xhosa), icholocholo, imphepho, isidwaba somkhovu (Zulu) | South Africa                                   |
| **Helichrysum pedunculatum** Hilliard & B.L. Burtt (Asteraceae) | Kooiged (Afrikaans), everlasting (English), isicwe (Xhosa), imphepho (Zulu) | South Africa                                   |
| **Lippia javanica** (Burm. f.) Spreng. (Verbenaceae) | Beukesbossie, koosbossie, lemoenbossie (Afrikaans), efurie (Chagga), fever tree, lemon bush, wild tea (English), olisioni (Maasai), muthiriti (Kikuyu, Meru), mvuti (Swahili, Zigua), mvudzi (Taita), bokuhkhwane, musukudu (Tswana), inzinziniba (Xhosa), umswazi, umuuswane (Zulu) | Kenya and South Africa                         |
| **Maesa lanceolata** Forsk. (Primulaceae)      | Valsassegai (Afrikaans), false assegai (English), intendekhane (Xhosa), muunguri (Venda), isindenda, ubhoqobhoqo, umagupu, umalunguzalazikhakhona, inhlavulbe (Zulu) | South Africa                                   |
| **Pterosynol obliquum** (Thunb.) Radlk. (Rutaceae) | Nieshout (Afrikaans), sneezewood (English), thate (Tswana), umthathi, umthote (Xhosa), mulari, munari, munukha-vhaloi (Venda), umthate (Zulu) | South Africa                                   |
| **Ricinus communis** L. (Euphorbiaceae)        | Bloubottelboom, bosluite, kasterolieboom (Afrikaans), castor bean, castor oil plant (English), mohafotsha, mokhura (Sotho), nhlampfura (Tswana), mpulure (Venda), umlakuva (Xhosa, Zulu) | South Africa                                   |
| **Scadoxus multiflorus** (Martyn) Raf. (Amaryllidaceae) | Bloedblom, gifworet (Afrikaans), blood flower, fireball lily, katricular wheel, poison root (English), inkupulwane (Xhosa), idunjana, ubukhoswane (Zulu) | South Africa                                   |
| **Seasia natalensis** (Bernh. ex C. Krauss) F.A. Barkley (Anacardiaceae) | Natal karree, Natal rhus (English), muthigiyu, muthihi (Kikuyu, Mbeere), ormisigiyi, ormisigiyi (Masai), mnunguru (Sambha, Sukuma), mkono chuma, munjia kondlo (Swahili), kitarika (Taita) | Kenya                                           |
| **Triumphetta rhomboidea** Jacq. (Tiliaceae)    | Burbusb, burweed, Chinese bur, diamond burbark, parquet bur (English), mboshoko (Pare), mchokhochle, mchokhochle, mfokhochere (Swahili), mfungang’ombe (Ziga) | Kenya and Tanzania                              |
| **Vachellia tortilis** (L.) P.J.H. Hurter & Mabb. (Fabaceae) | Egyptian thorn, scented-pod acacia (English), ngungu (Nyamwezi, Sukuma, Swahili), olkiloriti (Masai) | Tanzania                                        |

More than half (60.7%) of the species used to treat and manage circumcision wounds are traded as herbal medicines in local, regional and international markets.

*Fig. 3.* The number of Eastern and Southern African plant species per family used to treat and manage circumcision wounds.
markets and these include Achyranthes aspera L., Asparagus africanus Lam., B. disticha, Burkea africana Hook., Colopospermum mopane (J. Kirk ex Bent.) J. Kirk ex J. Léonard, D. stramonium, Dichrostachys cinerea (L.) Wight & Arn., Drimia capensis (Burm.f.) Wijnands, Gymnosporia heterophylla (Eckl. & Zeyh.) Loes., H. nudifolium, Lippia javanica (Burm. f.) Spreng., Paeroxylon obliquum (Thunb.) Radlk., R. communis, Searsia natalensis (Bernh. ex C. Krauss) F.A. Barkley, Triumfetta rhomboidea Jacq. and Vachellia nilotica (L.) P.J.H. Hurter & Mabb. (Table 2). Selling of the bark, bulbs, fruits, leaves, rhizomes, roots, seed oil, stems and whole plant parts of these species in Algeria, Botswana, Burundi, Eswatini, Ethiopia, Lesotho, Malawi, Mozambique, Nigeria, Rwanda, South Africa, South Sudan, Tanzania, Zambia and Zimbabwe generates economic opportunities for vulnerable groups living in peri-urban, rural and marginalized areas (38, 96-98, 107-110). It was observed that there is an increased trade both at domestic and international levels for medicinal plants with known phytopharmaceutical, nutraceutical and cosmeceutical properties (111).

Antibacterial and anti-inflammatory activities

Many of the ethnobotanical books and primary studies published in journal articles showed that different plant parts are used to treat circumcision wounds and also used as dressing after circumcision to prevent serious inflammation (Table 1). Three quarters (75.0%) of these species including Acalypha ornata Hochst. ex A. Rich., Achyranthes aspera L., A. africanus, B. distica, Brunsvigia grandiflora Lindl., B. africana, C. mopane, D. cinerea, D. stramonium, H. appendiculatum, H. foetidum, H. longifolium, H. nudifolium, H. pedunculatum, L. javanica, M. lanceolata, P. obliquum, R. communis, S. natalensis, T. rhomboidea and V. nilotica have shown antibacterial and anti-inflammatory effects in a set of in vitro models (Supplementary Table 1). All of these species were reported to be effective against one or more bacterial pathogens and also exhibited in vivo anti-inflammatory activities. It was argued that any medicinal plant species or natural pharmaceutical product to be classified as a good wound healing agent, it should possess antibacterial and anti-inflammatory properties among other pharmacological properties (112, 113). The wound healing process begins with the polarisation of cells towards the wound, initiation of protrusion and cell migration, which culminate in closure of the wound area (114, 115). Most of these plant species used to treat and manage circumcision appear to accelerate the wound healing process. Majority of these species have been as bandages and to soothe the pain and swelling after circumcision for a long time now and are within reasonable reach of the traditional medical practitioners (39). The remaining 25.0% are yet to be evaluated for in vitro antibacterial and anti-inflammatory properties. However, these species which demonstrated promising activities in vitro, should be re-evaluated using appropriate in vivo models. It is thus a future challenge to translate the basic ethnopharmacological knowledge gained from antibacterial and anti-inflammatory assays into meaningful data that can be used to further enhance Eastern and Southern African plants used against circumcision wounds.

**Traditional male circumcision is an ancient and common surgical procedure in Eastern and Southern Africa**

Circumcision has existed since time immemorial and is the oldest surgical procedure performed since before recorded history (15). In South Africa, traditional male circumcision ritual dates back to at least 1886 (14). Scholars distinguished three phases of the circumcision rites which include the preparation of the ritual, followed by a process of seclusion and reintegration (7, 161). In the Xhosa cultural circumcision ritual in South Africa, these three stages are clearly identifiable with the initiate (one who undergoes the cultural circumcision ritual) translocated to a temporary hut built which is isolated from the community. Here, the initiate is circumcised and stays for substantial period, during which he heals and is taught about manhood.
accordance to the Xhosa tradition. The initiate is
welcomed back to the community and the ritual
concludes with a celebration of his newly acquired
manhood (7). In some ethnic communities in Kenya,
South Africa and Tanzania, the ritual is an integral
part to many black customs and cultures (2, 8, 14,
162, 163). Circumcision is often associated with
factors such as masculinity, social cohesion with boys
of the same age being circumcised at the same time,
self-identity and spirituality (164). Traditional male
circumcision also aims at imparting strength and
bravery since anaesthetics are not used, therefore, it
is expected that during the act of circumcision, the
initiate is expected to show that he is not feeling any
pain (165). The educational sessions carried out
during the ritual are aimed at disseminating traditional knowledge to the initiates, and therefore,
passage of ethnic traditions to succeeding
generations. Some scholars are of the view that
traditional male circumcision rituals have a purpose
of moulding individuals into productive and
community oriented adults by guiding young people
through the important stages of life (166, 167). It is
only after circumcision that the boy can marry, own
property and speak in public gatherings (4, 6, 7, 14,
168, 169).

In Eastern and Southern Africa, male
circumcision appears to be a common practice for a
variety of reasons ranging from being an initiation
ritual into adulthood, the belief that it enhances
sexual pleasure to claims that it lowers the risk of
HIV infection, prevents penile and cervical cancer
and lowers the risk of urinary tract infection (4, 170,
171). Studies conducted in sub-Saharan Africa show
that there is high acceptability of medical
circumcision even among the traditionally non-
circumcising communities for health and hygiene
reasons (163, 172-175). Factors associated with the
increase of medical circumcision practices amongst
the traditionally non-circumcising communities
include education, personal health and hygiene,
religion and ethnic mixing (172). However, among
the Xhosa people in South Africa, traditional
circumcision is more highly valued than medical
circumcision for reasons of cultural meaning and
identity (7, 168, 169). Similar research carried out in
Tanzania, revealed that traditional male circumcision
is important to the social organisation and cultural
identity of Kurya clans (2). According to an
observation (176), traditional male circumcision is a
holistic concept characterized by multiple and
interconnected dimensions such as religious,
spiritual, social, biomedical, aesthetic and cultural.
Literature studies revealed that there is increasing
demand for male circumcision in Eastern and
Southern Africa and future expansion of
circumcision services must be embedded within safe,
affordable male circumcision procedures, socio-
cultural and medical determinants of circumcision.

**Conclusion**

This review highlights some Eastern and Southern
African plant species that are widely used to treat
and manage circumcision wounds. The documented
plant species are therefore, an important aspect of
the daily lives of many people and an important part
of the Eastern and Southern African cultural
heritage. The documented plant species are part of
the indigenous or traditional pharmacopoeia which
have ancient origins. Studies have reported that some
of the species used against circumcision wounds
exhibited antibacterial and anti-inflammatory
properties in vitro which are the main mechanisms
contributing to wound healing. However, further
studies are needed such as isolation of phytochemical
compounds, in vivo activities, clinical and
toxicological studies to evaluate the suitability of
these plant species for therapeutic use. Therefore,
there is a need to subject these plant species to

**Table 2. Eastern and Southern African plant species traded in local, regional and international markets**

| Plant species                  | Countries involved in trade                                                                 | Reference(s) |
|-------------------------------|-------------------------------------------------------------------------------------------|--------------|
| Achyranthes aspera            | Whole plant traded in many countries including South Africa (38,106)                      |              |
| Asparagus africanus           | Leaves, rhizomes, roots and stems are traded in Botswana and South Africa (98,99,103,106) |              |
| Boophone disticha             | Bulbs traded in Eswatini, Lesotho, Malawi and South Africa (38,96,98,99,101,102,106,108,109)|              |
| Burkea africana               | Bark and roots traded in tropical Africa (105)                                            |              |
| Colophonospermum mopane       | Bark and seeds traded in Namibia (38,108)                                                 |              |
| Datura stramonium             | Leaves and fruits traded in South Africa and Tanzania (98,106,107)                       |              |
| Dichrostachys cinereus        | Fruits and roots traded in Mozambique, South Africa, Tanzania, Zambia and Zimbabwe (38,96,107,108) |              |
| Drinia capensis               | Bulbs traded in South Africa (106)                                                        |              |
| Gymnosporia heterophylla      | Roots and thorns traded in South Africa (101)                                             |              |
| Helichrysum nudifolium        | Leaves, roots and stems traded in South Africa (98,101,104)                              |              |
| Lippia javanica               | Whole plant traded in Mozambique, South Africa, Tanzania and Zimbabwe (38,96,102,104,108,110) |              |
| Maesa lanceolata              | Bark and roots traded in South Africa (97,98)                                             |              |
| Pteroxylon obliquum           | Bark traded in South Africa (98,100)                                                      |              |
| Ricinus communis              | Cold-pressed oil and fruits traded in Burundi, Ethiopia, Mozambique, Nigeria, Rwanda and South Africa (38,96) |              |
| Searsia natalensis            | Roots traded in Tanzania (110)                                                            |              |
| Triumpheta rhomboidea         | Roots traded in South Africa (98)                                                          |              |
| Vachellia nilotica            | Bark, leaves and roots traded in Algeria, Mozambique, South Sudan and Tanzania (38,96,108,110) |              |
clinical studies aimed at corroborating the wound healing properties associated with management of circumcision wounds.

Acknowledgements
Funding for this research was provided by the National Research Foundation (NRF) of South Africa.

Conflict of interests
The author declares no conflict of interest.

Supplementary files
Table 1. Antibacterial and anti-inflammatory activities of Eastern and Southern African plants.

References
1. Salokoski M. How Kings are made: how Kingship changes: A study of rituals and ritual change in pre-colonial and colonial Owamboland, Namibia. Helsinki: Helsinki University Press; 2006.

2. Mshana G, Wambura M, Mwanga I, Mosha I, Mosha F, Changalucha J. Traditional male circumcision practices among the Kurya of north-eastern Tanzania and implications for national programmes. AIDS Care 2011;23:1111-16. https://doi.org/10.1080/09540121.2011.554518

3. Nkwo S, Washia R, Urassa M, Boerma JT. Dynamics of male circumcision practices in northwest Tanzania. Sexually Transm Dis. 2001;28:214-18. https://doi.org/10.1097/00002453-200104000-00005

4. Froneman S, Kapp PA. An exploration of the knowledge, attitudes and beliefs of Xhosa men concerning traditional circumcision. Afr J Primary Health Care Fam Med. 2017;9:a1454. https://doi.org/10.4102/phcfm.v9i1.454

5. Prusente S, Khuwanyoo N, Sikwevyi Y. Exploring factors influencing integration of traditional and medical male circumcision methods at Inguzua Hill Local Municipality, Eastern Cape: A socio-ecological perspective. Afr J Primary Health Care Fam Med. 2019;11:a1948. https://doi.org/10.4102/phcfm.v11i1.1948

6. Meel BL. Traditional male circumcision-related fatalities in Mthatha area of South Africa. Med Sci Law 2010;50:189-191. https://doi.org/10.1258/mssl.2010.010017

7. Mavundla TR, Netswera FG, Bottoman B, Toth F. Rationalization of indigenous male circumcision as a sacred religious custom: Health beliefs of Xhosa men in South Africa. J Transcult Nurs. 2009;20:395–404. https://doi.org/10.1177/1043659609340801

8. Drain P, Halperin D, Hughes J, Klausner J, Bailey R. Male circumcision, religion and infectious diseases: An ecological analysis of 118 developing countries. BMC Infect Dis. 2006;6:172. https://doi.org/10.1186/1471-2334-6-172

9. Williams BG, Lloyd-Smith JO, Gouws E, Hankins C, Getz WM, Harrgove I et al. The potential impact of male circumcision on HIV in Sub-Saharan Africa. PLoS Med. 2006;3:e262. https://doi.org/10.1371/journal.pmed.0003026

10. World Health Organization/ United Nations Programme on HIV/AIDS (WHO/UNAIDS): New data on male circumcision and HIV prevention: Policy and programme implications conclusion and recommendations. Montreux: WHO/UNAIDS Technical Consultation, 2007.

11. Taylor J, Lockwood A, Taylor A. The prepuce: Specialized mucosa of the penis and its loss to circumcision. British J Urol. 1996;77:291-95. https://doi.org/10.1046/j.1464-410x.1996.85023.x

12. Marck J. Aspect of male circumcision in sub-equatorial African culture history. Health Trans Rev. 1997;7:337-59.

13. Dunsmuir WD, Golden EM. The history of male circumcision. British J Urology Int. 1999;83:1-12.

14. Mogotlane SM, Ntlanqulela JT, Orunbanjo BG. Mortality and morbidity among traditionally circumcised Xhosa boys in the Eastern Cape Province, South Africa. Curationis 2004;27:57-62. https://doi.org/10.4102/curationis.v27i2.980

15. Doyle D. Ritual male circumcision: A brief history. J Royal College Phys., Edinburgh 2005;25:279-85.

16. Caldwell JC, Orubuloye IO, Caldwell P. Male and female circumcision in Africa from a regional to a specific Nigerian examination. J Theolog Stud. 1997;44:1181-93. https://doi.org/10.2471/BLT.09.072975

17. Hellsten SK. Rationalising circumcision: From tradition to fashion, from public health to individual freedom: Critical notes on cultural persistence of the practice of genital mutilation. J Med Ethics 2004;30:248-53. https://doi.org/10.1136/jme.2004.006888

18. Wilcken A, Keil T, Dick B. Traditional male circumcision in eastern and southern Africa: a systematic review of prevalence and complications. Bull World Health Org. 2010;88:907-14. https://doi.org/10.2471/BLT.09.072975

19. Dilika F, Meyer JJ. Antibacterial activity of Helichrysum pedunculatum callus cultures. S Afr J Bot. 1998;64:312-13. https://doi.org/10.1016/S0254-6299(15)30908-X

20. Dilika F, Afolayan AJ, Meyer JM. Comparative antibacterial activity of two Helichrysum species used in male circumcision in South Africa. S Afr J Bot. 1997;63:158-59. https://doi.org/10.1016/S0254-6299(15)30728-6

21. Dilika F. The medicinal value of Amaryllidaceae and Asteraceae species used in male circumcision. Phd Thesis. Pretoria: University of Pretoria; 2002.

22. Papu J, Verster P. A biblical, cultural and missiological critique of traditional circumcision among Xhosa-speaking Christians. Acta Theologica. 2006;2:178-96. https://doi.org/10.4314/actat.v26i2.49044

23. Venter MA. Some views of Xhosa women regarding the initiation of their sons. Koers 2011;76:559-75.

24. Gray RH, Kigozi G, Servadda D, Makumbi F, Watya S, Nalugoda H, et al. Male circumcision for HIV prevention in men in Rakai, Uganda: A randomised trial. Lancet. 2007;369:657-66. https://doi.org/10.1016/S0140-6736(07)60313-4

25. World Health Organization (WHO). Male circumcision: Global trends and determinants of prevalence, safety and acceptability. Geneva: WHO Press; 2007.

26. Boyle GJ, Hill G. Sub-Saharan African randomised clinical trials into male circumcision and HIV transmission: methodological, ethical and legal concerns. J Law Med. 2011;19:316–34.

27. Kilima SP, Shayo HE, Msowela I, Senkororo KP, Mayala BK, Mboera LEG et al. The potential of involving traditional practitioners in the scaling up of male circumcision in the context of HIV prevention in Tanzania. Tanzania J Health Res 2013;15:199–204. https://doi.org/10.4314/thrb.v14I1.9

28. Mutabazi V, Kaplan SA, Rwamisarabo E, Bitema JP, Nzeruka ML, Savio D et al. HIV prevention: Male circumcision comparison between a nonsurgical device to a surgical technique in resource-limited settings: A prospective, randomized, nonmasked trial. J Acquired Immune Def Syndr. 2012;61:49-55. https://doi.org/10.1097/QAI.0b013e3182631d69

29. Mwambawamba YM, Mwampagatwa IH, Rastegea V, Gesase AP. The male circumcision: The oldest ancient procedure, its past, present and future roles. Tanzania J Health Res 2013;15:199–204. https://doi.org/10.4314/thrb.v13i5.8

30. Chikuta A, Maharaj P. Social representations of male circumcision as prophylaxis against HIV and AIDS in Zimbabwe. BMC Public Health. 2015; 15:603. https://doi.org/10.1186/s12889-015-1967-z

31. Rugwijij JT. Circumcision and prevention of HIV and AIDS in Zimbabwe: Male genital cutting as a religio-cultural rite. Theolog Stud. 2018;74:4848. http://dx.doi.org/10.4102/ths.v74i1.4848

32. Van Wyk BE, Van Oudshoorn B, Gercke N. Medicinal plants of South Africa. Pretoria: Briza Publications; 2013.
33. Light ME, Sparø SG, Stafford GI, Van Staden I. Riding the wave: South Africa's contribution to ethnopharmacological research over the last 25 years. | Ethnopharmacol. 2005;100:127-30. https://doi.org/10.1016/j.ejep.2005.05.028

34. Mulholland DA. The future of ethnopharmacology: A southern African perspective. | Ethnopharmacol. 2005;100:124-6. https://doi.org/10.1016/j.ejep.2005.05.013

35. Karou D, Nadembega WMC, Ouattara L, Ilboudo DP, Canini A, Nikiéma JB, et al. African ethnopharmacology and new drug discovery. Med Aromatic Plant Sci Biotechnol. 2007;7:1-7.

36. Van Wyk B-E. A review of Khaï-San and Cape Dutch medical ethnobotany. | Ethnopharmacol. 2008;119:311-4. https://doi.org/10.1016/j.ejep.2008.07.021

37. Van Wyk B-E. A broad review of commercially important southern African medicinal plants. | Ethnopharmacol. 2008;119:342-55. https://doi.org/10.1016/j.ejep.2008.05.029

38. Van Wyk B-E. A review of African medicinal and aromatic plants. In Medicinal and aromatic plants of the world: Africa, volume 3. Edited by Neffati M, Naijaa H, Mathé A. Dordrecht: Springer 2017:19-60.

39. Watt JM, Breyer-Brandwijk MG. The medicinal and poisonous plants of southern and eastern Africa. Edinburgh: E & S Livingstone; 1962.

40. Hutchings A, Scott AH, Lewis G. Cunningham A. Zulu medicinal plants: An inventory. Pietermaritzburg: University of Natal Press; 1996.

41. Maundu P, Berger D, Ole Saitabau C, Nasieku J, Kipelian M, Mathenge S et al. Ethnobotany of the Loita Maasai: Towards community management of the forest of the lost child: Experiences from the Loita ethnobotany project. Paris: People and Plants Working Paper 8, UNESCO; 2001.

42. Schmelzer GH. Acalypha ornata Hochst. ex A. Rich. In Plant resources of tropical Africa 11: Medicinal plants 1. Edited by Schmelzer GH, Curib-Takim A. Leiden:Backhuys Publishers; 2008:26-27.

43. Kokwaro JO. Medicinal plants of East Africa. Nairobi: University of Nairobi Press; 2009.

44. Moffett R. Sesotho plant and animal names and plants used by the Basotho. Bloemfontein: Sun Press; 2010.

45. Roberts M, Roberts S. Indigenous healing plants. Pretoria: Briza Publications; 2017.

46. Randall RP. A global compendium of weeds. Perth: Western Australia: Department of Agriculture and Food; 2017.

47. Stepp JR, Moerman DE. The importance of weeds in ethnopharmacology. | Ethnopharmacol. 2001;75:19-23. https://doi.org/10.1016/S0378-8741(00)00385-8

48. Nioroge NG, Bussmann WR, Gemmill B, Njoroge NG, Bussmann WR, Gemmill B, Newton LE, Ngumi et al. Plant use of the Maasai of Matebele village in the Limpopo province, South Africa. Afr J Biotechnol. 2012;1:2392-2405. https://doi.org/10.5897/AJB12.2572n

49. Semenya SS, Potgieter MJ, Thishikawhe MP. Use, conservation and present availability status of ethnopharmaceuticals of Matebele village in the Limpopo province, South Africa. Afr J Biotechnol. 2017;16:635-39.

50. Semenya SS, Potgieter MJ. Bapedi traditional healers in the Limpopo province, South Africa: Their socio-cultural profile and traditional healing practice. | Ethnobiol Etnomned. 2014;10:4. https://doi.org/10.1186/s13002-017-0173-8

51. Bainbridge H. Indigenous use of mopane (Colophospermum mopane) in northwestern Namibia. Desert Pl. 2012;28:23-26.

52. Nair J, Van Staden J, Bonnet SI, Wilhelm A. Distribution and diversity of usage of the Amaryllidaceae in the traditional remediation of infectious diseases. Nat Prod Comm. 2017:12:635-39.

53. Van Wyk B-E, Gericke N. People's plants: A guide to useful plants of southern Africa. S Afr J Bot. 2008;74:696-704. https://doi.org/10.1016/j.saib.2008.05.001

54. Marowy A. Diversity of use and local knowledge of wild and cultivated plants in the Eastern Cape province. South Africa. J Ethnobiol Ethnomed. 2017;13:43. https://doi.org/10.1186/s13002-017-0173-8
Bhat RB. Plants of Xhosa people in the Transkei region of Eastern Cape (South Africa) with major pharmacological and therapeutic properties. J Med Pl Res. 2013;7:1474-80. https://doi.org/10.5897/JMPR12.973

Suntar I. The medicinal value of Asteraceae family plants in terms of wound healing activity. Fabad I Pharm Sci. 2014;39:21-31.

Gerstner I. A preliminary checklist of Zulu names of plants with short notes. Bantu Stud. 1938;12:215-36. https://doi.org/10.1080/02561751.1938.9676078

Swelankwambe N. Helichrysum foetidum (L.) Moench; 2021. Available from: http://pza.sanbi.org/helichrysum-foetidum, accessed on 7 January 2020

Maroyi A. Medicinal uses, biological and phytochemical properties of Helichrysum foetidum (L.) Moench (Asteraceae). Asian J Pharmaceut Clinical Res. 2019;12:13-18. https://doi.org/10.22159/ajpcr.2019.v12i3.3607

Xaba PM. Helichrysum nudifolium (L.) Less; 2021. Available from: http://pza.sanbi.org/helichrysum-nudifolium, accessed on 12 January 2021.

Sewani-Rusike CR, Mammen M. Medicinal plants used as home remedies: A family survey by first year medical students. Afr J Trad. Alt Med. 2014;11:67-72. https://doi.org/10.4341/ajtam.v11i11.1101

Maroyi A. Helichrysum nudifolium (L.) Less.; review of its medicinals uses, phytochemistry and biological activities. J Pharm Nutr Sci. 2019;9:189-94. https://doi.org/10.12096/1927-5951.2019.09.03.8

Bolofo RN, Johnson CT. The identification of ‘isicakathi’ and its medicinal use in Transkei. Bothalia 1988;18:125-30.

Van Vuuren CJ, De Jongh M. Rituals of manhood in South Africa: Circumcision at the cutting edge of critical intervention. S Afr J Ethnol. 1999;22:142-56.

Dilika F, Bremner PD, Meyer JJM. Antibacterial activity of Helichrysum pustulatum (Burm. f.) Spreng; A plant used during circumcision rites. Fitoterapia 2000;71:450-52. https://doi.org/10.1016/s0367-326x(00)00150-7

Bhat RB. Medicinal plants and traditional practices of Xhosa people in the Transkei region of Eastern Cape, South Africa. Indian J Trad Know. 2014;13:292-98.

Maroyi A. Helichrysum longifolium and H. pedunculatum: A comparative analysis of their medicinal uses, chemistry and biological activities. Asian J Pharmaceutical Clinical Res. 2019;12:41-46. https://doi.org/10.22159/ajpcr.2019.v12i3.3607

Hutchings A. Ritual cleansing, incense and the tree of life: Observations on some indigenous plant usage in traditional Zulu and Xhosa purification and burial rites. Alternation 2007;14:189-218.

Maroyi A. Lippia javanica (Burm. f.) Spreng; Traditional and commercial uses, phytochemical and pharmacological significance. Evidence-Based Compl Alt Med. 2017;article ID 6746071. https://doi.org/10.1155/2017/6746071

Mabogo DEN. The ethnomedicine of the Vhavenda. MSc Thesis. Pretoria: University of Pretoria; 1990.

Ovedemi SO, Ovedemi BO, Falowo AB, Fayemi PO. Coqooposamy RM. Antibacterial and ciprofloxacin modulating activity of Pteraeoxylon obliquum (Thunb.) Radlk leaf used by the Xhosa people of South Africa for the treatment of wound infections. Biochemical Compl Med. 2016;30:1006-15. https://doi.org/10.1080/13506121.2016.1209434

Chhabra SC, Mahunnah RLA, Mshini EN. Plants used in traditional medicine in Eastern Tanzania. VI. Angiosperms (Sapotaceae to Zingiberaeae). J Ethnopharmacol. 1993;39:83-103. https://doi.org/10.1016/0378-8741(93)90024-v

Bosch CH, Triumfetta rhomboidea Jacq. In Plant resources of tropical Africa 16: Fibres. Edited by Brink M. Achigan-Dako EG. Leiden: Backhuys Publishers 2012;446-49.

Kiringe JW. A survey of traditional health remedies used by the Maasai of southern Kajiado district, Kenya. Ethnobot Res Appl. 2006;4:61-73.

Cunningham AB. African medicinal plants: Setting priorities at the interface between conservation and primary health care. Paris: People and Plants Working Paper 1, UNESCO; 1993.

Mander M. Marketing of indigenous medicinal plants in South Africa: A case study in KwaZulu-Natal. Rome: FAO; 1998.

Williams VL, Bailbwill K, Witkowski ET. A lexicon of plants traded in the Witwatersrand umuthi shops. Bothalia 2001;31:71-98. https://doi.org/10.4102/abc.v31i1.508

Dold AP, Cocks ML. The trade in medicinal plants in the Eastern Cape province, South Africa. S Afr J Sci. 2002;98:s59-87.

Loudou P. Medicinal plant trade and opportunities for sustainable management in South Africa. MSc Thesis. Stellenbosch: University of Stellenbosch; 2008.

Botha J, Weiersbye IM. Ethnobotanic and forage uses of plants on mine properties in the Witwatersrand basin gold fields, South Africa. In Mine Closure. Edited by Fourie A. Tillett M. Wieritz J. Perth: Australian Centre for Geomechanics 2010;325-42.

Moeng ET. An investigation into the trade of medicinal plants by Muthi shops and street vendors in the Limpopo province, South Africa. MSc Thesis. Mankweng: University of Limpopo; 2010.

Setshogo MP, Mbereki CM. Floristic diversity and use of medicinal plants sold by street vendors in Gaborone, Botswana. Afr J Sci Biotechnol. 2011;5:69-74.

Van Wyk BE. The potential of South African plants in the development of new medicinal products. S Afr J Bot. 2011;77:812-29. https://doi.org/10.1016/j.sajb.2011.08.011

Maroyi A. Burkea africana Hook. In Plants resources of tropical Africa 7: Timbers 2. Edited by Lemmens RHMI, Louppe D, Ongmo-Akao AA. Leiden: Backhuys Publishers 2012:174-77.

Petersen LM, Moll EJ, Collins R, Hocking MT. Development of a compendium of local, wild-harvested species used in the informal economy trade, Cape Town, South Africa. Ecol Soc. 2012;17:26. http://dx.doi.org/10.5751/ES-04537-170226

Posthouwer C. Medicinal plants of Kariako market, Dar es Salaam, Tanzania. MSc Thesis. Leiden University; 2015.

Van Wyk BE. A review of commercially important African medicinal plants. J Ethnopharmacol. 2015;176:118-34. https://doi.org/10.1016/j.jep.2015.10.031

Hilonga S, Otieno JN, Ghorbani A, Pereus D, Kocyan A, de Boer WJ. The international trade of wild-harvested medicinal plant species in local markets of Tanzania and its implications for conservation. S Afr J Bot. 2019;122:214-24. https://doi.org/10.1016/j.sajb.2018.08.012

Rasethwabe TM, Semenyisa NY, Maroyi A. Medicinal plants traded by informal herbal medicine markets in the Limpopo province, South Africa. Evidence-Based Compl Alt Med. Volume 2019;article ID 2609532. https://doi.org/10.1155/2019/2609532

Vasisht K, Sharma N, Karan M. Current perspective in the international trade of medicinal plants material: An update. Current Pharmaceut Design 2016;22:4288-36. https://doi.org/10.2174/187112822666160607070736

Houghton PJ, Hylands PJ, Mensah AY, Hensel A, Deters A. In vitro tests and ethnopharmacological investigations: wound healing as an example. J Ethnopharmacol. 2005;100:100-07. https://doi.org/10.1016/j.jep.2005.07.001

Azyare C, Asase A, Lechtenberg M, Niehues M, Deters A, Hensel A. An ethnopharmacological survey and in vitro confirmation of ethnopharmacological use of medicinal plants used for wound healing in Bosomtwe-Awimna-Kwanumwe area, Ghana. J Ethnopharmacol. 2009;125:393-403. https://doi.org/10.1016/j.jep.2009.07.024
114. Walmsley GG, Maan ZN, Wong VW, Duscher D, Hu MS, Zielins ER et al. Scarless wound healing: Chasing the holy grail. Plast Reconstr Surg. 2015;135:907–17. https://doi.org/10.1097/PSR.0000000000000972

115. Chingwaru C, Bazar T, Maroey A, Kapwepangwoto PT, Chingwaru W. Wound healing potential of selected Southern African medicinal plants. J Herbal Med. 2019;17:100263. https://doi.org/10.1016/j.thermed.2019.100263

116. Tekla A, Rondevaldova I, Asfaw Z, Demissew S, Van Damme P, Kokoska L et al. In vitro antimicrobial activity of plants used in traditional medicine in Guraie and Silti Zones, south central Ethiopia. BMC Compl Alt Med. 2015;15:286. https://doi.org/10.1186/s12906-015-0822-1

117. Madzikizela B, Ndhlala AR, Finnie IF, Van Staden J. In vitro antimicrobial activity of extracts from plants used traditionally in South Africa to treat tuberculosis and related symptoms. Evidence-Based Compl Alt Med. 2013;Volume 2013:article ID 840719. https://doi.org/10.1155/2013/840719

118. Madzikizela B, Ndhlala AR, Finnie IF, Van Staden J. Antimycobacterial, anti-inflammatory and genotoxicity evaluation of plants used for the treatment of tuberculosis and related symptoms in South Africa. J Ethnopharmacol. 2014;153:386–91. https://doi.org/10.1016/j.jep.2014.02.034

119. Pandey R, Sambasivarao Y, Gurumurthy A. Antibacterial activity of medicinal plants against pathogens from extracts of Achyrantes aspera. Med Aromat Plants 2013;2:5. https://doi.org/10.4172/2167-0412.1000135

120. Nigussie D, Davey G, Leesesse BA, Bekadu A, Makonnen E. Antibacterial activity of methanol extracts of the leaves of Acalypha ornat. Pak J Pharm Sci. 2013;26:451–54.

121. Khuda F, Iqbal Z, Khan A, Zakiullah A, Nasir F, Shah Y. Antioxidant activity of leaf extracts of twelve plants used in traditional medicine in Gurage and Silti Zones, south central Ethiopia. BMC Compl Alt Med. 2015;15:286. https://doi.org/10.1186/s12906-015-0822-1

122. Shandukani PD, Tshidino SC, Masoko P, Moganedi KM. Antibacterial activity and in situ efficacy of Bidens pilosa Linn and Dichrochacthus cinerea Wight et Arn extracts against common diarrhoea-causing waterborne bacteria. BMC Compl Alt Med. 2018;18:171. https://doi.org/10.1186/s12906-018-2230-9

123. Nkisi S, Vuuren S, Van Eyk A, De Wet H. Plants used to treat skin diseases in northern Maputaland, South Africa: Antimicrobial activity and in vitro permeability studies. Pharm Biol. 2016;54:2420-36. https://doi.org/10.3109/13880209.2016.1158287

124. McGaw LJ, Jäger AK, Van Staden J. Prostaglandin synthesis inhibitory activity in Zulu, Xhosa and Sotho medicinal plants. Phytother Res. 1997;11:135–17. https://doi.org/10.1002/siph0999-1573(19970301):2<141::AID-PTDR>3.0.CO;2-S

125. Efekhah F, Youssefzadi M, Tafakor V. Antibacterial activity of Datura inoxia and Datura stramonium. Fiterapia 2005;76:118–20. https://doi.org/10.1016/j.fitoter.2004.10.004

126. Taye B, Giday M, Animit A, Seid J. Antibacterial activities of selected medicinal plants in traditional treatment of human wounds in Ethiopia. Asian Pac J Trop Biomed. 2011;1:370-75. https://doi.org/10.1016/S2221-1691(11)60062-8

127. Obi CL, Potgieter N, Randima LP, Machungu NJ, Musie E, Bessong PO, et al. Antibacterial activities of five plants against some medically significant human bacteria. S Afr J Sci 2002;98:25-28.

128. Ondua M, Novoa EM, Abdalla MA, McGaw LJ. Anti-inflammatory and antioxidant properties of leaf extracts of eleven South African medicinal plants used traditionally to treat inflammation. J Ethnopharmacol. 2019;234:27–35. https://doi.org/10.1016/j.jep.2018.12.030

129. Lourens ACU, Van Vuuren SF, Viljoen AM, Davids H, Van Heerden FR. Antimicrobial and anti-viral activity and in vitro cytotoxicity of selected South African Helichrysum species. S Afr J Bot. 2011;77:229–35. https://doi.org/10.1016/j.sajb.2010.05.006

130. Aiwegoro OA, Afalayan AI, Okoh AI. In vitro antibacterial activities of crude extracts of the leaves of Helichrysum longifolium in combination with selected antibiotics. Afr J Pharm Pharmac. 2009;3:293-300.

131. Aiwegoro OA, Afalayan AI, Okoh AI. Studies on the in vitro time kill assessment of crude acetone and aqueous extracts of Helichrysum pedunculatum leaves. Afr J Bot. 2008;7:3718-22. https://doi.org/10.5897/AJB08.578

132. Shikanga EA, Combrinck S, Regnier T. South African Lippia herbal infusions: Total phenolic content, antioxidant and antibacterial activities. S Afr J Bot. 2010;76:567–71. https://doi.org/10.1016/j.sajb.2010.04.010

133. York T, Van Vuuren SF, De Wet H. An antimicrobial evaluation of plants used for the treatment of respiratory infections in rural Maputaland, KwaZulu-Natal, South Africa. J Ethnopharmacol. 2012;144:118-27. https://doi.org/10.1016/j.jep.2012.08.038

134. Asowata-Ayodele AM, Otunola GA, Afalayan AI. Assessment of the polyphenolic content, free radical scavenging, anti-inflammatory, and antimicrobial activities of aceton and aqueous extracts of Lippia javanica (Burm.f.) Spreng. Pharmacogn Mag. 2016;12:353-62. https://doi.org/10.4103/0973-1296.185770

135. Elisha IL, Botha FS, McGaw LJ, Eloff IN. The antibacterial activity of extracts of nine plant species with good activity against Escherichia coli against five other bacteria and cytotoxicity of extracts. BMC Compl Alt Med. 2017;17:133. https://doi.org/10.1186/s12906-017-1645-z

136. Adamu M, Naidoo V, Eloff IN. The antibacterial activity, antioxidant activity and selectivity index of leaf extracts of thirteen South African tree species used in ethnoveterinary medicine to treat helminth infections. BMC Vet Res. 2014;10:52. https://doi.org/10.1186/1746-6148-10-52.

137. Madzikizela B, Ndhlala AR, Finnie IF, Van Staden J. Ethnopharmacological study of plants from Pondoland used against diarrhoea. J Ethnopharmacol. 2012;141:61–71. https://doi.org/10.1016/j.thermed.2012.01.053

138. Elisha IL, Dzovem JP, McGaw LJ, Botha FS, Eloff IN. The anti-arthritic, anti-inflammatory, antioxidant activity and relationships with total phenolics and total flavonoids of nine South African plants used traditionally to treat arthritis. BMC Compl Alt Med. 2016;16:307. https://doi.org/10.1186/s12906-016-1301-2
In vitro antimicrobial activity of methanol extract of "Triumfetta rhomboidea" against clinical isolates. Elixir Appl Bot. 2015;9:1–7.

146. Peltzer K, Ntshabele K, Pienaar A, de Souza G, van der Luit J, Dlamini S. Male circumcision and HIV prevention in South Africa: A community perspective. Afr J Health Stud. 2016;2:27–32.

147. Ramadwa TE, Awouafack MD, Sonopo MS, Eloff NJ. Antibacterial and antifungal activities of extracts from leaves of "Periploca aphylla" and "Ricinus communis". ISRN Pharmacol. 2012:Article ID 563267. https://doi.org/10.5402/2012/563267

148. Soyej OT, Masika PI. Antibacterial and antioxidant activities of selected plants used for the treatment of cattle wounds in the Eastern Cape. Afr J Biotech. 2012;11:3476-81. https://doi.org/10.5897/AJB10.1070

149. Iqbal J, Zaib S, Farooq U, Khan A, Bibi I, Suleman S. Antioxidant, antimicrobial and free radical scavenging potential of aerial parts of "Periploca aphylla" and "Ricinus communis". ISRN Pharmacol. 2012:Article ID 563267. https://doi.org/10.5402/2012/563267

150. Umaras A, Padmanabhav K, Thirunavukkarasan D, Rajesh SV, Govindaraj D. Evaluation of antimicrobial activity and phytochemical investigation of the leaf extracts of "Ricinus communis" Linn. against drug-resistant bacterial pathogens. Drug Invention Tod. 2019;11:1299-1303.

151. Suurbaum J, Mosobil R, Donkor A-M. Antibacterial and antifungal activities and phytochemical profile of leaf extract from different extractants of "Ricinus communis" against selected pathogens. BMC Res Notes 2017;10:660. https://doi.org/10.1186/s13104-017-3001-2

152. Kareru PG, Gachanja AN, Keriko JM, Kenji GM. Antimicrobial activity of some medicinal plants used by herbalists in Eastern Kenya. Afr J Trad Compl Alt Med. 2008;5:51–55.

153. Korir R, Kimani C, Gathirwa J, Wambura M, Bi i C. In vitro antimicrobial properties of methanol extracts of three medicinal plants from Kilifi district, Kenya. Afr J Health Sci. 2012:20:4-10.

154. Devmurari VP, Ghodasarai TJ, Jivani NP. Antibacterial activity and phytochemical study of ethanolic extract of "Triumfetta rhomboidea" Iacq. Int J Pharmaceut Sci Drug Res. 2012:10:40-42. https://ipsdr.com/index.php/ipsdr/article/view/77

155. Odimegwu CD, Uche IF, Ozugbo CL, Ogbuanya CE, Gugu HT, Esimone OC. In vitro antimicrobial evaluation of methanol extract of "Triumfetta rhomboidea" leaves against some clinical bacterial isolates. Int J Biol Chem Sci. 2011;5:1970-77. https://doi.org/10.4314/ijbc.v5i5.17

156. Thawkar B, Kale M, Oswal M, Maniyar K, Kadam K, Kamat S. In vitro anti-inflammatory activity of 70% methanolic extract of some selected plants used for the treatment of cattle wounds in the Eastern Cape. Afr J Biotech. 2012;11:3476-81. https://doi.org/10.5897/AJB10.1070

157. Larsen BHV, Soelberg J, Jæger AK. COX-1 inhibitory effect of antibacterial activity of crude extracts, anti-inflammatory, anticholinesterase and mutagenic effects of "Ricinus communis" Linn. against drug-resistant bacterial pathogens. Int J Appl Res. 2016;2:103-06.

158. Larkar D, Shetkar A, Shetkar V, Godse P, Dhangar A, Pandhare P. Antibacterial activity of "Periploca aphylla" and "Ricinus communis" against clinical isolates. Elixir Appl Bot. 2015;9:1–7.

159. Oomah BD, Alston JL, Arshad MR, Blumenthal RA, Burtis CA, Clark WH, Duford BW, Gudz C, Higginbotham K, Hinshaw L, et al. "Periploca aphylla" and "Ricinus communis" as sources of bioactive phytochemicals. J Nutr. 2014;144:2483-88. https://doi.org/10.3945/jn.113.197772

160. Ramadwa TE, Awouafack MD, Sonopo MS, Eloff NJ. Antibacterial and antifungal activities of crude extracts, fractions, and isolated compounds from leaves of "Periploca aphylla" (Rutaceae). Nat Prod Comm. 2019;14:1–7. https://doi.org/10.1177/1934578X19872927

161. Turner VW. The ritual process. Chicago: Aldine; 1969.

162. Carsens P. The socio-economic context of initiation ceremonies among two Southern African peoples. Canadian J Afr Stud. 1982;16:505–22. https://doi.org/10.1080/000839682.1982.10804010

163. Weiss HA, Plummer ML, Changalucha J, Mshana G, Shigongo ZS, Todd J et al. Circumcision among adolescent boys in rural northwestern Tanzania. Trop Med Int Health 2008;13:1054-61. https://doi.org/10.1111/j.1365-3156.2008.02107.x

164. Niang IC, Boiro H. You can also cut my finger: Social construction of male circumcision in West Africa, a case study of Senegal and Guinea Bissau. Reprod Health Matters 2007;15:22-32. https://doi.org/10.1058/000839682.19872927

165. Wambura M, Mwanza JR, Mosha JF, Mshana G, Mosha F, Changalucha J. Acceptability of medical male circumcision in the traditionally circumcising communities in Northern Tanzania; BMC Public Health 2011;11:373. https://doi.org/10.1186/1471-2338-11-373

166. Munthali AC, Zulu EM. The time and role of initiation rites in preparing young people for adolescence and responsible sexual and reproductive behaviour in Malawi. Afr J Reprod Health 2007;11:150-67.

167. Maposa RS. Going under the traditional knife: Linking African traditional education and the ethic of identity through Shangani culture, Zimbabwe. J Emerging Trends Educ Res Policy Stud 2011:2:479-84.

168. Vincent L. Boys will be boys: Traditional Xhosa male circumcision, HIV and sexual socialisation in contemporary South Africa. Cult Health Sex. 2008;10:431-46. https://doi.org/10.1080/1369105050081841447

169. Pelzter K, Kanta X. Medical circumcision and manhood initiation rituals in the Eastern Cape, South Africa: A post intervention evaluation. Cult Health Sex. 2009;11:83-97. https://doi.org/10.1080/13691050902839777

170. Mensch BS, Bazah D, Clark WH, Binka F. The changing nature of adolescence in the Kassena-Nankana district of northern Ghana. Stud Family Plan. 1999;30:95-111. https://doi.org/10.1111/j.1728-4465.1999.00095.x

171. Meissner O, Buso DL. Traditional male circumcision in the Eastern Cape: Scourge or blessing? S Afr Med J. 2007;97:371–73.

172. Nkwo S, W anguish R, Urassa M, Boerma JT. Dynamics of male circumcision practices in north-west Tanzania. Sexually Transmit Dis. 2001;28:214-18. https://doi.org/10.1097/00007435-200104000-00005

173. Bailey R, Muga R, Poulsen R, Abicht H. The acceptability of male circumcision to reduce HIV infections in Nyanza province, Kenya. AIDS Care 2002;14:27-40. https://doi.org/10.1095/000541020220097919

174. Kebaabetswe P, Lockman S, Mogwe S, Mandeve R, Thior I, Essex M et al. Male circumcision: An acceptable strategy for HIV prevention in Botswana. Sexually Transmit Inf. 2003;79:214-19. http://dx.doi.org/10.1136sti.79.3.214

175. Westercamp N, Bailey RC. Acceptability of male circumcision for prevention of HIV/AIDS in sub-Saharan Africa: A review. AIDS Behavior. 2007;11:341-55. http://dx.doi.org/10.1095/000541020220097919

176. Peltzer K, Ntshabele K, Pienaar A, de Souza G, van der Luit J, Dlamini S. Male circumcision, gender and HIV prevention in sub-Saharan Africa: A (social science) research agenda. J Social Aspects HIV/AIDS. 2011;479-84.

177. Policy Stud 2011;2:479-84.