

Medicinal Plants Used by the Inhabitants of Alfred Nzo District Municipality in the Eastern Cape Province, South Africa

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Abstract: Plant species used as herbal medicines play an important role in the provision of primary healthcare in several rural communities. The current study was aimed at documenting medicinal plants used by the inhabitants of Alfred Nzo District Municipality in the Eastern Cape province, South Africa. Information on medicinal plants used for primary healthcare was collected through open-ended interviews with a sample of 124 participants selected via snowball-sampling technique between April 2017 and May 2018. A total of 34 plant species and one fungus species representing 20 families were used in the treatment of 13 different human diseases. The major diseases treated by the documented species included respiratory system, pain, sores and wounds, infections and infestations, digestive system, blood and cardiovascular system, fever and malaria, general ailments, reproductive system and sexual health and mental disorders. Popular herbal medicines with relative frequency citation (RFC) values exceeding 0.50 included *Bulbine frutescens*, *Clivia miniata* var. *miniata*, *Elephantorrhiza elephantina*, *Centella asiatica*, *Hypoxis hemerocallidea*, *Dicerotheranthus rhinocerotis*, *Leonotis leonurus*, *Agapanthus africanus* and *Datura stramonium*. Such repository of medicinal plants and fungi reinforces the need for an evaluation of their biological activities as a basis for developing future medicines and pharmaceutical products.

Keywords: Alfred Nzo District Municipality, fungi, herbal medicines, South Africa, traditional knowledge.

INTRODUCTION

Several pharmaceutical drugs and health promoting products have been extracted from plant species. Van Wyk *et al.* [1] argued that plant species were once a primary source of all the medicines in the world and they still continue to provide mankind with new remedies. Natural products derived from plants and their derivatives represent more than 50% of all pharmaceutical drugs in clinical use in the world with higher plants contributing no less than 25% of the total [2]. Well-known examples of plant derived medicines include quinine (*Cinchona pubescens* Vahl), morphine (*Papaver somniferum* L.), codeine (*Papaver bracteatum* Lindl.), salicylic acid (*Salix* sp.), curare (*Chondrodendron tomentosum* Ruiz & Pavón), digitoxin (*Digitalis purpurea* L.), taxol (*Taxus brevifolia* Nutt.), atropine (*Atropa belladonna* L.), reserpine (*Rauwolfia vomitoria* Afzel) and vincristine (*Catharanthus roseus* (L.) G. Don) [1]. These discoveries generated a lot of interest in natural plant-based remedies as a source for pharmaceutical drugs and health promoting products.

In South Africa, medicinal plants are an important aspect of the daily lives of many people and they are an important part of the local people's cultural heritage [1]. Street and Prinsloo [3] argued that South Africa as

a country is known for a strong history of traditional healing, hosts a variety of around 30 000 flowering plant species and over 3 400 plant species in southern Africa are used for medicinal purposes [4,5]. Street and Prinsloo [3] also argued that medicinal and aromatic plants are now universally recognised as the basis for a number of critical human health, social and economic support systems and benefits. Similarly, Mander *et al.* [6] argued that for many people in South Africa, traditional medicine is not considered an inferior alternative to western medicine, but is thought to be desirable and necessary for treating a range of health problems that western medicine does not treat adequately. These authors argued that 72% of the Black African population in South Africa from a diverse range of age categories, education levels, religions and occupations are known to use traditional medicines. Therefore, use of traditional medicines in South Africa is by choice and not a result of access and cost issues associated with western medicines. Although, various ethnobotanical surveys have been conducted in different parts of South Africa, some parts of the Eastern Cape province are still poorly explored. The Eastern Cape province is characterized by low socio-economic standing with predominantly rural population suggesting that the majority of people in the province use traditional methods of healthcare [7-9]. It is therefore, within this context that the present study was undertaken aimed at providing the inventory of medicinal plant species used by the inhabitants of

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Alfred Nzo District Municipality in the Eastern Cape province, South Africa.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Alfred Nzo District Municipality in the Eastern Cape Province, South Africa (Figure 1). The research study focused on three local municipalities, that is, Mbizana, Mzimvubu and Ntabankulu Local Municipalities (Figure 1). Alfred Nzo District Municipality is located between longitude 29°20' E to 30°10' E and latitude 30°60' S to 30°30' S at an altitude ranging from 0 to 1055 m above sea level¹¹. The temperature varies from 7°C to 10°C in cool dry season, when it can also be snowy and from 18°C to 24°C in the hot wet season. The rainfall season is between October and March with the latter being the wettest month and rainfall varies from 750 mm to 1050 mm per annum [10]. Mucina and Rutherford [11] described the dominant vegetation of Alfred Nzo District Municipality as sub-escarpment grassland and

sub-escarpment savanna bioregions dominated by moist grasslands and *Acacia* species.

The majority of communities in Alfred Nzo District Municipality are predominantly rural with the dominant land use practise being rearing of livestock and dryland crop production. The residents raise goats together with other livestock species such as cattle, sheep, chickens and pigs [10]. The arable lands are typically consolidated rain fed farming areas. With high levels of poverty, low levels of economic activity and the poor quality of land allocated to households in Alfred Nzo District Municipality, non-farm activities are potentially an important source of livelihood for the residents. Local people rely primarily on river and rainwater, while fuelwood and paraffin constitute the primary energy sources [12]. Major crops cultivated in the study area include maize (*Zea mays* L.), potatoes (*Solanum tuberosum* L.), cabbage (*Brassica oleracea* L.), spinach (*Spinacia oleracea* L.), beetroot (*Beta vulgaris* L.) and carrots (*Daucus carota* L.). The majority of the inhabitants (at least 87%) in the study sites are traditional isiXhosa speaking people who are highly

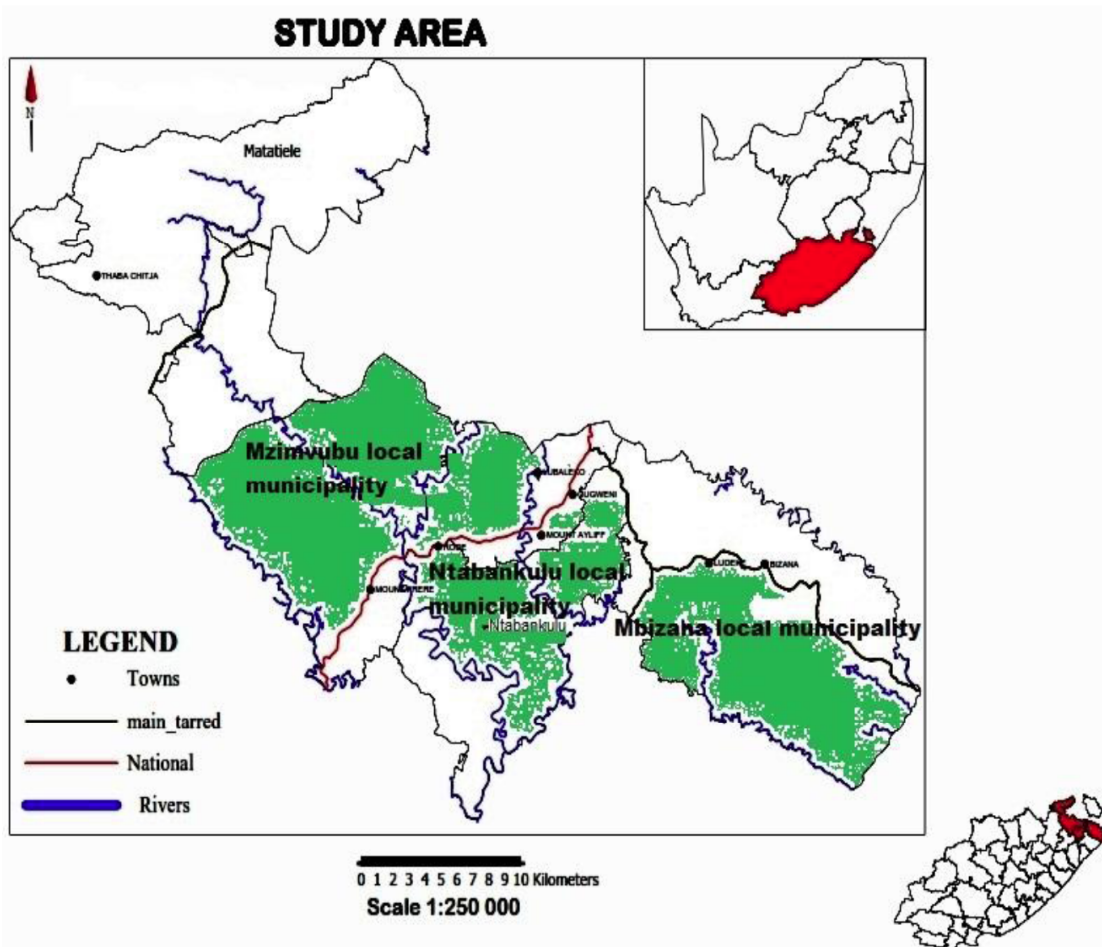


Figure 1: Map of South Africa showing the geographical position of the study areas in Alfred Nzo District Municipality.

dependent on natural resources for their livelihood needs [8,9].

Data Collection

The study was conducted between April 2017 and May 2018 documenting medicinal uses of plant species in the study area via interviews with 124 participants. Two data collection techniques, namely, snowball or chain-referral-sampling [13,14] and participatory rural appraisal (PRA) [15,16] techniques were used. Snowball sampling or chain-referral-sampling of a study sample begins with a convenience sample of initial subject, and this initial subject serve as "seeds," through which wave 1 subject is recruited; wave 1 subject in turn recruit wave 2 subjects; and the sample consequently expands wave by wave like a snowball growing in size as it rolls down a hill [13,14]. Etikan *et al.* [14] argued that snowball sampling generates biased samples because respondents who have great number of social connections are able to provide investigators with a higher proportion of other respondents who have characteristics similar to that of initial respondents. Fundamental to PRA is the use of hands-on methods, such as participatory mapping and diagramming resources flows, which are thought to overcome communication barriers that may exist between outside researchers and community members [16]. Similarly, Cornwall and Pratt [17] described PRA as a family of approaches and methods to enable rural people to share, enhance and analyze their knowledge of life and conditions, to plan and to act. Structured and semi-structured interviews were carried out in isiXhosa, a language spoken by all participants. In order to ensure that participant's right to voluntarily decide to participate in this research on medicinal plants. All participants were encouraged to sign a consent form, after the researcher or research assistants had fully explained the nature of research work and acknowledged indigenous prior rights of the participants. The researchers also agreed to a working relationship with the community, including willingness to comply with indigenous or local and cultural governance systems, customs, laws and protocols as stipulated by the International Society of Ethnobiology (www.ethnobiology.net). The medicinal plants were initially identified by participants using their vernacular names, Xhosa names. The voucher specimens of medicinal plant species with fruits, leaves, pods, flowers were collected and processed using standard taxonomic procedures [18,19] and incorporated into the Giffen Herbarium, University of Fort Hare as reference material.

Data Analysis

The collected data were carefully reviewed and assessed for accuracy, credibility, validation and reliability by the researcher prior to the analyses. The data were then analysed based on the information received from the local respondents using descriptive statistics such as frequencies, Microsoft Excel and Statistical Package for the Social Sciences (SPSS). We determined the Relative Frequency of Citation (RFC) of reported plant species using the following formula:

$$RFC = FC/N; (0 < RFC < 1)$$

This index shows the local importance of each species and is given by the frequency of citation (FC), that is the number of informants mentioning the use of species divided by the total number of informants participating in the study [20,21].

RESULTS

Demographic and Socio-Economic Characteristics of the Participants

A total of 124 participants selected via snowball technique from different local communities in Alfred Nzo District Municipality took part in this study. Table 1 provides demographic and socio-economic characteristics of the participants who provided information on herbal medicines in Alfred Nzo District Municipality. The majority of the participants (57.3%) were males while 42.7% were females (Table 1). Close to three quarters of the participants (70.2%) were between 26 years to 65 years, while 12.9% and 16.9% were below 26 years and above 66 years of age, respectively (Table 1). About a quarter of the participants (25.0%) were illiterate, while 18.6% of the participants were educated up to primary level, 37.2% of the sample were educated up to secondary level and 19.4% of the sample had attained tertiary education (Table 1). The majority of families (87.1% of households) comprised between four and more than ten household members (Table 1). More than half of the sample (50.8% of the participants) were married, 25.8% were single, 13.7% and 9.7% were widowed and divorced, respectively (Table 1). The majority of the participants (30.6% and 21.8%) were employed by government departments and private sector, respectively, while 20.2% had retired, 15.3% self-employed and 12.1% were unemployed (Table 1). About a third of the participants (29.8%) earned less than R2000.00 per month while about a quarter of the participants (21.8%) earned more than R10001.00 (Table 1).

Table 1: Demographic and Socio-Economic Characteristics of the Participants who Provided Information on Medicinal Plants in Alfred Nzo District Municipality, N = 124

Characteristics	No. of informants	Percentage (%)
Gender		
Males	71	57.3
Females	53	42.7
Age		
15-25 years	16	12.9
26-35 years	24	19.4
36-45 years	25	20.2
46-55 years	20	16.1
56-65 years	18	14.5
66 > years	21	16.9
Education		
No education	31	25.0
Primary	23	18.6
Secondary	46	37.2
Tertiary	24	19.4
Household size		
1-3 members	16	12.9
4-6 members	34	27.4
7-9 members	45	36.3
>10 members	29	23.4
Marital status		
Single	32	25.8
Married	63	50.8
Divorced	12	9.7
Widowed	17	13.7
Occupation		
Employed by government	38	30.6
Employed by private sector	27	21.8
Self-employed	19	15.3
Unemployed	15	12.1
Retired	25	20.2
Income per month		
<R2000*	37	29.8
R2001 - 4000	13	10.5
R4001 - 6000	11	8.9
R6001 - 8000	12	9.7
R8001 - 10000	20	16.1
> R10001	27	21.8
Not disclosed	4	3.2

*14.00 South Africa Rand (R) = 1.00 US\$.

Table 2: List of Medicinal Plants Used in Alfred Nzo District Municipality. Species Marked with an Asterisk (*) are Exotic to South Africa

Scientific and family names	Local name	Habit	Part s used	Species uses	RFC
* <i>Datura stramonium</i> L., Solanaceae	Ijoyi and umhlabavuthwa	Shrub	Leaves and roots	Decoction taken orally as aphrodisiac, against asthma, respiratory difficulties, tonsils, bronchitis, sore throat, pain and gout, and applied topically against rheumatism, boils, wounds and toothache	0.94
<i>Agapanthus africanus</i> (L.) Hoffmanns, Agapanthaceae	Isicakathi	Herb	Leaves and roots	Infusion taken orally against headache and to induced labour	0.85
<i>Leonotis leonurus</i> (L.) R. Br., Lamiaceae	Imficamficane	Shrub	Leaves and roots	Decoction taken orally against coughs, asthma, headache, common colds and tapeworms, and applied topically against snake bites	0.75
<i>Dicerthamnus rhinocerotis</i> (L.f.) Koekemoer, Asteraceae	Umlingatho	Shrub	Leaves and roots	Decoction taken orally to improve appetite, and against ulcers, dyspepsia and stomach cancer	0.69
<i>Hypoxis hemerocallidea</i> Fisch., C.A. Mey & Avé-Lall, Hypoxidaceae	Inkomfe	Herb	Corms, leaves and roots	Decoction taken orally against urinary tract infections, rheumatoid arthritis, tuberculosis, cancer, testicular tumours, depression and anxiety	0.67
<i>Bulbine latifolia</i> (L.f.) Spreng., Asphodelaceae	Incelwani, Ibhucu	Herb	Leaf sap and roots	Decoction taken orally against diarrhoea, dysentery, vomiting and diabetes, and applied topically against wound, burns, eczema, rashes and rheumatism	0.64
<i>Centella asiatica</i> (L.) Urb., Apiaceae	Udingu	Herb	Leaves and roots	Decoction taken orally against influenza, common colds, blood purification, diarrhoea, dysentery and enhance memory, and also applied topically against wounds	0.58
<i>Elephantorrhiza elephantina</i> (Burch.) Skeels, Fabaceae	Intolwane	Shrub	Leaves and roots	Decoction taken orally against diarrhoea, dysentery, syphilis, bleeding and heart ailments, and ointment used for sun burn	0.56
<i>Clivia miniata</i> (Lindl.) Regel var. <i>miniata</i> , Amaryllidaceae	Umayime	Herb	Leaves and rhizomes	Decoction taken orally against fever, pain, parturition and assist in child birth, and applied topically against snake bite	0.52
<i>Bulbine frutescens</i> (L.) Willd., Asphodelaceae	Ibhucu	Herb	Leaves and roots	Decoction applied topically on wounds, burns, rashes, itches, ringworms, cracked lips and herpes	0.51
<i>Helichrysum odoratissimum</i> (L) Sweet, Asteraceae	Impepho and isiquhumiso	Herb	Leaves and stems	Decoction taken orally against fever, colds, coughs, headache, febrile convulsions, insanity and pain, and applied topically for muscle cramps and wounds	0.49
<i>Zantedeschia aethiopica</i> (L.) Spreng., Araceae	Inyiba	Herb	Leaves and stems	Decoction applied topically on wounds, sores, boils, rheumatism, and taken orally against gout, heart burn and sore throat	0.49
<i>Dicoma capensis</i> Less, Asteraceae	Ucelezi and umuna	Herb	Leaves and roots	Decoction taken orally against fever, influenza, high blood pressure, stomach problems and diarrhoea	0.47
* <i>Solanum nigrum</i> L., Solanaceae	Umsobo	Herb	Leaves and stems	Decoction taken orally as appetite stimulant, against fever, asthma, ulcers, pain, tuberculosis, dysentery and stomach complaints, and also topically against skin disorders	0.43
<i>Aloe ferox</i> Mill., Asphodelaceae	Ikhala and Umlhlab	Shrub	Leaves and leaf sap	Decoction taken orally as laxative, against arthritis and hypertension; and topically for skin problems, wounds and conjunctivitis.	0.40
<i>Rumex lanceolatus</i> Thunb., Polygonaceae	Idololenkonyane and Inkonyane	Herb	Leaves and stems	Decoction taken orally against tapeworms, round worms, tumours, and internal bleeding	0.40
<i>Aloiampelos ciliaris</i> (Haw.) Klopper & Gideon F. Sm. var <i>ciliaris</i> , Asphodelaceae	Isihlungu	Herb	Leaves	Decoction taken orally against constipation and ulcers and topically against skin disorders	0.39
<i>Alepidea amatymbica</i> Ackl. & Zeyh., Apiaceae	Iqwili	Herb	Leaves, rhizomes and roots	Infusion taken orally against colds, coughs, rheumatism and applied topically on wounds	0.37

(Table 2). Continued.

Scientific and family names	Local name	Habit	Part s used	Species uses	RFC
* <i>Psidium guajava</i> L., Myrtaceae	Gwava	Tree	Fruits and leaves	Decoction taken orally against fever, coughs, ulcers, boils, wounds, malaria, diarrhoea and diabetes	0.36
* <i>Aloe vera</i> (L.) Burm f., Asphodelaceae	Intlaba	Herb	Leaves, leaf sap and stems	Decoction taken orally against constipation and ulcers, and topically against skin disorders.	0.31
* <i>Prunus persica</i> (L.) Batsch, Rosaceae	Ipesika	Tree	Leaves and stems	Decoction taken orally against cough, whooping cough, asthma, and applied topically on sores and wounds	0.31
<i>Typha capensis</i> (Rohrb.) N.E.Br., Typhaceae	Ingcongolo	Herb	Leaves and roots	Infusion taken orally for fertility in women, expansion of uterine during birth, improve blood circulation, diarrhoea and dysentery	0.30
* <i>Cannabis sativa</i> L., Cannabaceae	Somntsangu	Shrub	Leaves and twigs	Smoked as a cigarette for cough, colds, fever, headache and enhance memory	0.28
* <i>Foeniculum vulgare</i> Mill., Apiaceae	Imboziso	Herb	Leaves	Decoction taken orally for stimulating appetite	0.27
* <i>Catharanthus roseus</i> (L.) G. Don, Apocynaceae	Isihlungu	Shrub	Leaves and roots	Infusion taken orally against cancer and diabetes and applied topically against rheumatism	0.26
<i>Aloe greatheadii</i> Schönland var. <i>davyana</i> . (Schönland) Glen & D.S. Hardy, Asphodelaceae	Inkala	Herb	Leaves and leaf sap	Decoction taken orally against cancer or applied apically against wounds, sores, various skin ailments such as eczema, skin irritation and bruises	0.25
<i>Conyza scabrida</i> DC., Asteraceae	Isavu	Shrub	Leaves and twigs	Decoction taken orally against stomach aches, chest, heart problems, inflammation, coughs, colds, flu, fever and diabetes, and applied topically against rheumatism	0.24
<i>Lippia javanica</i> (Burm. f.) Spreng., Verbenaceae	inzinziniba	Shrub	Leaves and stems	Decoction taken orally against bronchial problems, coughs, fever, malaria and lung problems	0.23
<i>Artemisia afra</i> Jacq. ex. Willd., Asteraceae	Umhlonwane	Shrub	Leaves and stems	Decoction taken orally against fever, cough, respiratory problems, flu and stomach complications	0.22
* <i>Caesalpinia decapetala</i> (Roth) Alson, Fabaceae	Bobo	Shrub	Fruits and stems	Decoction taken orally against dysentery, malaria and pain.	0.20
<i>Tecoma capensis</i> (Thunb.) Lindl., Bignoniaceae	Umsilingi	Shrub	Leaves and stems	Decoction taken orally against bronchitis, stomach pains, diarrhoea and dysentery	0.19
<i>Helichrysum pedunculatum</i> Hilliard & B.L. Burt, Asteraceae	Impepho	Herb	Leaves and stems	Infusion taken orally against fever, respiratory problems and lung problems	0.15
* <i>Malva parviflora</i> L. var. <i>parviflora</i> , Malvaceae	Ujongelana	Herb	Leaves and roots	Decoction taken orally against coughs and ulcers, and applied topically on sores and wounds	0.14
<i>Agaricus subrufescens</i> Peck, Agaricaceae	Ikhowa	Fungus	Fruiting bodies	Infusion taken orally against ovarian cancer tumour	0.13
<i>Mentha longifolia</i> (L.) L., Lamiaceae	Inxina	Herb	Leaves and stems	Infusion taken orally against respiratory problems, cough, colds, stomach complications, asthma, indigestion, menstrual pains and swollen glands, and applied topically on wounds	0.12

Diversity of Medicinal Plants

This study recorded 34 plant and one mushroom species used traditionally to manage human diseases in Alfred Nzo District Municipality (Table 2). Of these, 25 species are indigenous to South Africa (71.4%), while 10 species are exotic (28.6%), either naturalized as weeds or cultivated in home gardens. The exotic

species to South Africa included *Aloe vera* (L.) Burm. f., *Caesalpinia decapetala* (Roth) Alson, *Cannabis sativa* L., *Catharanthus roseus* (L.) G. Don, *Datura stramonium* L., *Foeniculum vulgare* Mill., *Malva parviflora* L. var. *parviflora*, *Psidium guajava* L. and *Solanum nigrum* L. These medicinal plants were distributed among 20 families and the majority of medicinal plants (60.0%) were used in Alfred Nzo

District Municipality (Table 3). Plant families with the highest number of medicinal plants in Alfred Nzo District Municipality were from six families: Asphodelaceae and Asteraceae (six species each), followed by Apiaceae (three species), Fabaceae, Lamiaceae and Solanaceae (two species each) (Table 3). Herbs (57.1%) and shrubs (34.3%) were the primary sources of herbal medicines in Alfred Nzo District Municipality (Figure 2A). The mushroom and plant parts used for herbal preparations were fruits, fruiting bodies, leaves, roots, stems, twigs and whole plant (Table 2). The leaves were the most frequently used (88.6%), followed by stems (34.3%), roots (22.9%), fruits (5.7%), fruiting bodies, twigs and whole plant (2.9% each) (Figure 2B).

Table 3: Families with the Largest Number of Medicinal Plant Species in Alfred Nzo District Municipality

Family	Number of species	Percentage
Asteraceae	6	17.1
Asphodelaceae	6	17.1
Apiaceae	3	8.6
Fabaceae	2	5.7
Lamiaceae	2	5.7
Solanaceae	2	5.7

Popular medicinal plant with RFC values exceeding 0.50 included (in descending order of RFC values): *Bulbine frutescens* (L.) Willd., *Clivia miniata* (Lindl.) Regel var. *miniata*, *Elephantorrhiza elephantina* (Burch.) Skeels, *Centella asiatica* (L.) Urb., *Hypoxis hemerocallidea* Fisch., C.A. Mey & Avé-Lall,

Dicrothamnus rhinocerotis (L.f.) Koekemoer, *Leonotis leonurus* (L.) R. Br., *Agapanthus africanus* (L.) Hoffmanns and *Datura stramonium* L. (Table 2). The medicinal applications of mushroom and plant species were classified into the following 13 medical categories following the Economic Botany Data Collection Standard [22] with some changes proposed by Macía *et al.* [23] and Gruca *et al.* [24]: blood and cardiovascular system, digestive system, fever and malaria, general ailments, infections and infestations, mental disorders, muscular-skeletal system disorders, pain, sores and wounds, pregnancy, birth and puerperium disorders, reproductive system and sexual health, respiratory system and urinary system (Table 2). The major diseases treated by the documented plant species included the following (in descending order of importance): respiratory system (22 citations), pain, sores and wounds (21 citations), infections and infestations (15 citations), digestive system (14 citations), blood and cardiovascular system (12 citations), fever and malaria (12 citations), general ailments (6 citations), reproductive system and sexual health (6 citations) and mental disorders (5 citations) (Figure 3).

DISCUSSION

Demographic and Socio-Economic Characteristics of the Participants

The average annual household income within the sampled community population was low as well as literacy levels with 43.6% either illiterate or educated up to primary level (Table 1) and this is probably due to limited education facilities within the study area. The current study showed that the majority of households

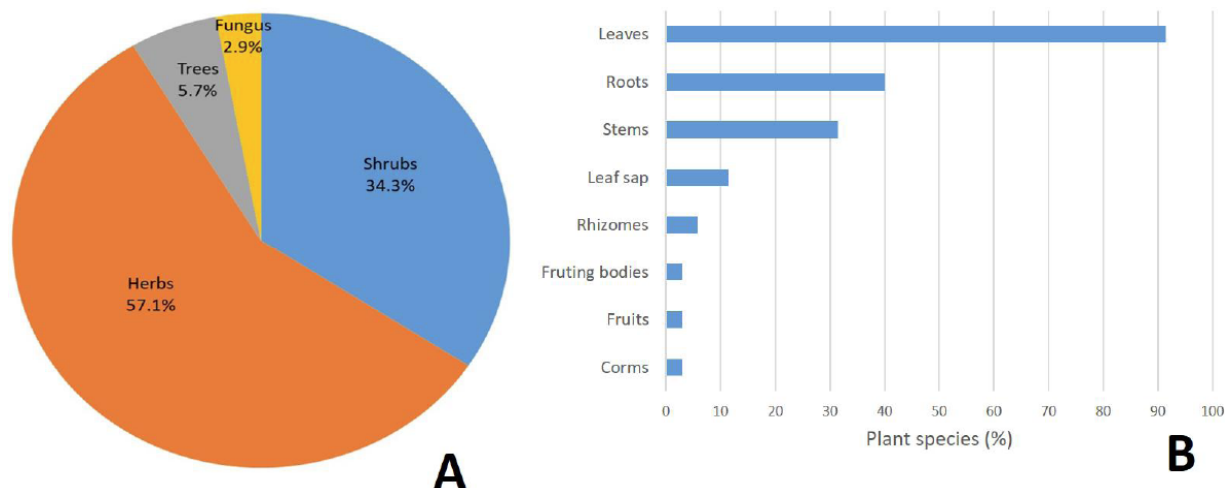


Figure 2: Characteristics of the plants and mushroom used as herbal medicines in Alfred Nzo District Municipality. (A) Growth form habit represented in pie diagram and (B) Fungus and plant parts used represented in bar chart.

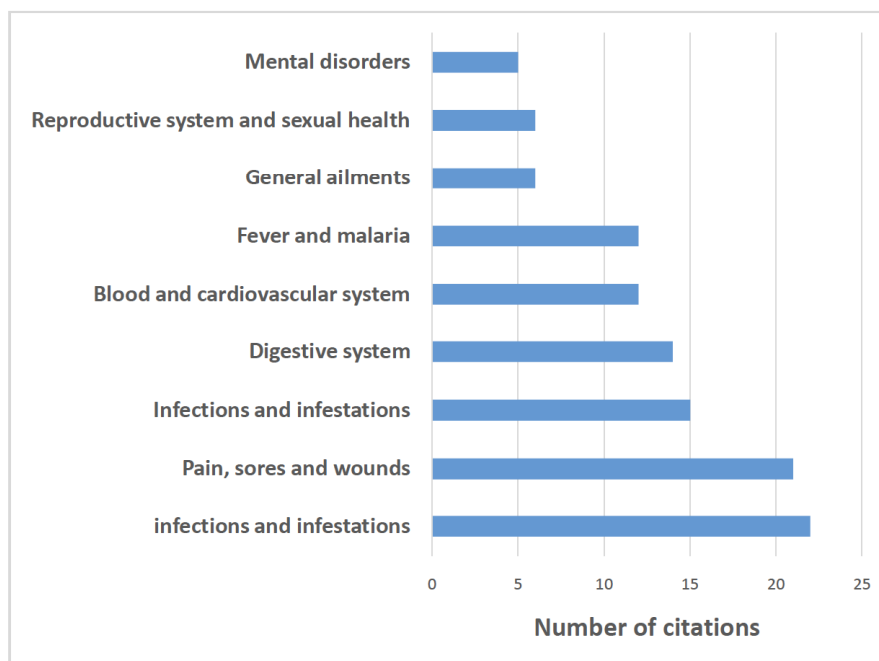


Figure 3: Major ailments and disease categories and number of plant species cited per category. Most species were reported in more than one ailment category.

are of low socio-economic standing, and therefore, these households use herbal medicines to fulfil their primary healthcare needs. Results of the current study correlate with research findings obtained by Paumgarten *et al.* [25] who revealed that the majority of the areas in the former homelands such as Ciskei and Transkei in the Eastern Cape Province are characterized by a strong reliance on migrant remittances and state pensions, low economic activity, low levels of education and poor skills base. Previous researchers, for example Dold and Cocks [7] and Maroyi [8,9] argued that since most areas in the Eastern Cape are predominantly rural, the large population in the province uses traditional methods of healthcare. Research by Maroyi [8] conducted in Ntabelanga dam catchment area, Eastern Cape province showed that out of 95 useful plant species, 46 species were used as herbal medicines. In another study conducted in six villages in the Eastern Cape province, Maroyi [9] found that the majority of the species (62.4%) were used as herbal medicines while 18.4% were used as ethnoveterinary medicines. With a medical doctor to total population ratio in South Africa of 1:17 400 reported by Pretorius *et al.* [26] there is no doubt that traditional medicines play an important role in the nation's healthcare system. Campbell-Hall *et al.* [27] argued that traditional practitioners provide culturally appropriate care which is linked to indigenous explanatory models of illness held by many South Africans and such explanatory models of illness are understood to refer to how a person interprets their

illness in relation to causation, precipitating events and initial symptoms, expected course of the illness as well as treatment options.

Diversity of Medicinal Plants

A significant number of medicinal plants (28.6%) documented in Alfred Nzo District Municipality are exotic to South Africa and some of these including *Caesalpinia decapetala*, *Catharanthus roseus*, *Datura stramonium* and *Psidium guajava* pose an immediate and significant threat by virtue of their aggressive qualities and having the capacity to invade natural habitats and overwhelm some of the indigenous species [28-32]. Previous studies showed that invasive plants may also have positive economical, social and ecological significance and these need to be taken into account when assessing the costs resulting from invasions [33-41]. There is now a large body of evidence supporting human dependency on invasive alien plant species as herbal medicines [33-41]. The results of this study, therefore, calls for a review of the socio-economic benefits of exotic plants to local communities in South Africa before blindly advocating for their eradication. In addition, the extensive use of exotic plants is seen as imperative for their ultimate control and should ultimately form part of their management strategy [38].

Exotic plant species are now recognized as an important component of indigenous pharmacopoeia in

several countries [42-46]. Alencar *et al.* [44] argued that any indigenous medical system is not a static social institution that is not evolving, as there is evidence of insertions and deletions of plants that compose it, with the addition of exotic plants as herbal medicines. In an earlier study, Alencar *et al.* [43] found that exotic plants are included in traditional pharmacopoeias to fill therapeutic vacancies that native plants cannot satisfy. While Palmer [47] argued that the medicinal plant collection of a community is the product of experimentations conducted throughout the history of a community and represents an adaptation of this culture over time. Bennett and Prance [42] argued that exotic plants that are used by a cultural group as food source or ornamental, may eventually be introduced into their traditional pharmacopoeias mainly because of the use-versatility of such species. Similarly, Alencar *et al.* [43] found exotic plants in Brazil to have more uses than native plants and the documented uses included applications as herbal medicines in addition to general uses as food plants or ornamentals.

AUTHORS' CONTRIBUTIONS

We declare that this work was done by the authors named in this article.

CONFLICT OF INTEREST

No conflict of interest is associated with this work.

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