

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/285905836>

Ethnomedicinal study of plants used to manage HIV/AIDS-related disease conditions in the Ohangwena region, Namibia

Article · January 2012

CITATIONS

23

READS

715

2 authors:



Marius Hedimbi

University of Namibia

72 PUBLICATIONS 489 CITATIONS

[SEE PROFILE](#)



Kazhila Croffat Chinsembu

University of Namibia

45 PUBLICATIONS 483 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



Survey on Host and Partner Perspectives on STEGH [View project](#)



Undergraduate thesis (University of Namibia) [View project](#)

Full Length Research

Ethnomedicinal study of plants used to manage HIV/AIDS-related disease conditions in the Ohangwena region, Namibia.

Marius Hedimbi* and Kazhila C. Chinsembu

University of Namibia, Faculty of Science, Department of Biological Sciences, Private Bag 13301, Windhoek, Namibia.

Received April 01, 2012; Accepted June 07, 2012

A survey of plants used to manage AIDS-related conditions can provide important leads and quicken the search for novel anti-HIV compounds. An ethnobotanical survey for plants used to treat disease conditions related to HIV/AIDS was conducted in several villages in Ohangwena region, northern Namibia. The study found a total of 34 plants belonging to 19 different families that were used to manage various opportunistic infections related to HIV/AIDS. Most of the plants were from the Fabaceae family (24%), followed by Combretaceae (9%), and Convolvulcaee, Molluginaceae, and Olacaceae with 6% each. A total of 19 opportunistic disease conditions were treated with the plants. Most of the plants were used to manage gonorrhoea (26%), coughing (24%), syphilis (18%), diarrhoea (9%), headache (9%), eczema (6%), and wounds (6%). The most used plant parts were leaves (47%), bark (26%), whole plant, root, and stems (21%), and fruits (4%). The study showed rich knowledge of medicinal plant use for AIDS-related conditions in the Ohangwena region, Namibia. Destructive harvesting of plants should be prevented.

Key words: HIV/AIDS opportunistic infections, medicinal plants, Namibia, indigenous knowledge holders.

Introduction

Namibia has one of the highest HIV prevalence rates in the world (GRN, 1999). The first four cases of HIV/AIDS were reported in 1986 (GRN, 2004). By 2001, it was estimated that there were about 230,000 adults and children living with HIV/AIDS (GRN, 2004). This was a staggering figure considering Namibia's small population of 2.1 million people. In 2008, the number of people living with HIV/AIDS was estimated at 204,000, with 14,000 new infections during that year alone, at a rate of 39 new infections per day (GRN, 2008). The national HIV prevalence increased from 17.8 to 18.8% between 2009 and 2010, having peaked at 22.0% in 2002 (GRN, 1999). Geographically, the prevalence of HIV/AIDS is higher in northern (> 25%) than southern (4%) Namibia. The HIV prevalence rates in the Ohangwena region ranges from

16-25% (GRN, 1999). In Namibia, HIV/AIDS accounts for almost half of all adult deaths, and life expectancy decreased from 62 years in 1996 to 44 years in 2006 (Family Health International, 2007).

At the end of August 2009, there were approximately 70,000 Namibians on antiretroviral treatment (ART) (Chinsembu, 2009), but this number is expected to increase to 122,300 by 2014 (GRN, 2009). During the 2008/09 financial year, the total cost of antiretroviral treatment (ART) was 148 million Namibian dollars (approximately US\$ 21 million); 68% of the cost was financed through donations by the Global Fund and the US Centers for Disease Control (GRN, 2009). The Namibian government subsidy was 23%, the Clinton Foundation paid for 8%, and Supply Chain Management Systems contributed the remaining 1% (GRN, 2009).

Although Namibia has made remarkable progress in the provision of ART to those in need, the country's antiretroviral programme is like a candle in the wind as it battles to glimmer against the inevitable possibility of

*Corresponding author's Email: mhedimbi@unam.na;
Tel: +264-61-2063425; Fax: +264-61-2064577;

dying from another form of AIDS- 'Acquired Immune Deficiency Syndrome (Chinsembu, 2009). There are genuine concerns that Namibia's free public sector ART programme is not sustainable due to its heavy reliance on donor funds. Besides funding, access to treatment in Namibia is challenged by insufficient levels of human and infrastructural resources needed to roll-out services to people living with HIV/AIDS, both within the Pre-ART and the ART clinics (GRN, 2009). Specifically, more trained professionals are needed, not only for pharmaceutical services but also for doctors, clinical officers, and nurses in hospitals, health centers, and clinics. Estimates suggest that the vacancy rates for public sector doctors, nurses and pharmacists are 40%, 25%, and 58%, respectively (USAID, 2002). Health facilities that provide ART services also need to be renovated in order for them to adequately accommodate clients.

Further, since Namibia is the second most sparsely populated country in the world, providing full ART services to the rural population requires a fully decentralized and community-based model with strong policies and leadership from the central government. However, insufficient numbers of skilled technical personnel and limited managerial capacity at all levels have impaired the challenges of decentralization, and access to services remains a Herculean obstacle for those living in sparsely populated areas (McCourt and Awases, 2007). As a country with one of the highest *Gini* coefficients and levels of income disparity in the world (UNDP, 2000), household poverty and nutrition also pose major questions to ART access, treatment adherence, and success.

Against this backdrop, the World Health Organization (WHO) recommended that traditional healers be included in national responses to HIV/AIDS (Homsy et al., 2004). As early as 1989, WHO had already voiced the need to evaluate ethnomedicines for the management of HIV/AIDS. In this context, there is need to evaluate those elements of traditional medicine, particularly medicinal plants and other natural products that might yield effective and affordable therapeutic agents. This will require a systematic approach", stated a memorandum of the WHO (WHO, 1989). Although there are a good number of reports on traditional uses of plants to treat various diseases, knowledge of herbal remedies used to manage HIV/AIDS are scanty, impressionistic and not well documented (Kayombo et al., 2007; Chinsembu and Mutirua, 2008).

Namibia has rich plant biodiversity and a long tradition of medicinal use of plants. This rich plant biodiversity provides an important resource that may contain novel anti-HIV compounds. Thus, it is important to search for novel antiretroviral agents that can be added to or replace the current arsenal of drugs against HIV (Klos et al., 2009). A survey of plants that treat HIV/AIDS-related conditions can provide important leads and quicken the

search for novel HIV/AIDS chemical compounds. Given this background, we report the use of plants used to manage conditions and opportunistic infections related to HIV/AIDS in Oshana region, northern Namibia.

MATERIALS AND METHODS

A snowball survey for plants used to treat opportunistic disease conditions related to HIV/AIDS was conducted in several villages in Oshana region (Figure 1), northern Namibia. Key gatekeepers were used to access respondent knowledge holders in various parts of the region. The knowledge holders in the communities were first asked for their permission before the interview was started. During semi-structured interviews, knowledge holders were asked which plants they use (local name), the disease condition treated with the plants, parts of the plants used, and the mode of application of the herbal medication to the patient. One of the researchers in the study is a native of that area and can speak the local language and therefore he acted as the translator and a guide during the study. A voucher specimen of each plant was prepared and identified.

A total of 28 knowledge holders in the communities, 10 were males and 18 females, were interviewed. Their ages ranged from 37-78 years with a median age of 57 years. The survey was conducted between March and June 2011. The sample of knowledge holders was limited because of inaccessibility of some areas due to severe flooding in the region. The frequency of plant use was calculated by dividing the number of knowledge holders who mentioned the use of a particular plant to treat a similar disease by the total number of respondents (28). A high frequency of use indicates a strong correlation between respondents on the use of a particular plant to treat a certain disease.

RESULTS

The study showed that a total of 34 plants belonging to 19 different families were used to manage HIV/AIDS-related opportunistic conditions (Table 1). Most of the plants were from the Fabaceae family (with 24% of all the plants used coming from this family), followed by Combretaceae with 9%, and Convolvulaceae, Molluginaceae, and Olacaceae with 6% each (Figure 2).

During the survey, a total 19 different HIV/AIDS-related disease conditions were found to be treated with herbal plants. Most of the plants were used to manage gonorrhoea (26%), coughing (24%), syphilis (18%), diarrhoea (9%), headache (9%), eczema (6%), and wounds (6%) (Figure 3). The most frequently used plant parts were leaves (47%), bark (26%), whole plant, root, and stems (21%), and fruits (4%) (Figure 4). Most

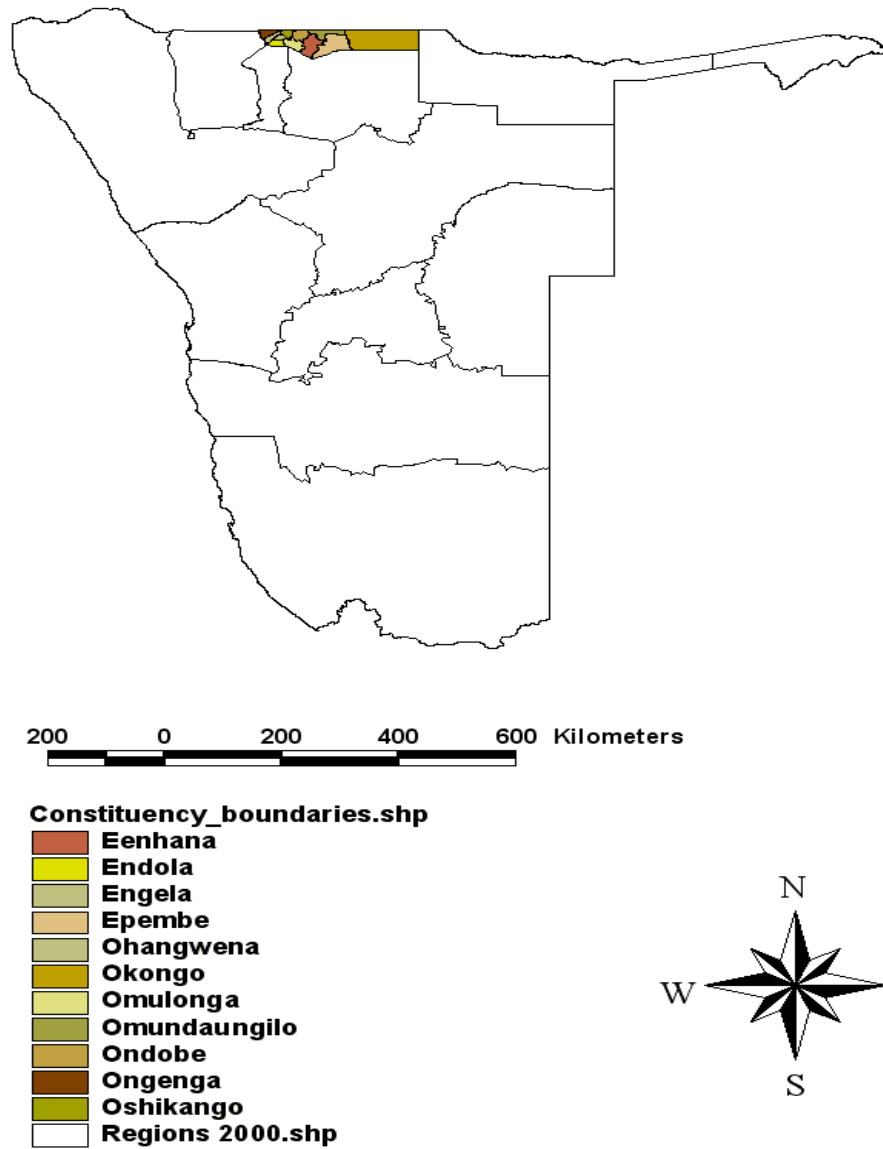


Figure 1: Map of Namibia showing the Ohangwena region and its constituencies.

disease conditions were remedied by a single plant part. However, 38% of diseases were treated by two or multiple plant parts from the same plant species. Whole plant use was also widely used, with 21% of diseases treated by this approach. The plants with high frequency of use were: *Corchorus tridens* (Okalyoipute = wound eater) which is used to treat genital ulcers (0.96) and *Heliotropium supinum* (Ohanauni = wound disperser)

which is used to treat wounds (0.96) (Table 1). *Epaltes elata* (Odivadiva = fast wound healer), used to treat syphilis wounds, had a frequency value of 0.93 while *Boscia albitrunca* (treats syphilis) and *Combretum imberbe* (gonorrhoea) has a frequency value of 0.89. *Solanum delagoense* (Onululu = bitter) is used to treat coughing (0.82), *Acanthoscyocis naudinianus* (gonorrhoea) and *Ziziphus mucronata* (treats gonorrhoea)

Table 1: Plants used to treat HIV/AIDS-related infections in Ohangwena region, Namibia.

Scientific name	Family	Oshiwambo name	Voucher no.	Symptom(s) treated	Frequency of plant use	Method of administration	Part used
<i>Acacia ataxacantha</i> DC	Fabaceae	Omukoro	HKM015	Pneumonia	0.07	Dissolve in boiling water and drink the filtrate	Bark
<i>Acanthosicyos naudinianus</i> (Sond.) Jeffrey	Cucurbitaceae	Katangakamufifi	HKM019	Gonorrhea	0.71	Mix with water and drink	Fruit
<i>Asparagus africanus</i> Lam.	Asparagaceae	Okawekamuthithi	HKM009	Eczema	0.04	Dissolve in water and apply filtrate on infected area	Whole plant
<i>Boscia albitrunca</i> Gilg & Benedict	Capparaceae	Omunghudi	HKM027	Syphilis	0.89	Rubbing on infected area, Dissolve in boiling water and drink the filtrate	Leaves and Bark
<i>Cassia occidentalis</i> L.	Fabaceae	Omutiweyoka	HKM004	Coughing	0.46	Chew and swallow the juice from leaves	Leaves
<i>Clerodendrum ternatum</i> Schinz	Lamiaceae	Oshanyu	HKM029	Eczema	0.04	Dissolve in water and apply filtrate on infected area	Leaves and Bark
<i>Combretum collinum</i> Fresen.	Combretaceae	Omukubu	HKM005	Coughing	0.14	Dissolve in boiling water and drink the filtrate	Leaves
<i>Combretum imberbe</i> Wawra	Combretaceae	Omukuku	HKM014	Gonorrhea	0.89	Dissolve in boiling water and drink the filtrate	Bark
<i>Combretum mechowianum</i> O. Hoffm.	Combretaceae	Omupupuaheke	HKM026	Coughs	0.32	Boil roots into tea and drink	Roots
<i>Corchorus tridens</i> L.	Tiliaceae	Okalyaoipute	HKM008	Genital ulcers caused by syphilis or chancroid	0.96	Crush in water, put on wounds	Stems and leaves
<i>Epaltes elata</i> (DC.) Steetz	Asteraceae	Odivadiva	HKM022	Syphilis wounds	0.93	Rubbing roasted leaves or powder into wounds	Leaves
<i>Erythrophleum africanum</i> (Welw. & Benth.) Harms	Fabaceae	Omupako	HKM028	Gonorrhea; headache	0.18 0.07	Boil into tea	leaves
<i>Gisekia pharnaceoides</i> L.	Aizoaceae	Omundjulu	HKM012	Antihelminth; Diarrhea	0.07 0.14	Drinking infusion	Whole plant
<i>Gomphocarpus tomentosus</i> Burch	Apocynaceae	Etamupyra	HKM030	Syphilis, Gonorrhea	0.14 0.18	Dried, roasted, powdered and applied on infected area	Stem, leaves
<i>Heliotropium supinum</i> L.	Boraginaceae	Ohanauni	HKM023	Tumors; Wounds	0.14 0.96	Grind into powder, mix with water, and apply to tumor or wound	Any plant part
<i>Jacquemontia tamnifolia</i> (L.) Griseb.	Convolvulaceae	Okatangaela	HKM003	Headache	0.04	Boil and inhale steam under cover of blanket	Whole plant
<i>Limeum fenestratum</i> (Fenzl) Heimerl	Molluginaceae	Oluide	HKM011	Coughing	0.11	Boil, drink as tea	Stem and Leaves
<i>Limeum viscosum</i> (J. Gay) Fenzl	Molluginaceae	Oluide	HKM031	Coughing	0.11	Boil, drink as tea	Leaves

Table 1: cont.

<i>Merremia tridentate</i> (L.) Hall	Convolvulaceae	Okashila konhoka	HKM020	Headache	0.29	Boil and inhale steam under cover of blanket	Whole plant
<i>Orthoptera burchellii</i> DC.	Fabaceae	Omalakaka	HKM006	Diarrhea	0.18	Boil, drink infusion as tea	leaves
<i>Ozoroa schinzii</i> (Engl.) R.A. Fernandes	Anacardiaceae	Oshifiku	HKM018	Diarrhea	0.39	Boiled in water and drunk	Stems, Fruits, Leaves
<i>Piliostigma thonningii</i> (Schum.) Milne-Redh.	Fabaceae	Omutuutuu	HKM024	Coughs	0.32	Boil and drink; chewing	Root; Bark
<i>Pterocarpus angolensis</i> DC.	Fabaceae	Uguva	HKM016	Coughing	0.07	Boil, Cool and drink	Bark
<i>Rhigozum brevispinosum</i> Kuntze	Bignoniaceae	Ngandu	HKM034	Syphilis	0.32	Rubbing on infected area, Dissolve in boiling water and drink the filtrate	All plant parts
<i>Securidaca longipedunculata</i> Fresen.	Polygalaceae	Omutiwongobe	HKM001	Gonorrhoea; Syphilis	0.32 0.18	Chewing; Infusion; Powder, mix with hot water	Roots, Bark
<i>Senna italic</i> Mill.	Fabaceae	Okatundangu	HKM033	Abscess	0.04	Topical	Whole plant
<i>Solanum delagoense</i> Dunal	Solanaceae	Onululu	HKM021	Coughing	0.82	Boil in water, drink	Roots, Leaves
<i>Swartzia madagascariensis</i> Desv.	Fabaceae	Omumonga	HKM007	Diarrhea	0.46	Boil, drink	Bark, Stems, Roots
<i>Vetiveria nigriflora</i> (Benth.) Stapf	Poaceae	Omanenge	HKM013	Gonorrhoea	0.04	Powder boiled in water and drunk	Roots
<i>Vigna dinteri</i> Harms	Fabaceae	Omuyimbo	HKM017	Herpes	0.07	Rubbing on infected area, Dissolve in boiling water and drink the filtrate	Roots
<i>Waltheria indica</i> L.	Sterculiaceae	Oshihakulamesho	HKM025	Syphilis	0.42	Sap is applied to wounds	Stem
<i>Ximenia americana</i> L.	Olacaceae	Oshimbyu	HKM010	Gonorrhoea	0.32	Dried and crushed powder boiled in water and drunk	Leaves, Stem
<i>Ximenia caffra</i> Sond.	Olacaceae	Ompeke	HKM032	Gonorrhoea	0.67	Dried and crushed powder boiled in water and drunk	Leaves, Stem
<i>Ziziphus mucronata</i> Willd.	Rhamnaceae	Omukekete	HKM002	Gonorrhoea	0.71	Dissolve in boiling water and drink the filtrate	Bark, Leaves

had a frequency value of 0.71, while *Ximenia caffra* (treats gonorrhoea) with a frequency value of 0.67 (Table 1).

Roots accounted for 15% of the total plant parts used as remedies in this study. The use of roots should perhaps be discouraged because uncontrolled digging of roots can lead to reduced

availability of water and nutrients to the plant and this could lead to death of the plant. Interestingly, we found low use of bark as source of traditional medicine. The low use of bark is significant from a conservation point of view since it is very destructive and the survival of the plant after harvesting the bark is not always certain. The use

of whole plant accounted for 15% of plant parts used and it is destructive since it entails the complete uprooting of the plant including the roots which reduces the possibility of plant regeneration. However, we note that whole plant usage involved mainly shrubs and creepers that usually take less time to grow and reproduce

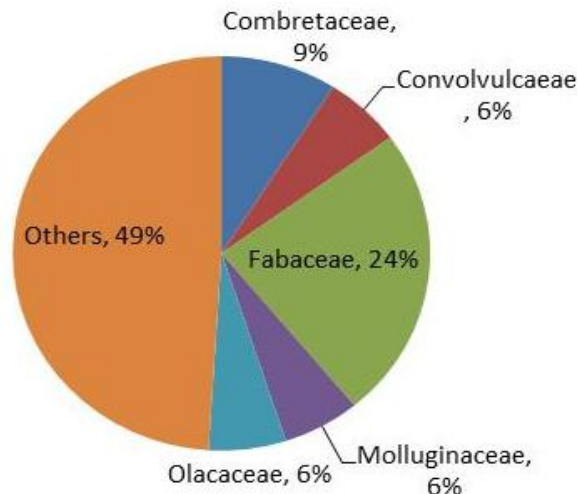


Figure 2: Percentage use of plants from different families.

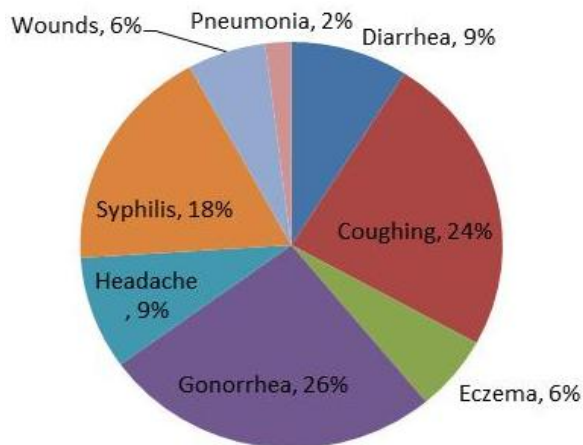


Figure 3: Percentages of plants used to treat diseases.

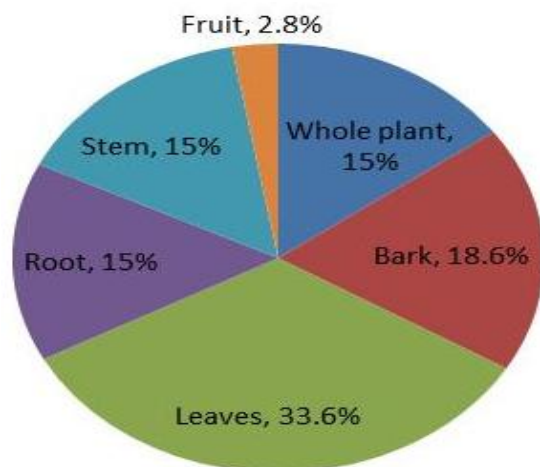


Figure 4: Percentages of different plant parts used as remedies.

compared to trees. Therefore, we view the use of whole shrubs and creepers for medicinal purposes to be less destructive than other methods such as roots and bark.

DISCUSSION

Several plants have indigenous names that speak to their specific ethnomedicinal properties and applications. For example, *Corchorus tridens*, used as herbal remedy for genital ulcerative disease, is locally known as *okalyaopute*, which literally means wound-eater. *Epaltes elata*, used in treatment for syphilitic wounds, is locally known as *odivadiva* (meaning fast wound healer), while *Heliotropium supinum*, another plant with wound-healing properties, is locally known as *ohanauni*, meaning wound disperser. Some local plant names are associated with the severity of the condition they treat. For instance, *Cassia occidentalis* is prepared into a medication for coughing, yet it is known as *omutiweyoka*, loosely translated as snakebite medicine or antidote for snakebites. The severity of coughing in HIV/AIDS patients might be equated to the danger posed by a snakebite thereby prompting the name 'snake antidote plant for *C. occidentalis*. *Merremia tridentate*, known as *okashila konhoka* (small black Mamba's tail) is used to treat chronic headache whose pain is figuratively comparable to a black Mamba snake bite. Still, *Rhigozum brevispinosum*, known as *ngadu* (meaning crocodile) is used to treat syphilis, a stigmatized sexually transmitted infection that is metaphorically likened to someone caught by a crocodile. This kind of symbolism is also present in the Caprivi region of Namibia where HIV/AIDS is termed *simbandembande*, the Lozi name for the fish eagle (Chinsembu et al., 2011). The Lozi people believe that AIDS quickly takes away peoples' lives, just as quickly as the eagle picks away fishes from the river. *Solanum delagoense*, known as *onululu* (meaning bitter), is used to treat coughing. The use of bitter herbal medicines is a popular means of managing coughing in Namibia and beyond. *Securidaca longipedunculata* which is known as *omutiwongobe* (meaning cattle medicine) is indicative of the possibility that this plant may contain ethno-veterinary properties. The nomenclature of plants based on their ethnomedicinal uses strongly indicates the long historical use of a particular plant to treat the various conditions, and the continued usage of such names to this day, might suggest that the plant actually has medicinal properties to treat that particular disease.

Although the inhabitants of Ohangwena region in northern Namibia use *Acacia ataxacantha* to manage pneumonia, the same plant is used as herbal remedy for dysentery in Nigeria (Olowokudeyo et al., 2008). This finding suggests that *A. ataxacantha* may have antibacterial properties. *Acanthosicyos naudinianus*, locally called the Gemsbok cucumber in Namibia, is a moisture-bearing wild plant and strong competitor of the

medicinal plant *Harpagophytum procumbens* (the Devil's Claw). Although the plant is used as food in Angola, Botswana, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe (Arnold et al., 1985), this is the first report, to our knowledge, of its use in treating gonorrhea. *A. naudinianus* contains cucurbitacin B which gives the fruits a bitter taste (Arnold et al., 1985).

In this study, leaves and bark of *Boscia albitrunca* (the Shepherd's tree) are reportedly used to treat syphilis. In Mozambique, the leaves of *B. albitrunca* are used to treat diarrhea and hemorrhoids (Ribeiro et al., 2010). In other parts of Southern Africa, *B. albitrunca* treats epilepsy (Van der Walt and Le Riche, 1999), and a cold fusion of the leaves heals inflamed eyes of cattle while an extract of the roots remedies hemorrhoids (Coates, 1983). We found that the bark and leaves of *Ximenia americana* are used to treat gonorrhea. However, the same plant is used to manage skin rashes (Kisangau et al., 2007); candidiasis (Runyoro et al., 2006; Chinsebu and Hedimbi, 2010) and throat infections, malaria and dysmenorrhea (Grønhaug et al., 2008). The widespread ethnomedicinal use of *X. americana* suggests that this plant may contain several active compounds which are responsible for its purported activities, and this may warrant further research on this plant.

Our finding that *Cassia occidentalis* is a cough remedy is similar to ethnomedicinal knowledge from Nigeria and Asia where *Cassia obtusifolia* is also used to treat coughs (Guo et al., 1998). In Mozambique, *Cassia abbreviata* alleviates eye infections, stomachache and diarrhea (Ribeiro et al., 2010). This evidence suggests that members of the genus *Cassia* may contain antibacterial properties. Yadav and co-workers (2010) reviewed the ethnobotany, phytochemical, and pharmacological profile of *C. occidentalis* and interestingly, the plant possesses a wide range of chemical compounds (including anthraquinones) that confer significant antibacterial, antifungal, laxative, analgesic, chloretic and diuretic properties. However, the efficacy of *C. occidentalis* varies according to geographical locations and seasons (Yadav et al., 2010).

In this study, *Clerodendrum ternatum* was used to treat eczema and a similar result was also found in another Namibian study by Cheikhyoussef and co-workers (2011). *Clerodendrum* is also reportedly used to manage sexually transmitted infections, gastrointestinal diseases, and pneumonia (Chinsebu et al., 2011). In India, China, Thailand, Korea, and Japan, *Clerodendrum* spp is used to treat several diseases such as syphilis, typhoid, cancer, jaundice and hypertension (Shrivastava and Patel, 2007). Various species in the genus *Clerodendrum* contain phenolics, steroids, di- and triterpenes, flavonoids, and volatile oils (Shrivastava and Patel, 2007).

Chinsebu and co-workers (2011) reported that *Combretum* spp was used as a herbal remedy for

diarrhea and tuberculosis in HIV/AIDS patients. This would suggest that plants in the Combretaceae family have antibacterial properties; hence their effect against coughing and gonorrhea. During our survey, *Epaltes elata* was reported as a treatment for syphilis. In Asia, *E. elata* is used in traditional Ayurvedic medicine to alleviate urethral discharges. It is also recommended as a diaphoretic, diuretic, and an expectorant herbal medication (Hewawasam et al., 2004). Whereas *Corchorus tridens* is reportedly used as a herbal medication for genital ulcer diseases in Ohangwena region, Namibia, the same plant species is gathered and eaten as a vegetable herb in Senegal (Gueye and Diof, 2007), but the authors mention no apparent medicinal uses in Senegal. *Erythropheum africanum*, used to treat gonorrhea and alleviate headache pain in Namibia, reportedly contains several classes of compounds such as coumarins, alkaloids and various chemicals such as tanins, saponins and flavonoids which may encourage defense against microbial fermentation (Kadja et al., 2011).

When our findings were compared to other literature, several plants had different ethnomedicinal purposes. For example, *Merremia tridentate*, a medication for headache in our study, had wound healing properties (Gupta and Jain, 2010), and also effectively suppressed inflammation produced by histamine, bradykinin, prostaglandins and serotonin (Arunachalam et al., 2011). We also found that *Piliostigma thonningii*, whose leaves are a remedy for coughing, was used in the management of diarrhea in the Plateu state, Nigeria (Offiah et al., 2011).

Elsewhere, *Waltheria indica* had anti-inflammatory activities (Garcia et al., 2010), yet we found that the same plant was used to manage syphilis. *Ziziphus mucronata* was shown to contain anti-candida activity (Runyoro et al., 2006), but it was a medication for gonorrhea in our survey. There were also regional differences in the ethnomedicinal usage of plants in Namibia. For example, *Securidaca longipedunculata* alleviated symptoms of syphilis and gonorrhea in the Ohangwena region, but ameliorated the signs of cryptococcal meningitis, oral candidiasis, and coughing in the Caprivi region (Chinsebu and Hedimbi, 2010). *S. longipedunculata* was also administered against cryptococcal meningitis and oral candidiasis in Bukoba rural district in Tanzania (Kisangau et al., 2007).

This study showed that several plant species in the Ohangwena region are used to ameliorate symptoms of diseases and conditions associated with HIV/AIDS. Scientific validation of such plants may reveal active compounds against HIV enzymes, HIV associated infections as well as enhancing immunity status of the body. Although there seems to be a rich reservoir of indigenous knowledge of medicinal plant use in the Ohangwena region, the destructive harvesting of medicinal plants calls for educational initiatives to curb

the unsustainable utilization of medicinal plants. We recommend that community forestry officers should mount educational programmes to sensitize the communities about the importance of plant species diversity. The creation of new conservation projects may also help to curb the over-harvesting of medicinal plants.

ABBREVIATIONS

HIV: Human immunodeficiency virus; **AIDS:** Acquired immune deficiency syndrome; **ART:** Antiretroviral treatment; **WHO:** World Health organization.

ACKNOWLEDGEMENTS

We are thankful to various indigenous knowledge holders in the Ohangwena region for their support and for providing valuable information during the survey. Fransiska Kangombe from Namibia Botanical Research Institute is thanked for providing us with the map of the area of study. We thank the Department of Biological Sciences, University of Namibia, and the NEPAD/SANBio programme for financial support.

REFERENCES

- Arnold TH, Wells MJ, Wehmeyer AS (1985). Khoisan food plants: taxa with potential for future economic exploitation. In: Plants for arid lands. Proceedings of the Kew International Conference on Economic Plants for Arid Lands. Edited by Wickens GE, Goodin JR, Field DV. London: Allen & Unwin, pp. 69-86.
- Arunachalam K, Parimelazhagan T, Manian S: Analgesic and anti-inflammatory effects of *Merremia tridentata* (L.) Hallier F. Int. J. Pharm. Pharm. Sci. 3(1):75-79.
- Cheikhyyoussef A, Shapi M, Matengu K, Mu Ashekele H (2011) Ethnobotanical study of indigenous knowledge on medicinal plant use by traditional healers in Oshikoto region, Namibia. J. Ethnobiol. Ethnomed. 7:10.
- Chinsembu KC (2009). Model and Experiences of Initiating Collaboration with Traditional Healers in Validation of Ethnomedicines for HIV/AIDS in Namibia. J. Ethnobiol. Ethnomed. 5:30.
- Chinsembu KC, Hedimbi M (2010) An ethnobotanical survey of plants used to manage HIV/AIDS opportunistic infections in Katima Mulilo, Caprivi Region, Namibia. J. Ethnobiol. Ethnomed. 6:25.
- Chinsembu KC, Hedimbi M, Mukaru CW (2011) Putative medicinal properties of plants from the Kavango region, Namibia. J. Med. Plants Res. 5(31): 6787-6797.
- Chinsembu KC, Mutirua T (2008). Validation of traditional medicines for HIV/AIDS treatment in Namibia. A report of the study visit to Zambia and South Africa. Namibia, Windhoek, Namibia.
- Coates PK (1983). Trees of Southern Africa, 2nd edition. Struik Publishers (Pty) Ltd, Cape Town, South Africa.
- Family Health International (2007). Impact, Implementing AIDS Prevention and Care Project, Namibia Final Report. Family Health International, Windhoek, Namibia.
- Garcia D, Domingues MV, Rodrigues E (2010) Ethnopharmacological survey among migrants living in the Southeast Atlantic Forest of Diadema, São Paulo, Brazil. J. Ethnobiol. Ethnomed. 6:29.
- GRN [Government of the Republic of Namibia] (1999). Report on the 2010 National HIV Sentinel Survey. Ministry of Health and Social Services, Windhoek, Namibia.
- GRN [Government of the Republic of Namibia] (2004). The National Strategic Plan on HIV/AIDS: Third medium term plan 2004-2009. Directorate, Special Programmes, Ministry of Health and Social Services, Windhoek, Namibia.
- GRN [Government of the Republic of Namibia] (2008). Estimates and Projections of the Impact of HIV/AIDS in Namibia. Ministry of Health and Social Services, Windhoek, Namibia.
- GRN [Government of the Republic of Namibia] (2009). United Nations General Assembly Special Session (UNGASS) country report, reporting period 2008-2009. Ministry of Health and Social Services, Windhoek, Namibia.
- Grønhaug TE, Glæserud S, Skogsrud M, Ballo N, Sekou Bah S, Diallo D and Paulsen BS (2008) Ethnopharmacological survey of six medicinal plants from Mali, West-Africa. J. Ethnobiol. Ethnomed. 4:26.
- Gueye M, Diouf M (2007). Traditional leafy vegetables in Senegal: diversity and medicinal uses. Afr. J. Trad. CAM 4(4):469-475.
- Guo HZ, Chang ZZ, Yang RJ, Guo D, Zheng JH (1998) Anthraquinones from hairy root cultures of *Cassia obtusifolia*. Phytochemistry, 49(6):1623-1625.
- Gupta N, Jain UK (2010) Prominent wound healing properties of indigenous medicines. J. Nat. Pharmaceuticals, 1(1):2-13.
- Hewawasam RP, Jayatilaka KAPW, Pathirana C, Mudduwa LKB (2004) Hepatoprotective effect of *Epaltes divaricata* extract on carbon tetrachloride induced hepatotoxicity in mice. Indian J. Med. Res. 120:30-34.
- Homsy J, King R, Tenywa J, Kyeiyune P, Opio A, Balaba D (2004). Defining minimum standards of practice for incorporating African traditional medicine into HIV/AIDS prevention, care and support: a regional initiative in Eastern and Southern Africa. J. Altern. Complement. Med. 10(5):905-910.
- Kadja AB, Mamyrbékova-Békro JA, Benie A, Boua BB, N'gaman KC and Bekro Y (2011). *Erythrophleum africanum* Afzel. (Caesalpiniaceae), an African toothpick: Phytochemical screening, total flavonoid content and antioxidant activity. J. Med. Plants Res. 5(27):6273-6277.
- Kayombo EJ, Uiso FC, Mbwambo ZH, Mahunnah RL, Moshi MJ, Mgonda YH (2007). Experience of initiating collaboration of traditional healers in managing HIV and AIDS in Tanzania. J. Ethnobiol. Ethnomed. 3:6.
- Kisangau DP, Lyaruu HVM, Hosea KM, Joseph CC (2007) Use of traditional medicines in the management of HIV/AIDS opportunistic infections in Tanzania: a case in the Bukoba rural district. J. Ethnobiol. Ethnomed. 3:29.
- Klos M, van de Venter M, Milne PJ, Traore HN, Meyer D, Oosthuizen V (2009). *In vitro* anti-HIV activity of five selected South African medicinal plant extracts. J. Ethnopharmacol. 124:182-188.
- McCourt W, Awases M (2007). Addressing the human resources crisis: a case study of Namibian health service. Hum. Resour. Health, 5:1.
- Offiah NV, Makama S, Elisha IL, Makoshi MS, Gotep JG, Dawurung CJ, Oladipo OO, Lohlum AS, Shamaki D (2011). Ethnobotanical survey of medicinal plants used in the treatment of animal diarrhoea in Plateau State, Nigeria. BMC Vet. Res., 7:36.
- Olowokudejo JD, Kadiri AB, Traviv VA (2008) An ethnobotanical survey of herbal markets and medicinal plants in Lagos State of Nigeria. Ethnobotanical Leaflets, 12:851-65.
- Ribeiro A, Romeiras MM, Tavares J, Faria MT (2010). Ethnobotanical survey in Canhane village, district of Massingir, Mozambique: medicinal plants and traditional knowledge. J. Ethnobiol. Ethnomed. 6:33.
- Runyoro DKB, Matee MIN, Ngassapa OD, Joseph CC, Mbwambo ZH (2006). Screening of Tanzanian medicinal plants for anti-Candida activity. BMC Compl Alter Med. 6:11.
- Shrivastava N, Patel T (2007).. *Clerodendrum* and healthcare: an overview. Med. Aromat. Plant Sci. Biotech. 1(1):142-150.
- UNDP [United Nations Development Programme] (2000). Namibia Human Development Report 2000. UNDP, Windhoek, Namibia.
- USAID [United States Agency for International Development] (2002). Namibia in the second decade of independence:

successes and challenges. USAID, Windhoek, Namibia.

Van der walt P, Le Riche E (1999). The Kalahari and its plants. Van der Walt & Le Riche, Pretoria, South Africa.\xtraditional medicines for anti-HIV activity: memorandum from a WHO meeting. Bulletin of the World Health Organization 87:613-618.

Yadav JP, Arya V, Yadav S, Pangha M, Kumar S, Dhankhar S (2010) *Cassia occidentalis* L.: a review on its ethnobotany, phytochemical and pharmacological profile. Fitoterapia 81:223-230.