Journal of Medicinal Plants Research Vol. 6(18), pp. 3415-3424, 16 May, 2012
Available online at http://www.academicjournals.org/JMPR
DOI: 10.5897/JMPR11.1707
ISSN 1996-0875 ©2012 Academic Journals

Full Length Research Paper

Ethnobotanical survey of medicinal plants used in the treatment of gastrointestinal disorders in the Eastern Cape Province, South Africa

O. O. Olajuyigbe and A. J. Afolayan*

Phytomedicine Research Centre, Department of Botany, University of Fort Hare, Alice, 5700, South Africa.

Accepted 11 April, 2012

An ethnobotanical survey of plants used for the treatment of gastrointestinal disorders was carried out in the Eastern Cape Province, South Africa. Information on the names of plants, used parts and methods of preparation was obtained from traditional medical practitioners, herbalist, hawkers in traditional medicines and rural dwellers, using semi-structured questionnaire. 36 plant species representing 24 families were found to be commonly used in the treatment of a variety of gastrointestinal disorders in this study. The family Fabaceae had the highest number of species being used for treating gastrointestinal disorders. 47.06% of the plants used in treating dysentery and other gastrointestinal disorders were used in the treatment of dysentery alone while 46.15% of the plants used to treat diarrhoea and other gastrointestinal disorders, were used in the treatment of diarrhoea alone. 30.3% of the different plants were implicated in the treatment of various stomach problems. Rationales for the choice of these plants were also identified. The leaves were the most commonly used parts, followed by roots and bark while decoctions and infusions are the most frequent methods of preparation. The traditional healers in this Province possess rich ethno-pharmacological knowledge and depend largely on naturally growing plant species. The documented medicinal plants can serve as a basis for further and future phytochemical and pharmacological studies.

Key words: Medicinal plants, gastrointestinal disorders, dysentery, indigenous knowledge, over-exploitation.

INTRODUCTION

Traditionally, plants are reliable sources for the treatment of diseases in different parts of the world (Eisenberg et al., 1993; Cowan, 1999; Hostettmann et al., 2000). Their use contributes significantly to primary health care delivery (Holetz et al., 2002) as they are regarded as invaluable sources of pharmaceutical products (Olalde, 2005). Globally, medicinal plants have been unique sources of medicines and constituted the most common human use of biodiversity (Hamilton, 2004; Hiremath and Taranath, 2010). In African societies, the tradition of collecting, processing and applying plants and plant-based medications have been handed down from generation to generation. Traditional medicine, with medicinal plants as their most important component, are sold in market places or prescribed by traditional healers in their homes (Von Maydell, 1996). As a result of this strong dependence on plants as medicines, many ethnopharmacological studies have been conducted to determine their safety, efficiency and discovery of new active principles from them.

Ethnopharmacology, the science of application of indigenous or local medicinal remedies, including plants for treatment of diseases (Gurib-Fakim, 2006; Pande et al., 2008), is the investigation of biologically active agents traditionally used by humans (Bruhn and Holmested, 1981). These active agents included plant mixtures, whole plants and a portion of a plant as well as special preparations from plant materials. Being a multidisciplinary science, successful research in ethno-pharmacology requires the interaction of ethnobotanists, natural products chemists, pharmacologists, taxonomists, traditional healers and/or user communities. According to Vanden Berghe et al. (1986), Rojas et al. (1992) and Silva et al. (1996), the goal of ethnobotany or

*Corresponding author. E-mail: Aafolayan@ufh.ac.za.

ethnopharmacology, therefore, is to utilize the impressive array of knowledge assembled by indigenous peoples about the plant and animal products they have used to maintain health.

Although the use of medicinal plants for subsistence, home remedies, trade and alleviating human suffering (Kunwar et al., 2006) plays important roles in the lives of rural people (Ahmad, 2003), the non-sustainable collection methods have caused threat from harvesting and many valuable medicinal herbs are becoming rare due to their continuous utilization (Swe and Win, 2005) and over-exploitation for commercial purposes (Tabuti et al., 2003; Kamatenesi-Mugisha and Oryem-Origa, 2005). In addition to these endangering effects of human-plant relationships, traditional folk knowledge and folklore information from many different cultures, which are the sum of attitudes, opinions, beliefs and customs handed down from generation to generation in a given society, (Anonymous, 1993) which are important tools in revealing plants with useful medicinal properties (Balandrin et al., 1993), are neither often found in written form, nor organized and structured in ways accessible to science. As a result, this knowledge changes because of indigenous creativity, innovativeness and contact with other knowledge systems. Along with the traditional lifestyles, traditional usage and folk knowledge of plants are disappearing due to copying of westernized lifestyles and economic systems.

Considering a sharp decrease in the biological species all across the globe and the increasing economic values placed on medicinal plants, documentation on ethno-botanical knowledge is a way to understand the use of different plant species to cure various ailments and means to conserve these natural resources. Globally, there is currently a renaissance of ethnobotanical surveys of medicinal plants and the need to screen specific parts of the plants (Paterson and Anderson, 2005; Igoli et al., 2005; Li and Vederas, 2009). Regardless of many ethnobotanical studies on medicinal plant resources in South Africa (Cunningham, 1988; Hutchings, 1989; Hutchings et al., 1996; Mander, 1998; Van Wyk et al., 1997; Van Wyk and Gericke, 2000; Appidi et al., 2008, Olorunnisola et al., 2011) and the world over, a large number of medicinal plants and associated indigenous uses still wait proper documentation (Tabuti et al., 2003). Although Appidi et al. (2008) had earlier reported some plants used in the treatment of diarrhoea, there is a lack of information on plants used in the treatment of gastrointestinal disorder such as dysentery while many plants relevant in treating diarrhoea and other gastrointestinal disorders are inexhaustible. This may be due to the thin line of distinction differentiating these infections especially diarrhea and dysentery. Hence, previous attentions may have been directed towards plants used in treating diarrhea while possibly and unknowingly addressing dysentery simultaneously. This ethnobotanical survey is, however, aimed at identifying plants and part(s) that are used in the treatment of some gastrointestinal disorders as well as indicating their methods of preparation and rationale for their trado-therapeutic effects in the Eastern Cape Province, South Africa.

MATERIALS AND METHODS

The study area falls within the latitude 30°00' to 34°15'S and longitudes 22°45' to 30°15'E. It is bounded by the sea on the East and the drier Karroo (Semi-desert vegetation) in the West. The elevation ranges from sea-level to approximately 2200 m in the North and the vegetation is veld type, known as the Eastern Cape thorn veld (Acocks, 1975; Masika and Afolayan, 2003). This area consists of many villages which are generally classified as rural and poor with difficulty in distinguishing between gastrointestinal disorders such as diarrhoea and dysentery infections.

Field visits for this study were carried out in May and July, 2011. Information was obtained from rural dwellers, traditional healers, hawkers of medicinal plant preparations and herbalists with the help of a semi-structured questionnaire and the guided field-walk method as described by Martin (1995) and Maundu (1995). The questionnaire was used to interview these individuals while the guided field-walk involved contacting and interviewing individuals recommended by other community members for their knowledge. The information collected included local names, the parts of the plant used and methods of preparation. The information was further validated by common response. The information from at least three or more respondents was considered as common response. Proper scientific identification of the plants and their uses in these communities were reaffirmed from the literature sources containing medicinal plants used in South Africa (Roberts, 1990; Hutchings et al., 1996; Van Wyk et al., 1997; Mander, 1998; Van Wyk and Gericke, 2000).

Intellectual property agreement statement

Prior to the interviews, the informants were duly informed about the objectives of the research. With verbal agreement that this research shall not be used for commercial purposes but to enlighten and document medicinal plants used for the treatment of gastrointestinal disorder, the interview was granted.

RESULTS

A total of 36 plant species distributed in 24 families were found to be used locally for treating various gastrointestinal disorders including diarrhoea, dysentery, abdominal cramps, gut disturbances, stomach disorders, upset and aches. The families are arranged in alphabetical order. Family names are followed by vernacular names or local names and plant part(s) used and their methods of preparations. The results are summarized in Table 1. The Fabaceae was represented by five plants, followed by Apiaceae, Asphodelaceae, Lamiaceae and Solanaceae (3 species each), Hyacinthaceae (2 species each) while other families (1 species each) were found to be used medicinally by the local communities. Of these plants, 19 (52.78%) different plants were indicated to be used for treating dysentery

Table 1. Ethnomedicinal plants used in Eastern Cape, South Africa, for the treatment of gastrointestinal disorders.

Plant	Family	Local name	Used part	Uses	Preparation
Acacia mearnsii	Fabaceae	Idywabasi	Bark and leaves	Dysentery	Infusions and concoctions of the bark; decoction of the bark
Acacia karroo Hayne	Fabaceae	Umngampunzi, intlaka, umnga	Leaves, bark and gum	Dysentery, diarrhoea and haemorrhage	Infusions and concoctions of the leaves, bark and gum
Alepidea amatymbica Eckl. and Zeyh.	Apiaceae	Iqwili	Root/rhizome	Abdominal cramps	Decoction of the roots
Bulbine abyssinica A.Rich., B.	Asphodelaceae	Iyeza lipulayiti, utswelana, Uyakayakana	Leaves and roots	Dysentery	Decoctions of the leaves and roots
Brachylaena ilicifolia (Lam.) E. Phillips and Scheweick.,	Asteraceae	Umgqeba	Leaves	Diarrhoea	Infusion and decoction of the leaves
Bulbine latifolia (L.f.) Roem. et Schult.	Asphodelaceae	Ibhucu, ingcelwane	Root	Diarrhoea	Decoctions of the root
Bulbine asphodeloides Roem. et Schult.	Asphodelaceae	Umthi kanoyayi, Uyakayakane	Tuber	Diarrhea, dysentery	Decoctions of the root/tuber
Cussonia spicata Thunb.,	Araliaceae	intsenge, umgezisa, umsenge,	Leaves	Stomach complaints	Infusion
Curtisia dentata (Burm.f.) C.A.Sm., Olea	Cornaceae	umLahleni, umGxina, Uzintlwa,	Bark	Stomach ailments	Decoctions of the bark
Centella asiatica (Linn.)	Apiaceae	Inyongwane, iphuzi	Roots and leaves	Stomach disorders, dysentery and diarrhoea	Infusion, decoction and concoction of the leaves and roots
Clausena anisata (Willd.) Hook.f. ex Benth.	Rutaceae	Iperepes	Root, bark, the fresh leaves	Stomach complaints	A decoction of the aromatic leaves or roots
Cissampelos capensis L.f.,	Menispermaceae	Umayisake	Roots, leaves	Stomach upset and diarrhoea	Infusion

Table 1. Contd

Eucomis autumnalis (Mill.)	Hyacinthaceae	Isithithibala Esimathunzi,	Bulbs	Stomach ache and colic	Decoctions of the bulb
Ekebergia capensis Sparrm.	Meliaceae	uManaye, umGwenya-wezinja	Bark	Dysentery	A decoction of the back
Foeniculum vulgare Mill.,	Apiaceae	Imbambosi	Leaves and stem	Stomach cramps	Infusion
Hydnora Africana (Thunb.)	Hydronaceae	Umavumbuka	Whole plant	Diarrhoea, dysentery	Infusions and decoctions
Ipomoea crassipes Hook.,	Convolvulaceae	Ubhoqo	Whole plant	Dysentery	Infusions and decoctions
Iconotis leonurus (L.) R. Br.	Lamiaceae	Imvovo	Whole plant	Dysentery	Infusion, decoction, rectum application
Mentha aquatica L., *Mentha longifolia* (L). L.	Lamiaceae	Inxina,	Leaves	Stomach aches	Infusion
Olea europaea L. subsp. africana (Mill.) P. S. Green	Oleaceae	Umnquma	Bark, leaves and roots	Diarrhoea	Infusions and decoctions of dried leaves, bark and roots.
Pelargonium reniforme Curtis	Geraniaceae	Umkumiso,	Root	Dysentery	Decoction
Persicaria lapathifolia (L.) Gray	Polygonaceae	Idolo lenkonyana	Roots and leaves or whole plant	Stomach complaints and diarrhoea	Infusion
Plantago lanceolata (L.)	Plantaginaceae	Ubendlela	Leaves	Diarrhoea, dysentery	Infusion
Rubia petiolaris DC.	Achanthaceae	Impendulo	Roots, leaves	Stomach problems, haemorrhagic diarrhoea and amoebic dysentery	Infusion, decoction and concoction
Sarcophyte sanguinea Sparrm.,	Balanophoraceae	umavumbuka	Whole plant	Diarrhea, dysentery	Infusion, Decoction
Schotia afra (L.) Thunb.	Fabaceae	Umgxam,	Bark and root,	Diarrheoa	Decoction
Schotia latifolia Jacq.	Fabaceae	Umgxam	Bark and root	Diarrheoa	Decoction
Schotia brachypetala Sond.	Fabaceae	Ishimnumyane,	Bark and roots	Dysentery, diarrhoea	Decoction
Strychnos henningsii Gilg,	Loganiaceae	umnonono, umnono,	Stem Bark	Stomach aches	Decoctions of the bark and infusions of the leaves

Table 1. Contd.

Syzygium cordatum Hochst.	Myrtaceae	Umsu	Bark, leaves and roots	Stomach complaints, diarrhoea	Decoction and concoction
Schizocarphus nervosus (Burch.) Van der Merwe	Hyacinthaceae	umagaqana, inkwitelu	Roots or rhizomes	Dysentery	Decoction of the roots
Solanum aculeastrum Dun., *Solanum tomentosum* L.	Solanaceae	Umthuma	Root, bark and berries	Dysentery	Infusion, decoction and concussion
Typha capensis (Rohrb.) N.E.Br.,	Typhaceae	inqoboka, ingcongolo	Rhizomes	Diarrhoea, dysentery	Decoction of the rhizomes
Ziziphus mucronata Willd. subsp. *mucronata* Willd	Rhamnaceae	Umphafa	Bark, leaves and roots	Diarrhoea, Dysentery	Decoction of the roots; concoction of bark and leaves

and other gastrointestinal disorders. Of these 19 plants used to treat dysentery and other gastrointestinal disorders, 8 (42.11%) plants were implicated in the treatment of dysentery alone. These plants include *Acacia mearnsii, Bulbine abyssinica, Ekebergia capensis*, *Ipomoea crassipes*, *Iconotis leonurus, Pelargonium reniforme, Schizocarphus nervosus* and *Solanum aculeastrum*. In addition, 14 (38.89%) plants were used to treat diarrhoea along with other gastrointestinal disorders. While six (42.86%) of these plants: *Brachylaena ilicifolia, Bulbine latifolia*, *Cissampelos capensis*, *Olea europaea*, *Persicaria lapathifolia* and *Schotia afra*, were implicated in the treatment of diarrhoea alone; eight plants (22.22%): *Acacia karroo*, *Hydnora Africana, Plantago lanceolata, Rubia petiolaris, Sarcophyte sanguine, Schotia brachypetala, Typha capensis* and *Ziziphus mucronata*, were implicated in treating dysentery and diarrhoea as shown in Figure 1. Though *Curtissia dentata* alone was mentioned as being used in the treatment of diarrhoea and stomach complaints, ten (27.78%) different plants were implicated in the treatment of various stomach problems. These plants include *Alepidea amatymbica, Cussonia spicata, Centella asiatica, Clausena anisata*, *C. capensis*, *Eucomis autumnalis, P. lapathifolia*, *R. petiolaris, Syzygium cordatum* and *Strychnos henningsii.*

In different communities, many plants are given different names. Many of these plants, eventually, have more than one local name. These plants are prepared and mostly administered orally in different ways, except *Iconotis leonurus* having rectum application in addition to its oral administration, in different ways to treat gastrointestinal and its associated disorders. In their preparations for therapeutic purposes, whole plants as well as various parts of each plant species were either used singly or in combined forms. Parts used also depend on the plant under consideration and severity of ailments. Leaves constituted the majority of uses (30.77%), followed by roots (25%) and bark (21.15%), whole plant (9.62%), rhizomes (5.77%), fruits (3.85%) as well as bulb and tuber (1.92%). The results are shown in Figure 2. Decoctions and infusions are the most frequently used methods of preparation as shown in Figure 3.

DISCUSSION

Over the last century, ethnobotany has evolved into a specific discipline that looks at the people–plant relationship in a multidisciplinary manner such as ecology, economic botany, pharmacology and public health (Balick, 1996). With extensive uses of medicinal plants, numerous drugs have been introduced into the international markets as a result of exploring ethnopharmacology and traditional medicines (Bussmann, 2002) which have expressed different pharmacological actions (Gregory, 2004). Hence, the traditional use of low profile and less known medicinal plants should

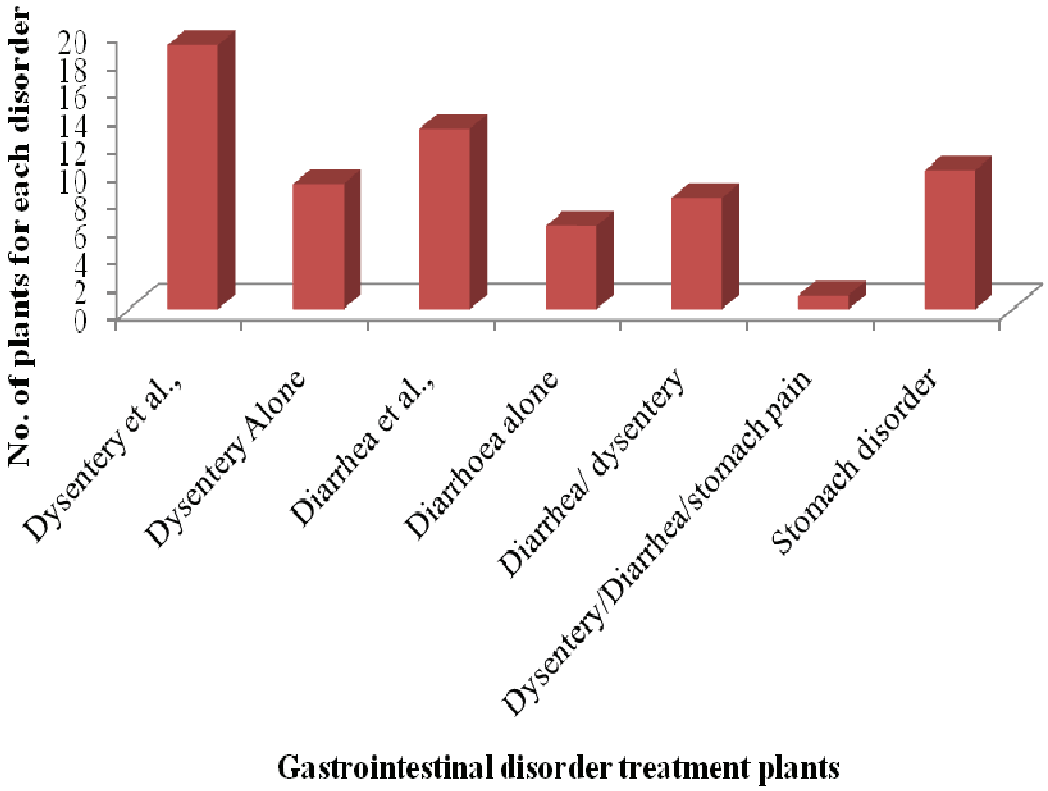

Figure 1. Number of plants relevant in treating each gastrointestinal disorder.

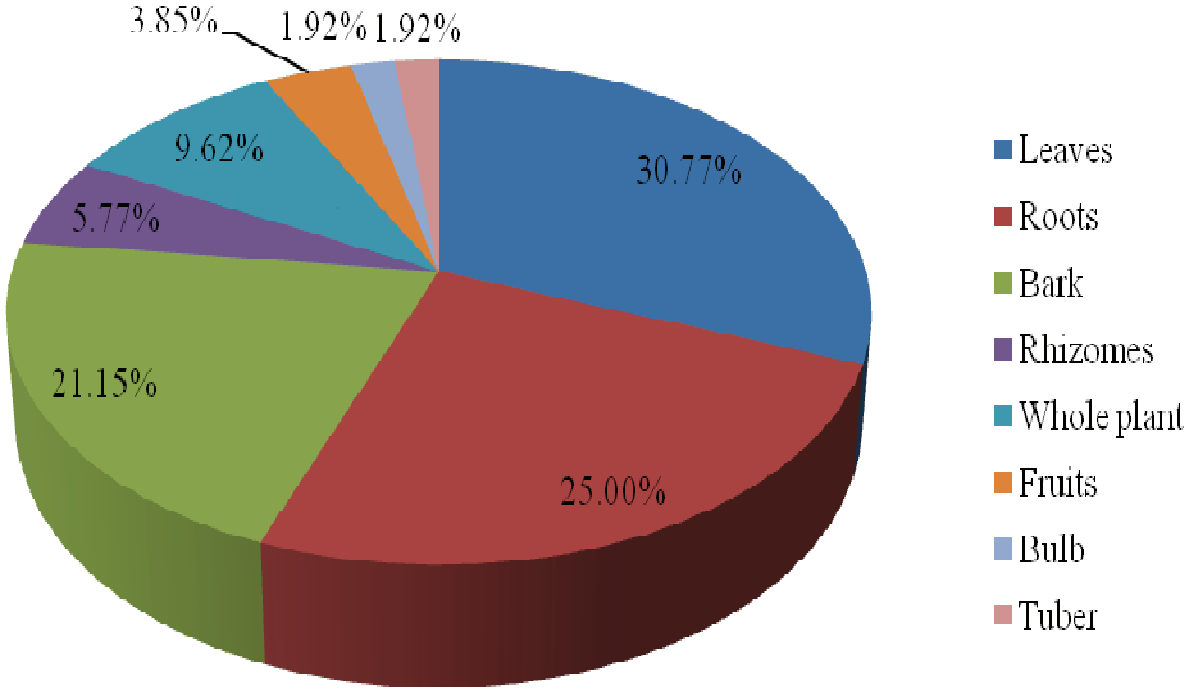

Figure 2. Frequency of plant parts used for treating gastrointestinal disorders.

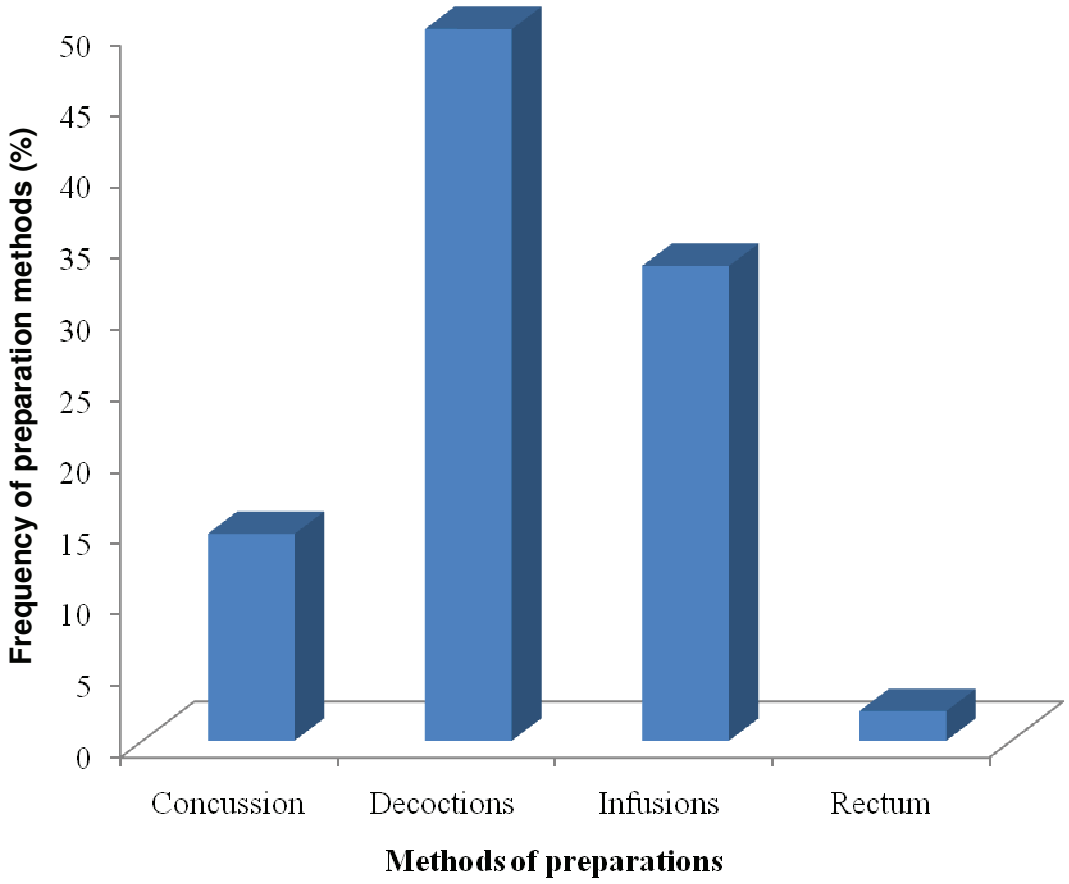

Figure 3. Frequency of different preparation methods for treating gastrointestinal disorders.

be documented to disseminate their therapeutic efficacy to pave the way for preparation of acceptable medicine and to reduce the pressure on overexploited species (Kala et al., 2006).

In South Africa, up to 60% of the population consults traditional healers (van Wyk et al., 1997), especially in rural areas where traditional healers are more numerous and accessible than Western health-care providers. The traditional healer are found within a short distance and are familiar with the patient's culture while the environment and the costs associated with treatments are negligible (Rinne, 2001). While the loss of valuable medicinal plants due to population pressure, agricultural expansion and deforestation have been widely reported (Abebe, 2001; Berhan and Dessie, 2002), documenting indigenous knowledge becomes essential to preserve the traditional knowledge and valuable information passed verbally from generation to generation and can be lost whenever a traditional medical practitioner passes without conveying his knowledge about traditional medicinal plants.

In this study, the number of indicated medicinal plants and their potential applications in the treatment of gastrointestinal disorders reflect the rich ethnomedicinal knowledge in the Eastern Cape. Here, traditional medicine remains the main resource of phytotherapy for a large majority of the people. The wide spread use of the various plants could be attributed to cultural acceptability, efficacy, physical accessibility and economic affordability as well as playing a major role in the treatment of gastrointestinal disorders in comparison to modern medicine. Based on the difficulty in distinguishing between diarrhoea and dysentery by the local people, many of the plants have been used in treating either of these infections unknowingly, thereby, indirectly showing their multipurpose efficacies. For instance, 38.89% of the plants mentioned are used for diarrhoea and other gastrointestinal disorders while 52.78% were indicated as being used against dysentery and other gastrointestinal disorders. While 22.22% of these plants are used in treating dysentery and diarrhoea, 27.78% are used in the treatment of various stomach problems. There are overlaps in plants used in treating both infections. Plants used in treating different stomach problems are not an exemption. In addition to earlier report of Appidi et al. (2008), *B. ilicifolia, C. capensis*, *P. lapathifolia* and *S. afra* have been used in the treatment of diarrhoea locally. The prevalence of the use of leaves for the preparation of

traditional herbal remedies as shown in this study corresponds with earlier reports in other studies (Brinkhaus et al., 2000; Yineger and Yewhalaw, 2007; Pradhan and Badola, 2008; Zainol et al., 2008). While the use of more than one plant or plants' parts in herbal preparations could be attributed to the additive or synergistic effect that extracts from the different plants are thought to have during treatment (Bussman and Sharon, 2006), Gessler et al. (1994) indicated that the use of concoctions suggests that the traditional medicines may only be active in combination due to the synergistic effects of several compounds that are acting singly. On the contrary, the use of bark, roots or uprooting the whole plant of a given species could be destructive means of obtaining the herbal remedies. These unfavorable extraction methods will eventually contribute to the loss of the forest trees.

Though the methods of preparing these medicinal plants vary, decoction and infusion methods are highly reputed and valued by traditional healers in Southern African native population for its curative and palliative effects in the treatments of diseases generally (Watt and Breyer-Brandwyk, 1962; Hutchings, 1996) while active compounds in preparations taken anally are more effectively re-absorbed by the mucus membranes of the rectum (Van Wyk and Wink, 2004). Decoction of a part or combination of different parts could be more effective as more active phytochemicals are likely to be extracted by boiling. In agreement with Nanyingi et al. (2008) and Bekalo et al. (2009), there is a lack of standardization and quality control in orally administered traditional medicine. Against these parameters, oral dosages are estimated using lids, spoons, cups, pinches and handfuls while most preparations are often prescribed through estimation in term of a full, half or one-fourth of a cup, depending on the age, physical condition of the patient being treated, severity and type of infection.

In addition, without scientific proofs from the traditional healers and local people, the rationales for the choice of some of these plants have been attributed to include some inherent properties of these plants. These attributes included being purgative, anti-dysenteric, anodyne, anti-inflammatory, carminative, demulcent, diaphoretic, emollient, styptic or astringent, refrigerant, stomachic, tonic and vasodilator. Usher (1984) and Koide et al. (1998) reported that the folk use of *A. mearnsii* (Fabaceae), *Mentha aquatic* (Lamiaceae), *P. lanceolata* (Plantaginaceae), *P. lapathifolia* (Polygonaceae), *R. petiolaris* (Achanthaceae), *S. sanguine* (Balanophoraceae), *S. afra* (Fabaceae) and *S. latifolia* (Fabaceae) as anti-dysenterics was due to their tannin content imparting astringent activity which helps to recuperate from diarrhoea and dysentery. Plants containing tannins are astringent, able to draw together or constrict body tissues and are effective in stopping the flow of blood or other secretions. Tannins strengthen veins by repairing the connective tissues surrounding veins and decrease capillary fragility. They are also known as antimicrobial (Cowan, 1999) and triterpenoids are beneficial for inflammation (Cipak et al., 2006). The anti-inflammatory activities may be due to the presence of alkaloids, flavonoids and saponins present in these plants like every other plants (Wong et al., 1992; Ono, 1994; Kerber, 1999; Fernanda et al., 2002; Fawole et al., 2009). The refrigerant, purgative and vasodilatory activities of these plants substantiate their ability to cause the blood to stop flowing and clog the arteries and veins as well as removing enough "heat" from the system (Littlewood, 1988; Lans, 2006).

Conclusion

Traditional knowledge of medicinal plants and their uses by indigenous cultures are not only useful for conservation of cultural traditions and biodiversity but also for community healthcare and drug development in the present and future. In this study, 36 plant species consisting of 24 families were used as ethnomedicines for gastrointestinal disorders in the Eastern Cape, South Africa. These plants treated diarrhoea, dysentery and various stomach problems. Reasons for the choice of these plants, plants' parts used and methods of preparations were indicated. Since traditional healers harvest roots and barks of some of these medicinal plants, there is need to educate them about the looming danger of wiping out some of the plant species if over-exploited. Further investigation of ethnopharmacology is worthwhile to affirm their antimicrobial activities against bacteria in diarrhoea and dysentery, isolate the plants' active chemical compounds, and decipher their modes of action.

ACKNOWLEDGEMENT

The authors are grateful to the National Research Foundation (NRF) of South Africa for supporting this research.

REFERENCES

Abebe D (2001). Biodiversity conservation of medicinal plants: Problem and prospects. In *Conservation and sustainable use of medicinal plants in Ethiopia Proceeding of The National Workshop on Biodiversity Conservation and Sustainable Use of Medicinal Plants in Ethiopia* Edited by: Zewdu M, Demissie A. Addis Ababa: IBCR, 198-203.

Acocks JPH (1975). *Veld Types of South Africa*, Memoirs of Botanical Survey of South Africa Bot. Res. Inst., Dep. Agric. Water Suppl., Pretoria, p. 57.

Ahmad M (2003). Ethnobotanical and taxonomic studies of economically important plants of Tehsil Attock. M. Phil. Thesis, Quaid-e-Azam Univ., Islamabad Pak., pp. 205-207.

Anonymous (1993). Guidelines for the Conservation of Medicinal Plants. IUCN. WHO & WWF, Gland, Switzerland.

Appidi JR, Greirson DS, Afolayan AJ (2008). Ethnobotanical study of plants used for the treatment of diarrhoea in the Eastern Cape, South Africa. Pak. J. Biol. Sci., 11(15): 1961-1963.

Balandrin MF, Kinghorn AD, Farnsworth NR (1993). Plant-Derived Natural Products in Drug Discovery and Development. In: Kinghorn, A.D., Balandrin, M.F. (Eds.), Human Medicinal Agents from Plants, ACS Symposium series 534. Am. Chem. Soc. D.C., pp. 2–12.
Balick MJ (1996). *Annals of the Missouri botanical garden*. Missouri Bot. Garden, 4: 57-65.
Bekalo TH, Woodmatas SD, Woldemariam ZA (2009). An ethnobotanical study of medicinal plants used by local people in the lowlands of Konta Special Woreda, southern nations, nationalities and peoples regional state, Ethiopia. J. Ethnobiol. Ethnomed., 5: 26.
Berhan G, Dessie S (2002). Medicinal Plants in Bonga Forest and Their Uses. In *Biodiversity Newsletter I* Addis Ababa, IBCR, 9-10.
Brinkhaus B, Lindner M, Schuppan D, Hahn EG (2000). Chemical, pharmacological and clinical profile of the East Asian medical plant *Centella asiatica*. Phytomedicine, 7: 427-428.
Bruhn JG, Holmestedt B (1981) Ethnopharmacology, objectives, principles and perspectives. In: Beal JL, Reihnard E (eds). Nat. Prod. Med. Agents, Verlag, Stuttgart, pp. 405-430.
Bussman RW, Sharon D (2006). Traditional medicinal plant use in Northern Peru: tracking two thousand years of healing culture. J. Ethnobiol. Ethnomed., 2: 47.
Bussmann RW (2002). Ethnobotany and biodiversity conservation. in *Modern Trends in Applied TerrestrialEcology*, pp. 345-362
Cipak L, Grausova L, Miadokova E, Novotny L, Rauko P (2006). Dual activity of triterpenoids. Arch. Toxicol., 80: 429-435.
Cowan MM (1999). Plant products as antimicrobial agents. Clin. Microbiol. Rev., 12: 564-582.
Cunningham AB (1988). An Investigation of the Herbal Medicine Trade in Natal/KwaZulu. Investigational Report No. 29. Institute of Natural Resources, Scottsville, South Africa.
Eisenberg DM, Kessler RC, Foster C, Norlock FE, Calkins DR, Delbanco TL (1993). Unconventional medicine in the United States: Prevalence, costs and patterns of use. The New Engl. J. Med. (NEJM), 328: 246-252.
Fawole OA, Ndhlala AR, Amoo SO, Finnie JF, van Staden J (2009). Anti-inflammatory and phytochemical properties of twelve medicinal plants used for treating gastro-intestinal ailments in South Africa. J. Ethnopharmacol., 123(2): 237-243.
Fernanda LB, Victor AK, Amelia TH, Elisabetsky E (2002). Analgesic properties of Umbellatine from*Psychotria umbellata*. Pharm. Biol., 44: 54-56.
Gessler MC, Nkunya MHH, Mwasumbi LB, Heinrich M, Tanner M (1994). Screening Tanzanian medicinal plants for antimalarial activity. Acta Trop., 56: 65–77.
Gregory J (2004). Herbal medicine, Modern Pharmacology with clinical applications. 6th Edn., Lippincott Williams and Wilkins, Philadelphia, pp. 785-796.
Gurib-Fakim A (2006). Medicinal plants: Traditions of yesterday and drugs of tomorrow. Mol. Aspects Med., 27: 1-93.
Hamilton AC (2004). Medicinal plants, conservation and livelihoods. Biodiver. Conserv., 13: 1477-1517.
Hiremath VT, Taranath TC (2010). Traditional phytotherapy for snake bites by tribes of Chitradurga District, Karnataka, India. Ethnobot. Leafl., 14: 120-25.
Holetz FB, Pessini GL, Sanches NR, Cortez DAG, Nakamura CV, Dias FBP (2002). Screening of some plants used in the Brazilian folk medicine for the treatment of infectious diseases. Mem. Inst. Oswaldo Cruz, 97: 1027-1031.
Hostettmann K, Marston A, Ndojoko K, Wolfender J (2000). The potential of Africa Plants as a source of drug. Curr. Org. Chem., 4: 973-1010.
Hutchings A, Scott AH, Lewis G, Cunningham A (1996). Zulu Medicinal Plants: An Inventory. Univ. Natal Press, Pietermaritzburg.
Hutchings A (1996). Zulu Medicinal Plants, Natal University Press, Pietermaritzburg. ISBN-0-86980-893-1.
Hutchings A (1989). A survey and analysis of traditional medicinal plants as used by the Zulu, Xhosa and Sotho. Bothalia, 19: 111–123.
Igoli JO, Ogaji OG, Igoli NP, Tor-Anyiin TA (2005). Traditional medicinal practices among the Igede people of Nigeria (part II). Afr. J. Trad. Compl. Alt. Med., 2: 134–152.
Kala CP, Dhyani PP, Sajwan BS (2006). Developing the medicinal plants sector in Northern India: challenges and opportunities. J. Ethnobiol. Ethnomed., 2: 32.
Kamatenesi-Mugisha M, Oryem-Origa H (2005). Traditional herbal remedies used in the management of sexual impotence and erectile dysfunction in western Uganda. Afr. Health Sci., 5(1): 40–49.
Kerber VA (1999). Analysis of alkaloids in Psychotria brachiceras Mull. Arg. And Psychotria umbellate Vell., And the establishment and characterization of the cellule culture of P. umbellata Vell. Ph.D. Thesis, Course of Post - Graduate em Pharmaceutical Sciences. Federal University of Rio Grande do Sul.
Koide T, Nose M, Inoue M, Ogihara Y, Yabu Y, Ohta N (1998). Trypanocidal effects of gallic acid and related compounds. Planta Med., 64(1): 27-30.
Kunwar RM, Nepal BK, Kshhetri HB, Rai SK, Bussmann RW (2006). Ethnomedicine in Himalaya: a case study from Dolpa, Humla, Jumla and Mustang districts of Nepal. J. Ethnobiol. Ethnomed., 2: 27.
Lans C (2006). Creole remedies of Trinidad and Tobago book self-published on Lulu.com
Li JWH, Vederas JC (2009). Drug discovery and natural products: end of an era or an endless frontier? Science, 325: 161–165.
Littlewood R (1988). From vice to madness: the semantics of naturalistic and personalistic understandings in Trinidadian local medicine. Soc. Sci. Med., 27(2): 129-148.
Mander M (1998). Marketing of indigenous medicinal plants in South Africa. In: A Case Study in Kwa-Zulu Natal. Food and Agriculture Organization of the United Nations, Rome.
Martin GJ (1995). Ethnobotany: a 'People and Plants' Conservation Manual, Chapman and Hall, London, pp. 268.
Masika PJ, Afolayan AJ (2003). An ethnobotanical study of plants used for the treatment of livestock diseases in the Eastern Cape Province, South Africa. Pharm. Biol., 41: 16-21.
Maundu P (1995). Methodology for collecting and sharing indigenous knowledge: a case study. Indig. Knowl. Dev. Monitor., 3: 3-5.
Nanyingi MO, Mbaria JM, Lanyasunya AL, Wagate CG, Koros KB, Kaburia HF, Munenge RW, Ogara WO (2008). Ethnopharmacological survey of Samburu district, Kenya. J. Ethnobiol. Ethnomed., 4: 14.
Olalde RJA (2005). The systemic theory of living systems and relevance to CAM. Part I: The theory. Evid. Based Comp. Alt. Med., 2: 13–18.
Olorunnisola OS, Bradley G, Afolayan AJ (2011). Ethnobotanical information on plants used for the management of cardiovascular diseases in Nkonkobe Municipality, South Africa. J. Med. Plants Res., 5(17): 4256-4260.
Ono M (1994). Inflammation Inhibitors Containing Cepharanoline or Berbamine Patent-Japan Kokai Tokkyo Koho-06 211; 661.
Pradhan BK, Badola HK (2008). Ethnomedicinal plant use by Lepcha tribe of Dzongu valley, bordering Khangchendzonga Biosphere Reserve, in North Sikkim, India. J. Ethnobiol. Ethnomed., 4: 22.
Pande VV, Shastri KV, Khadse CD, Tedade AR, Tankar AN, Jain BB (2008). Assessment of indigenous knowledge of medicinal plants from Vidarbha region of Maharashtra. Int. J. Green Pharm., 2(2): 69-71.
Paterson I, Anderson EA (2005). The renaissance of natural products as drug candidates. Science, 310: 451–453.
Rinne E (2001). Water and Healing - Experiences from the Traditional Healers in Ile-Ife, Nigeria. Nordic J. Afr. Stud., 10: 41-65
Roberts M (1990). Indigenous Healing Herbs, Southern Book Publishers, South Africa, pp. 1–285.
Rojas A, Hernandez L, Rogeho PM, Mata R (1992). Screening for antimicrobial activity of crude drug extracts and pure natural products from Mexican medicinal plants. J. Ethnopharmacol., 35: 127-149.
Silva O, Duarte A, Cabrita J, Pimentel M, Diniz A, Gomes E (1996). Antimicrobial activity of Guinea-Bissau traditional remedies. J. Ethnopharmacol., 59: 55–59.
Swe T, Win S (2005). Herbal gardens and cultivation of medicinal plants in Myanmar regional consultation on development of traditional medicine in the South East Asia region, department of Traditional Medicine, Ministry of Health, Myanmar, Pyongyang, DPR Korea, 22-24 June 2005, World Health Organization (Regional office for South-East Asia).
Tabuti JRS, Dhillion SS, Lye KA (2003). Traditional medicine in Bulamogi county, Uganda: its practitioners, users and viability. J. Ethnopharmacol., 85: 119–129.
Usher G (1984). *Acacia catechu* Willd (Catechu, Dark catechu). A

dictionary of plants. Delhi: CBS publishers and distributors, India.
van Wyk BE, Gericke N (2000). People's Plants: A Guide to Useful Plants of Southern Africa. Briza Publications, Pretoria.
van Wyk BE, Wink M (2004). Medicinal Plants of the World. Briza, Pretoria, South Africa.
van Wyk BE, van Oudtshoorn B, Gercke N (1997). *Medicinal Plants of South Africa*, Briza, Pretoria, pp. 1–304.
Vanden BA, Vlietinck AJ, van Hoof L (1986). Plant products as potential antiviral agents. Bull. Pasteur Inst., 84: 101-147.
von Maydell HT (1996). Trees and Shrubs of the Sahel. Josef Margraf, Weikersheim, Germany., p. 562.
Watt C, Breyer-Brandwijk MG (1962). The medicinal and poisonous plants of southern and eastern Africa. Livingstone, Edinburgh, London, Great Britain, pp. 449-455.
Wong CW, Seow WK, Ocallaghan JW, Thong YH (1992). Comparative effects of tetrandrine and berbamine on subcutaneous air pouch inflammation induced by interleukin 1, tumour necrosis factor and platelet-activating factor. Agents Actions, 36: 112-118.
Yineger H, Yewhalaw D (2007). Traditional medicinal plant knowledge and use by local healers in Sekoru District, Jimma Zone, Southwestern Ethiopia. J. Ethnobiol. Ethnomed., 3: 24.
Zainol NA, Voo SC, Sarmidi MR, Aziz RA (2008). Profiling of *Centella asiatica* (L.) Urban extract. The Malaysian J. Anal. Sci., 12: 322-327.