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South African Journal of Botany 77 (2011) 830 – 843

SOUTH AFRICAN JOURNAL OF BOTANY

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Review

Commercial herbal preparations in KwaZulu-Natal, South Africa: The urban face of traditional medicine

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Abstract

The modern trend in traditional medicines reflects an increase in the sale of complex herbal mixtures rather than those prepared from single plants. This trend is well documented in Traditional Chinese Medicine (TCM) and can be seen in recent developments in African traditional medicine. An increase in the prevalence of locally produced herbal preparations, especially those containing complex mixtures of several medicinal plants, sold in numerous retail outlets, including supermarkets and pharmacies has been observed. The appearance of these preparations is not surprising in rapidly urbanizing societies where traditional products are still desired but the users have neither the time nor resources to produce them. The production of these herbal mixtures has resulted in a growing herbal industry with about 50 to 100 private entrepreneurs in the informal market and has also contributed to creation of numerous jobs. The products are extensively advertised in newspapers, on the internet, television and radio programmes as well as through pamphlets and posters. This review examines and documents the prevalence of commercial herbal mixtures and preparations common in Pietermaritzburg, KwaZulu-Natal. Different types of herbal mixtures, claims, ethical and legal implications are discussed. Methods of preparation and marketing strategies as well as the way forward in ensuring economic impact, safety and efficacy of this new aspect of South African traditional medicine are also highlighted.

Keywords: Cytotoxicity; Herbal mixtures; Herbal preparations; Traditional medicine; Urbanization

Contents

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doi:10.1016/j.sajb.2011.09.002

1. Introduction: Commercial herbal mixtures and preparations

In Traditional Chinese Medicine (TCM), there has been a paradigm shift from using single agents to combining them to generate more complex herbal mixtures (Kong et al., 2009). This has been observed and studied (Kong et al., 2009). Several centuries ago, traditional remedies consisted of only single agents (Zhang, 1993) but with the accumulation of therapeutic experience, traditional healers realised that combining diverse natural medicines to constitute a mixture could effectively enhance healing effects (Kong et al., 2009). This process was greatly enhanced by the fact that TCM has been documented and recorded in detail for centuries. The documentation of TCM provided a solid base of knowledge from which development could be initiated and added to. Thus in a period of approximately 2000 years the number of components in TCM increased seven-fold while the number of documented formulae (preparations of two or more components) increased 400 times (Kong et al., 2009). In South Africa, traditional healers do not only rely on single plant extracts for healing but often combine various plant parts or even different species to make herbal mixtures.

The sale of commercially processed herbal mixtures as part of traditional medicine has increased over the last decade. The use of over-the-counter herbal products has since become popular with an estimated 12% of the world population. This has resulted in an estimated world market of 50 billion USD in the commercial herbal industry, giving an annual growth of 6.5% (Addae-Mensah, 2000; Rates, 2001; Ashar and Dobs, 2004; Makunga et al., 2008). The World Health Organisation (WHO) has played a leadership role in encouraging the development of scientific approaches to the evaluation and utilization of traditional medicine through the Alma-Ata Declaration (WHO, 1978); the manual on quality control methods for medicinal plant material (WHO, 1998); and the general guidelines for methodologies on research and evaluation of traditional medicines (WHO, 2000). In South Africa alone, 20 000 t of plant material is estimated to be used per year (Mander et al., 2007) to produce these herbal remedies, with a market value of between 75 to 150 million USD per year (Dold and Cocks, 2002; Mander and Breton, 2006; Mander and McKenzie, 2005). In KwaZulu-Natal province alone, 13 years ago, 6 million people were known to be involved in the trade of indigenous medicinal plants, either through collecting, selling or buying (Mander, 1998).

Herbal preparations, in most cases are mixtures of selected medicinal plants or plant parts used to treat specific health conditions. Plant parts such as leaves, flowers, tubers, bulbs and/or roots from different plant species in specific proportions are used (Rates, 2001). The mixtures could be simple, commonly known home remedies used for primary health care to treat minor illnesses (such as colds, headaches, stomach pains and menstrual pains) or complex preparations often used for life threatening diseases (Pujol, 1990; Cano and Volpato, 2004).

This review article is aimed at recording and documenting the prevalence of commercial herbal mixtures and preparations common in KwaZulu-Natal while discussing the different types of herbal mixtures, claims, ethical and legal implications involved in the marketing and production of such products. The review is also aimed at bringing to the attention of policy makers, researchers and manufacturers the rapid escalation and magnitude of this new aspect of South African traditional medicine. Ways forward to ensuring economic impact, safety and efficacy will also be discussed. In this review, the term 'mixture' will be used to refer to commercial herbal products that contain more than one plant species while 'simple preparation' will refer to products made from only a single plant species.

2. Modernization, commercialization and marketing strategies of traditional medicine in South Africa

It was expected that traditional healers would diminish as people become 'urbanised' and the youth become more 'westernised'. Instead this seems not to be the case. The influence of traditional beliefs runs deep within most of the indigenous black people's cultures (Sheriffs, 1996). Despite western-based modernization and urbanization, Marsland (2007), reported that African Traditional Medicine (ATM) is not merely a rural phenomenon but also an urban one, increasing in frequency in both urban and rural black communities. De Jong (1991) reported that educated black people living in urban areas continue to use the services of traditional healers for their primary health care. It has been speculated that the demand for traditional healers could even increase with modernization since they become skilled in helping people to cope with the stress associated with current contemporary urban life (Hardon et al., 2008).

With rapid globalization and urbanization, there have been notable changes in the operation of ATM. With more accessible education, as people get involved in modern occupations, particularly the youth, preferences and buying power are rapidly changing. Traditional healers and herbalists are also adapting in order to accommodate such social changes. Furthermore, the widespread uses of the internet, television, radio, newspapers and the formation of social networks have provided traditional healers and herbalist with a new platform for marketing ATM (Bonora, 2001). Health care systems appear to change in response not only to research and development (random or science driven), but also largely due to factors affecting the consumers like any other commodity. These include changes

in the consumer's economy, rural–urban shifts, religious beliefs (traditional, Christianity) and education.

The evidence of the adaptive nature of ATM is prevalent in the medicinal plant (*muthi*) trade in urban areas of South Africa. The ATM being practiced in urban areas follow similar practices used in rural areas as it also deals with both the so-called 'natural' or biomedical diseases (colds and headaches) and the 'spiritual' diseases (witchcraft related and ancestry displeasure) (Bonora, 2001). The term *muthi* refers to substances, in most cases plant material, prepared and administered as an aid to patients in distress by an experienced or trained traditional healer. Most healers or herbalists claim to possess secret knowledge regarding the mixing and administering of effective *muthi* to achieve positive healing powers (Pujol, 1990; Ashforth, 2005).

Several activities associated with ATM can be identified in almost every town or city in South Africa, including traditional medicinal plant gatherers, herbal shops (*muthi* shops), herbal pharmacists, herbal hawkers, herbal wholesalers (Dauskardt, 1990), and recently herbal product processors and distributors. Fig. 1A shows a typical herbal shop commonly found in both rural and urban areas; Fig. 1B represents a more commercialised production chain with mostly processed herbal preparations instead of the plant material while Fig. 1C and D represents traditional open markets.

It can be deduced that for a huge traditional medicine trade to be present within urban areas, there has to be a great demand for such services and/or products. Urbanization and movements of people to informal settlements has introduced a range of traditional activities in the cities that subsequently became informal employment (Dauskardt, 1990). A decade ago, it was estimated that most households in South Africa spend between 4 and 6% of their annual income on traditional medicine and related services (Mander, 1998). As a result, the herbal trade has become a way of generating an extra income for many people. However, this has caused, what is considered by many as, an illegal plant trade and smuggling problem (Mander, 1998). Many of the activities associated with ATM are in direct contravention of the National Environmental Management: Biodiversity Act (No. 10 of, 2004), (NEMBA).

As expected, such demand on traditional medicine and related services has brought about competition amongst herbalists. The competition is so intense that even in the streets of urban

Fig. 1. (A) Traditional herbal shop with dry plant materials on the shelves, (B) traditional urbanised herbal shop with plant material replaced by commercial herbal preparations alongside other items showing the blending of African Traditional Medicine (ATM) and Hinduism in Pietermaritzburg, (C) and (D) traditional open herbal market (Nongoma, Zululand) with packaged herbal preparations dominating the products on sale.

towns, for example Pietermaritzburg, the capital of KwaZulu-Natal, different posters and pamphlets advertising herbal products and services are distributed to people. Fig. 2 shows examples of some of the pamphlets advertising an assortment of services offered by the urbanised traditional healers. Besides pamphlets, advertisements of herbal products in newspapers, television and radio have also increased. Most of the pamphlets advertise doubtful services such as the protection of houses and cars as well as lucky charms for increasing chances of winning gambling games such as the National Lottery (lotto) and others offered at social establishments such as casinos. Besides lucky charms, the pamphlets also advertise such services as business attraction, job recovery, promotion at work and even penis enlargements. There are, however, some potentially dangerous and harmful services that are also advertised, such as abortion, 'short boys for money' (*tokoloshes*—creatures reportedly made from human body parts) and 'hiring of magic sticks' (Fig. 2). Such services have led to a negative stigma that is now being associated with traditional medicine in KwaZulu-Natal. This is unfortunate as these services are most likely the work of a small group of money-hungry con-artists, 'quacks' and *abathakathi* ('witchdoctors') who use dubious concoctions as remedies, and do not have knowledge about the basics of herbalism. This has resulted in the numerous '*muthi*-motivated' uses of human remains in traditional medicine and '*muthi*-related' murders are suspected. The *abathakathi's* intentions are not to heal but rather to destroy and take advantage of the ignorance of the unsuspecting desperate patients in urban communities.

Fig. 2. Examples of pamphlets handed to people in the streets of Pietermaritzburg, KwaZulu-Natal. The pamphlets advertise a range of services offered by commercial and modernised 'traditional' herbalists.

The pamphlets have the contact information of the service providers that include the address where the consultations are done, business phone and cellular phone numbers and/or street directions. Most of the pamphlets have names of the herbalists and in most cases with bogus titles such as 'Dr.' or 'Prof.' (Fig. 2). Some of the names on the pamphlets are clearly not of Zulu origin. For example one of the pamphlets in Fig. 2 has 'Dr. Shaban and Mama Aminah' as the herbalists, both of which are not Zulu names. This shows that with urbanization, ATM is slowly being blended with other cultures such as Hinduism and Islam. This also suggests that healers from other cultures may be more appreciated than local healers and individuals from other cultures may be tapping into the ATM client base.

3. Commercial herbal mixtures in KwaZulu-Natal

Apart from pamphlets discussed above, there has recently been an appearance in shops, pharmacies and supermarket shelves of different preparations, manufactured by private entrepreneurs. The manufacturers advertise numerous claims regarding the efficacy of their products. The mixtures usually take the form of dark brown liquids, in 500 ml to 1 l labelled bottles or coloured solids and capsules. The mixtures represent something in-between ATM and western medicine (Ndhlala et al., 2009). Their design is based on traditional theories and spiritual concepts i.e. recipes and preparations that are of ATM origin. However, the packaging and presentations are modern, but they lack scientific safety and quality controls (Ndhlala et al., 2009). The products range from single-species products (preparations) to complex multi-species blends (mixtures) (Mander and McKenzie, 2005).

Some herbal mixtures and simple preparations are manufactured in small quantities by informal street traders, market traders or individual traditional healers and are often packaged in recycled bottles with hand-written labels. However, some of the herbal mixtures on sale in shops are professionally manufactured in large quantities by private entrepreneurs in establishments that produce packaged and labelled products (Ndhlala et al., 2009). Table 1 documents some of the common herbal mixtures sold in Pietermaritzburg, KwaZulu-Natal. Included are the manufacturer's details, medicinal uses and other information printed on the labels. Some of the common herbal mixtures/simple preparations sold in shops around Pietermaritzburg are presented in Fig. 3. The production of these herbal mixtures has resulted in a huge herbal industry, thus creating jobs for many people in the urban areas, not only for those involved in the mainstream production but for other companies such as printers, bottle manufacturers and distributors as well.

The herbal mixtures are in most cases made up of combinations of plant species that have been used in ATM for centuries thus they represent a social heritage, and their ethnobotanical investigation can add much to the understanding of the changes occurring in traditional medicine (Cano and Volpato, 2004). Despite the obvious differences in the degree of 'modernization' of these herbal preparations, they share a common market and their formulation and conception are based on ATM. These herbal preparations are becoming extremely popular in KwaZulu-Natal and are becoming an important component of the medicinal plant trade throughout the region. Most of the products have African names and the dosages and indications are mostly written in South African languages, most commonly *isiZulu*.

It is believed that the development and proliferation of these manufactured herbal mixtures and simple preparations is driven by the recent drastic changes in the African society seen over the last two to three decades. The herbal preparations are used for the treatment of a wide range of syndromes/disorders that could be considered traditional. These basically include treatment of diseases, lucky charms, driving away of evil spirits and some are believed to facilitate dream-communications with ancestral spirits (*amadlozi*). Such 'charm' preparations are usually carried around the person's neck (*imfingo*) and the waist in the form of a protective talisman to drive away evil spirits. Some of the common herbal products are the 'Tokoloshe' salts (Fig. 3A). The *Tokoloshe* salts can be sprinkled (*intelezi*) around the homestead, under the bed, or added to bathing water or chewed. In rural areas, the traditional *intelezi* (equivalent of the *Tokoloshe* salts in urban areas) is usually made of a mixture of bulbous plants, leaves and barks that are placed in a container (normally a broken used clay-pot) infused in cold water and sprinkled around the homestead or on the person. Species used for making *intelezi* and *imfingo* are mainly strongly scented plants.

Other products include aphrodisiacs, used to increase sexual prowess, sexual appetite or stamina. These products include Fire-BarkTea® (*Bangalala root*) (Fig. 3F), mainly advertised on the internet as a 'love reed'. *Bangalala root*, also known as 'African Viagra', is prescribed as an aphrodisiac, notably to enhance male potency. *Bangalala root* is a product likely made of a mixture of *Corchorus aspleniifolius* Burch. and *Eriosema cordatum* E. Mey. roots. Both plants have a reputation of being powerful sexual tonics (Hutchings et al., 1996), however, a lot of controversies surround the true species that are mixed to make up the product. Other species that are likely to be used for the same purpose include *Securidaca longepeduculata* Fres. (Polygalaceae). The instructions on the packaging states that the roots are either boiled in water and the decoction is drunk, or can be mixed into milk, which is also then drunk. The packaging of *Bangalala root* professes its love powers: "It was once a closely guarded secret of a few Xhosa and Zulu witchdoctors but because of its potency and popularity it is now available to all who wish to enjoy its benefits". The packaging also declares it to be the most powerful tonic known to *muthi* practitioners, prescribed throughout Africa for centuries. Apparently you cannot overdose on it; according to most herbalists, "if you overdo this love drug, it will simply upset your stomach" reads one of the internet advertisements. 'Sex sugar' (Fig. 3D) is also another popular aphrodisiac available on the market in KwaZulu-Natal.

Another important group of herbal mixtures found throughout KwaZulu-Natal include the 'general tonics'. The names of these mixtures are chosen because of their association with the strength of powerful animals, for example '*Ingwe* (leopard) *izifozonke*' presented in Fig. 3G. As the word '*izifozonke*' means 'all diseases', these mixtures are used for the treatment of numerous

conditions. General tonics are in most cases administered orally by drinking a warmed portion or by adding the mixture to a traditional beer (*umqomboti*), fermented corn (*amageu*), traditional porridge (*uphutu*) and/or tea. *Umqomboti* is an integral part of everyday Zulu life both in urban and rural communities thus it is widely used in administering herbal preparations.

Table 1
Information on commercial herbal mixtures commonly found in Pietermaritzburg, KwaZulu-Natal.

Product name	Medicinal uses	Ingredients (as listed on the label)	Directions of use
Trade name			Packaging
Batch number			Shelf life
African potato extract—South Africa's miracle herb 6008306000506	Used to boost the immune system and treatment of HIV/AIDS symptoms.	NL	1 cup daily 1 l
Amandla esambane no. 1	Used to relieve: blood pressure, period pain, HIV/AIDS, swollen body or legs, kidney infections, back pain, sores, rash, diarrhoea and chickenpox. Also helps to improve appetite.	NL	4 teaspoons every morning, afternoon and evening. 1 l
Ibhubezi	Used for wounds, fungal infections, STDs, treatment of influenza, to reverse impotence, clean the body system and stimulate blood production.	NL	1/4 cup twice a week. Not for children under 14 years of age and pregnant women. Shake well before use. 500 ml 6 months
Imbiza ephuzwato	A detoxifying and energising tonic used to increase sexual prowess, relieve constipation, reduce stress, reduce high blood pressure, clear skin conditions, boost energy, boost vitality, helps to prevent arthritis, kidney problems and relieve general body pains.	Refer to Ndhlala et al. (2011)	1/4 cup in the morning after meals twice a week. 1 l
Ingungumbane Mahlabizifo	Used to relieve: 'hangover', ulcers, skin eruptions, blood pressure, asthma, gout and stress. Also used to increase CD4 count, reduce viral load, clean blood and increase sex drive.	*Sutherlandia*, *Aloe* extracts, African potato, fortified with vitamins B and C. Also contains brewer's yeast.	6 teaspoons in the morning and afternoon before meals. Not for pregnant women. Shake well before use. 1 l
Ingwe muthi mixture Ingwe AMM 0011	A traditional African mixture for chest infections, STDs, arthritis, heart burn, relieving constipation and increasing sexual prowess.	NL	3 tablespoons every morning. 500 ml 6 months
Ingwe special muti Ingwe AMM 003	Used for alleviating menstrual pain, general pain.	NL	Take one 5 ml teaspoon in hot water or with tea every morning until the course is finished. Not for children under 14 years of age and pregnant women. 40 g
Lion izifozonke Ingwe AMM 003	Used for chest infections, STDs, arthritis, heart burn, relieving constipation and increasing sexual prowess.	NL	1/4 cup three times a day after meals. Not to be taken by children and pregnant women. 500 ml 6 months
Mvusa ukunzi	A 'man tonic' for increasing sexual prowess and can be used as an energiser.	NL	Not on label. 500 ml
Ngoma herbal tonic 710001001	Used as an immune booster, against diabetic and blood pressure conditions. *Ngoma* is also used for the relief of stomach ailments, arthritis, hypertension, stress and influenza.	*Sutherlandia*, *Echinacea* sp., *Dandelion* sp., *Alfalfa* sp., *Aloe ferox*, *Harpagophytum* sp. and 13.5% alcohol.	1 tablespoon in the morning and evening after meals. Shake well before use. Not to be taken by children under 6 years of age, pregnant and breastfeeding women. 500 ml 1 year
S'mangaliso herbal mixture 6000528154548	Used for treatment of HIV aids symptoms, high blood pressure, period pain and cancer.	NL	5 tablespoons per day for persons aged 13 years and over. 500 ml
Sejeso herbal mixture Ingwe AMM 005	Used to relieve heartburn, constipation, stomach ache, stomach cramps and indigestion.	NL	1/4 cup three times a day after meals. Not to be taken by children and pregnant women. 500 ml 6 months

(continued on next page)

Table 1 (*continued*)

Product name / Trade name / Batch number	Medicinal uses	Ingredients (as listed on the label)	Directions of use / Packaging / Shelf life
Stameta BODicare® 04020207	Used for nervous system disorders, skin conditions, boosts sexual performance, poor blood quality, and high blood pressure. Chest, lung and kidney infections. Fever and flu. Heart problems, back pain, and persistent tiredness. Used for menstrual pain, bleeding gums, and body sores and cleans out bile. Strengthens bones and boosts the immune system.	*Hypoxis rooperi*, *Mentha piperital*, *Pimpinella anisum*, *Aloe* (unspecified). Fortified with multivitamins (unspecified), calcium, magnesium, potassium, phosphorus and iron.	1/2 or 1/4 cup three or four times a week. Not for children under 14 years of age and pregnant women. Drink water after using *Stameta*™. 500 ml
Supreme one hundred BODicare 05020207	Used for nervous system disorders, skin conditions, stimulates blood production, boosts sexual performance, treats back pains, fights influenza and strengthens the body.	NL	1/4 cup every night before sleeping after meals. Not for children under 14 years of age and pregnant women. 500 ml 6 months
Umpatisa inkosi	An 'adult tonic' used for increasing sexual prowess, as an energiser also used to treat sexually transmitted diseases (STDs), to stop menstrual pains, increase appetite, treat high blood pressure and fight arthritis.	NL	Not on label. 500 ml
Umuthi wekukhwehlela ne zilonda	Used as a cough mixture, to treat chest infections and difficulty in breathing.	NL	Not on label. 500 ml
Umzimba omubi	Used to treat wounds, skin rashes, fungal infections and boils.	NL	Not on label. 500 ml
Uvukahlale 100901713	Natural sex enhancer for men. The natural herbs contained in the mixture have long been used as tonics and aphrodisiacs. The mixture is a natural testosterone booster and increases sex drive and red blood cell production. Contains *Aloe ferox*, vitamins, trace elements, natural *Tribulus* and is preserved in sodium benzoate and potassium sorbate.	NL	1/2 a cup twice a day before meals. Use on a regular basis. 500 ml 6 months
Vuka Uphile herbal remedy 6009814670007	Used to treat diabetes, TB, kidney infections, arthritis, back pains, influenza, period pains, high blood pressure, ulcers, painful eyes, painful ears and diarrhoea. Also used for treatment of inflammation related conditions. Also used to boost erection and purify blood.	NL	1/4 cup every morning and evening. Can safely be used after 3 months of giving birth.
Vusa umzimba Ingwe AMM 0016	Used to treat wounds, rashes, fungal infections, boils and chest infections, stop menstrual pains, increase stamina and fight against influenza virus.	NL	4 tablespoons twice a day. Not for children under 14 years of age and pregnant women. 500 ml 6 months

Information in the table was obtained through informal surveys from herbal shops in Pietermaritzburg in order to document the commonly sold herbal preparations. Some of the information was taken from Ndhlala et al. (2009; 2010b; 2011).
NL—not listed on the packaging.

Mixtures used as general tonics may also have names that describe how they are administered or what they cure. An example includes a general tonic called '*Imbiza ephuzwato*' that literally means 'a medicine to drink' (Ndhlala et al., 2011). Some names describe the use of the tonic for example '*Umzimba omubi*' refers to 'bad skin', and is used to treat skin conditions such as rashes (Ndhlala et al., 2009). The general tonics usually consist of a mixture of up to 100 plant species traditionally used to treat a wide range of conditions.

Some of the herbal preparations have names designed to instil a sense of inscrutability for marketing purposes. An example of such products is *Umckaloabo*® that is a multipurpose herbal remedy, widely used as a tonic as well as a treatment for tuberculosis, fever and cough. The preparation consists of the rhizome of *Pelagonium sidoides* DC. and is used in traditional medicine to treat colds, influenza, pneumonia and malaria (Brendler and Van Wyk, 2008). The term *umckaloabo* is derived from *isiZulu*, with a rough translation of 'a stabbing pain' or 'a stitch in the side'. It is, however, believed that the term may be an invention based on the Zulu language, intended to create a mysterious image of the remedy as a marketing strategy (Brendler and Van Wyk, 2008).

Other types of herbal mixtures include herbal teas, resins, snuffs and herbal cigarettes. From personal observation, the most frequently sold herbal mixtures/simple preparations in urban societies and rural communities of KwaZulu-Natal are for abortion and those used as aphrodisiacs. This disproportionate favour towards treatments of a sexual or reproductive nature is also evident in the advertisements and pamphlets. Perhaps this is an area of healthcare that the public perceive as being best treated using traditional medicine.

Fig. 3. Herbal mixtures and preparations common in herbal shops and markets in Pietermaritzburg, KwaZulu-Natal. (A) *Tokoloshe salts*—protective charm against evil spirits and witchcraft; (B) *Tshepe*—general tonic consisting of herbs fortified with vitamin supplements; (C) *Impotex forte*; (D) *Sex sugar*—herbal supplements for sexual dysfunction; (E) a Pietermaritzburg bulk shopping store with an assortment of herbal mixtures and preparations; (F) Fire-BarkTea® herbal tonic for men. *Bangalala root* is claimed to be the most powerful aphrodisiac known to *muthi* traders. It is sometimes referred to as '*African Viagra*' and is usually prescribed to men to enhance potency, increase sexual appetite and stamina; however women are also known to use the sexual tonic. The product is widely advertised on the internet; (G) a multipurpose mixture 'for all diseases' with a name mimicking a strong and vicious animal. *Ingwe*—Leopard. *Izifozonke*—all types of diseases.

4. Preparation of commercial herbal mixtures

Methods of preparing herbal mixtures varies from simple brewing processes to more complicated procedures that make use of alcohol and other organic solvents to dissolve the 'essences' of the plant (Pujol, 1990). In some cases, addition of accepted western medicines, such as aspirin, has been recorded for some herbal mixtures (Cano and Volpato, 2004; Johns, 1990; Oates, 1978).

Herbal preparations used as stomachic and sedative mixtures mainly contain aromatic plant species, rich in therapeutically active essential oils, which exert antispasmodic, antibacterial and stomach-soothing properties (Cano and Volpato, 2004). Mixtures for stomach ulcers and diarrhoea are characterised by plant species with high tannin content, popularly used as astringents, antimicrobials and anti-inflammatories (Cano and Volpato, 2004).

Few studies have been done on the contents and ingredients of commercial herbal mixtures. It should however be noted that in ATM, it still remains a challenge to convince the herbalist to reveal their ingredients as well as the recipes of their products as they are guarded 'trade secrets' amongst themselves (Ndhlala et al., 2009).

One of the studied mixtures, *Imbiza ephuzwato*, which is a traditional herbal tonic, has been shown to contain a mixture of extracts of roots, bulbs, rhizomes and leaves of 21 medicinal plants that have been used by Zulu communities for centuries (Ndhlala et al., 2011). The chopped, dried materials of the 21 plant species are mixed in equal portions (dry weight) and extracted with water by boiling for 1 h. The mixture is then cooled and subsequently filtered through a cloth. The cold infusion is then packaged into 1 l labelled plastic containers (pers. comm.). The 21 plant species are from 17 families, with Hyacinthaceae (now Asparagaceae, subfamily Scilloidea) being the most represented family (three species) in the herbal tonic, followed by Amaryllidaceae and Asteraceae (two species each) while the remaining are represented by one species each. The medicinal and aromatic plants that are used to make the mixture are collected by the gatherers and professional herbalists, who in turn sell them to the manufacturers. The plants are also sold in the herbal shops and markets of KwaZulu-Natal with the biggest market situated at KwaNongoma (*Mona* market), in Zululand, northern KwaZulu-Natal.

Ingestion is the preferred means of taking herbal mixtures and topical application as a lotion is used to treat skin problems (rashes and boils) while inhaling is often used for mental conditions (Pujol, 1990). Decoctions are sometimes administered as enemas (*uchatho* in *isiZulu*). In urban areas, they are administered using enema syringes or tubes. However in rural areas, a lubricated, truncated cow's horn is often used (Van Wyk et al., 1997).

There appears to be very little regulation and scientific backing of these products in South Africa, thus posing a potential threat to consumer health. Many of these private entrepreneurs seem not to conform to Good Manufacturing Practice (GMP) standards leaving only a few certified pharmaceutical manufacturers producing formalised traditional herbal medicines (Mander et al., 2007). Despite the existence of the Medicines and Related

Substances Control Act 101 of 1965 and its amendments of 2002 (Department of Health, 1965) it is still difficult to regulate commercially labelled medicines, herbal formulations and nutritional supplements. Medicine regulation, is in the public interest, and comprises of three integral aspects: quality, safety and efficacy. In terms of quality, hygiene and potential contamination of herbal products used in traditional medicines are a concern as they are sold on pavements and in markets where the materials are often exposed to a host of unhygienic conditions, contrasting with the strict pharmaceutical manufacturing standards that are necessary for production and packaging of other medicines (Rates, 2001; Steenkamp et al., 2006).

The lack of standardization of these commercial products can also be a result of high investment requirements for the development of clinically tested and certified medicines especially those derived from medicinal plants. Intellectual property rights regarding products from natural resources and the high cost of resolving such issues prior to investing in product development can impact directly to the consumer through higher prices (Mander et al., 2007). An increase in the price of these products will make them inaccessible to the majority of current users. Also, there are risks associated with sustainability of raw plant material supplies, as many of the indigenous medicinal plants are difficult to cultivate in local gardens (Mander et al., 2007). A solution to this could be state funded and non-governmental organisation (NGO) assisted research projects related to cultivation and development of important medicinal species and preparations. The Department of Science and Technology and the Department of Health, directly or through the Medical Research Council (MRC), Agricultural Research Council (ARC) and National Research Foundation (NRF) could further expand on exciting research in this area.

5. Mode of action of herbal preparations

The use of herbal mixtures presents unique challenges not encountered by typical single compound allopathic medicines. Since these preparations are mostly complex mixtures of different plant species with different bioactive compounds, the indications and use criteria for western single compound medicines may not be applicable. Compared to single compound pharmaceuticals, traditional herbal mixtures may have more than one mode of action (Yong and Loh, 2004). The following sections discuss some of the possible modes of action through which herbal mixtures exert their therapeutic actions.

5.1. Combinational or additive effects

The healing effects of herbal mixtures could be as a result of the total sum of different classes of compounds having diverse mechanisms of action. A typical example of combinational effect is shown when an herbal mixture causes platelet activation and antioxidant effects that could combine to reduce inflammation and increase microcirculation of blood flow and improve brain function. Ginkgo (*Ginkgo biloba* L.) has been reported to have membrane stabilising effects and smooth muscle relaxation properties that could in combination result in total vasodilatation and microvascular effects of the preparation (Yong and Loh, 2004).

5.2. Synergistic effects

Synergism in drugs occurs when compounds interact in ways that enhance or amplify one or more healing effects of mixtures of drugs than when they are administered individually (Becker et al., 2004). Therefore, a partially purified extract of a plant offers advantages over a single isolated ingredient. This is the concept that underpins the philosophy of herbal mixtures (Yong and Loh, 2004). The presence of synergistic properties in medicinal plants is an old concept put forth by Hippocrates (an ancient Greek physician) and reinforced by Ibn Sina (the great Persian Physician). However, this concept lacks sufficient scientific evidence (Hall et al., 1983; Gilani and Rahman, 2005; Meletiadis et al., 2010; Van Vuuren, 2008). Apart from the studies on synergistic and additive interactions of commercial oils in South Africa by Van Vuuren et al. (2007), the importance of the concept of synergism can clearly be reflected in the evolution of TCM. The history of TCM dates back 4000 years and is still popular and becoming even more accepted by western countries. The early TCM prescriptions consisted of mainly single agents. With accumulation of experience, the Chinese traditional healers realised that combining diverse natural medicines to form a herbal mixture could efficiently enhance the therapeutic effect (Kong et al., 2009).

Synergism in TCM categorises the components of herbal mixtures into four roles: role of an 'emperor,' of an 'adviser,' of a 'minister' and of an 'ambassador.' The philosophy demands a balanced system that includes effectiveness, efficacy, reinforcement, moderation and safety. Based on this philosophy, poisonous herbs can be used when there is need to forcibly bring about an effective treatment, while toxicity is being checked and controlled by other herbs that possess different effects or that act as antidotes, low doses on the other hand are supplemented by a variety of other herbs present in the mixture (Leung, 2004). This philosophy is used to clear the mystery that surrounds the use of poisonous herbs in herbal mixtures. Many of the mixtures used in ATM, including those presented in Table 1 contain at least one toxic plant. Examples are the potentially poisonous herbs such as *Gomphocarpus fruticosus* (L.) Aiton f. (Apocynaceae), *Scadoxus puniceus* (L.) Friis and Nordal (Amaryllidaceae) and *Drimia robusta* Baker (Hyacinthaceae) that have been reported to form components of '*Imbiza ephuzwato*', a popular Zulu herbal multipurpose mixture (Ndhlala et al., 2011).

6. Advantages of using herbal mixtures

Herbal mixtures containing multiple and complex compounds can thus offer a solution to multi-drug resistance that is evidenced in most antibiotics, antimalarial, antiviral and anticancer treatments (Keith et al., 2005; Yeh and Kishony, 2007). The absorption, distribution, metabolism, and excretion (ADME) and the disposition of herbal mixtures within an organism are poorly understood. Thus studies on herbal mixtures

should be conducted on 'whole' systems and animal models using metabolomics.

Many urban and rural dwellers rely on ATM because of its accessibility and often fall victim to quacks or con-artists. The population in the middle-to-upper income bracket have access to private healthcare and still have the means to choose the type of medication they want (Makunga et al., 2008). These groups include the larger portion of the white and growing black, coloured and Indian populations (Makunga et al., 2008). One other reason why urban people prefer to use these commercially available herbal preparations include the perception that natural products represent purity, simplicity and safety that in some cases may be far from the truth (Tanko et al., 2005). Herbal mixtures are also more convenient as they can be purchased over the counter from any herbal or food store without the need for a prescription. In the future indigenous herbal mixtures are not to be regulated as drugs but rather fall under a separate category as ATM. The ATM Committee of the Medicines Control Council is tasked with drawing up the regulations for the registration of such products. The dates and regulations have not yet been released, so the safety, efficacy and quality of these products have not yet been subjected to regulatory scrutiny.

7. Problems associated with use of herbal mixtures

Despite the popularity of botanical supplements, many herbal mixtures on the market are of low quality and unreliable efficacy. Researchers and clinicians are usually concerned about safety, effectiveness and consistency of herbal mixtures and simple preparations. The low quality of herbal products may be due to several factors. These include factors that are difficult to control such as the time and methods of collection of raw materials, processing methods and complex heterogeneity of plant secondary metabolites, and unpredicted consequences when herbs are mixed with western medicines as well as a general lack of scientific validation (McIntyre, 1998).

7.1. Problems due to misidentification, harvesting and manufacturing

Plant taxa that resemble each other make it hard to identify species used in herbal preparations (e.g. differentiating between *Clivia* spp.) (especially when chopped and ground), and this may pose a threat to consumers if species within the same genus have different chemical constituents. Inappropriate use of herbs through misidentification is one of the major causes of morbidity and mortality in local communities (Rates, 2001; Tanko et al., 2005).

Inconsistent processing methods used by manufacturers can result in varying quality levels between batches of a particular product. Different therapeutic potentials in herbal products result from different factors such as the age of plants, season of harvesting, geography of plant habitat and post harvest handling. Furthermore, herbal mixtures may not be pure and may possibly contain pollen grains, common allergens, or heavy metal contaminants, which are known to cause numerous illnesses. Incidentally, they may also contain carcinogenous aflatoxins and mycotoxins since many of these plants are transported to the markets in recycled maize/grain bags. There is cause for concern for the sterility of the products, and various tests should be conducted to determine their microbial (fungal and bacterial) load. General cleanliness should also be maintained in the manufacture and product packaging. Therefore the introduction of standardised manufacturing and testing protocols are much needed in the South African herbal industry (Mander et al., 2007).

7.2. Lack of clinical efficacy and safety evidence

The risk and benefits of most herbal mixtures and simple preparations have not been confirmed by scientific or clinical data. Randomised control trials are the standard for clinical efficacy and currently they have been done on only a handful of herbal products that are now acceptable in the European Union (EU) and other western countries (Yong and Loh, 2004). Little or no information exists for the vast majority of the herbal mixtures flooding South African markets today.

The plant ingredients of *Umckaloabo* were identified in the 1970s and to date the product is supported with data on efficacy and safety, provided through scientific research. *Umckaloabo* consists of the rhizome of *P. sidoides* DC. Several clinical studies with ethanolic extracts of the rhizome referred to as EPs® 7630 (*Umckaloabo*®) have confirmed its safety and efficacy against bronchitis. *Umckaloabo* is now popular in the EU and is a fully licensed herbal medicine in Germany (Brendler and Van Wyk, 2008).

The pharmacological properties with respect to antibacterial, antifungal and anti-inflammatory effects of nine commercial herbal mixtures common in KwaZulu-Natal were recently published in the Journal of Ethnophamacology (Ndhlala et al., 2009). *Imbiza ephuzwato* and *Ibhubezi*™, both multipurpose mixtures exhibited high antibacterial and antifungal properties as well as high inhibitory effects towards cyclooxygenase (COX-1 and COX-2) enzymes. *Umzimba omubi* and *Umuthi wekukhwehlela ne zilonda*, both remedies for wounds, boils and chest infections were not active against the two Gram-positive and two Gram-negative bacterial strains tested. *Vusa umzimba* and *Supreme one hundred* were active against *Candida albicans*. The authors concluded that lack of activity in the assays could be due to the different modes of action that natural products exert when taking effect (Ndhlala et al., 2009, 2011).

As a follow up to this, the same authors published on the *in vitro* antioxidant properties, HIV-1 reverse transcriptase (RT) and acetylcholinesterase (AChE) inhibitory effects of fourteen common traditional herbal mixtures and simple preparations (Ndhlala et al., 2010a). The fourteen herbal preparations included the nine above mentioned preparations plus an additional five mixtures. Nine of the herbal were reported to have high antioxidant potentials while only four showed potent activity against the RT enzyme. Nine mixtures showed AChE enzyme inhibitory activity greater than 50%. The authors concluded that the observed activity exhibited by some of the herbal mixtures gives some credence to the manufacturers' claims and

goes part of the way towards validating their use against certain conditions such as oxidative stress, HIV/AIDS proliferation and some mental conditions (Ndhlala et al., 2010a).

The amounts and plant parts used in preparations are poorly documented but many claim to use GMP (Makunga et al., 2008). In as much as these studies are important, they only cover a very small portion of all the commercial herbal mixtures that are sold in South Africa. Clearly a more systematic study focused on the quality control of these mixtures is urgently needed.

7.3. Inadequate and contradictory government regulations

In many countries, including South Africa, herbal remedies are sold for stimulating, maintaining, supporting, regulating and promoting health apart from treating diseases. Such supplements are required to carry a label that describes the ingredients intended to affect the structure or functions within humans in line with Act 101 of 1965 and amendments (2002) (Department of Health, 1965). However, this represents an example of a law that exists only on the statute books as many herbal mixtures are being sold without ingredient information on their labels. It is also regrettable that this law does not require product standardization for uniformity between batches. It is an important factor in the future to investigate batch to batch pharmacological activities in order to understand the effects of storage and other manufacturing practices. Furthermore, the use of different processing methods for a particular herb could result in inconsistencies in chemical constituents (Yong and Loh, 2004).

Recently, South Africa has published a draft national policy on ATM (ATMSA, 2008) that is aimed at institutionalizing ATM in healthcare systems. This is in line with the African Union's Decade of Traditional Medicine (2001–2010) vision, which urged the integration of ATM into public health systems of member states by 2010. The policy recommended the regulation of ATM through appropriate legislation, which would include a registration process for ATM products, intellectual property provisions and formalization of the traditional practitioner profession. In addition, the policy recommends the establishment of a National Ethics Committee for African Traditional Medicine research and the development of a national pharmacopoeia.

7.4. Insufficient consumer education

Many consumers have the belief that herbal mixtures are safe and natural. It is, however, important for such consumers to be told that even though herbal mixtures have been in use for a long time, they still bring with them risks of side effects (Steenkamp et al., 2006). As the use of unregistered commercial herbal mixtures increase, alongside concerns about evidence of efficacy, the media, which represents a significant source of medical information for the lay persons and some professionals, should step up and enlighten the public about the developments in traditional medicine. There has been a large increase in research on medicinal plants over the last 20 years, the vast majority published in specialised scientific journals that are hardly accessible to lay persons. There has not, however, been a concomitant increase in the number of newspaper articles reporting on research in herbal remedies. Media coverage is not doing enough in providing the public with the information necessary to make informed decisions about medical treatments, especially those that do not involve trained personnel, for example, the use of commercial herbal preparations (Bubela et al., 2008). If people know there are safety concerns then they are likely to avoid retailers who don't follow the rules and regulations. Thus a campaign educating people about some of the dangers of certain traditional medicines and practices could possibly be very effective in regulating the industry and greatly reduce some of the deaths due to poisoning and malpractice.

8. When do herbal mixtures become poisonous?

Poisoning due to plant products (herbal poisoning) in Africa is generally not well documented. This is possibly because people are unwilling to admit poisoning by herbal products because of the fear that their cultural heritage will be more stringently regulated (Steenkamp et al., 2006).

The largest number of acute poisoning occurs in the age group 1 to 5 years and according to descriptions on most of the labels of the herbal mixtures (Table 1), most preparations are not recommended for children under the age of 14 years (Street et al., 2008). Adult poisoning occurs usually as a result of mislabelling of products, or products that are not stored in their original containers. Occasionally, poisoning is through confusing a toxic plant with something that is thought to be edible (Van Wyk et al., 2002). In some instances, adults could be poisoned by taking incorrect doses, thus it is also important for the manufacturers to clearly state the directions for use and possible side effects and that the composition of the product is standardised and monitored.

A pharmaceutical product is defined as being stable if it has five basic properties which are: physical, chemical, microbial, toxicological and therapeutic stability. Many natural products readily oxidise and degrade, giving products with variable properties if they are not properly stored. Carotenoids such as β-carotene and lycopene may have antioxidant properties as intact molecules yet their degradation products can be toxic (Halliwell, 2004; Yeh and Hu, 2001).

Microbial contamination from soil, during handling of plant material and storage is a potential threat to the consumer's health. Aflatoxins are amongst the deadly products that are generated by bacterial/fungal infections (Ames and Gold, 2000; Halliwell, 2004). Heavy metal contamination and pesticide and herbicide residues from the soil are also a common cause of poisoning. Heavy metal contamination can be introduced during sample preparation, for example when extraction of herbal products is done in lead containers (Ong et al., 1999). Dry mixtures are often coloured with mineral compounds that contain heavy metals such as copper, iron and cadmium.

Cytotoxic and mutagenic effects of thirteen commercial herbal mixtures sold in KwaZulu-Natal, South Africa have been reported in the South African Journal of Botany (Ndhlala

et al., 2010b). The relative cytotoxicity of the herbal mixtures was established by determining their NI_{50} values (50% inhibition of neutral red uptake) in the neutral red uptake assay. The test revealed that the most toxic herbal mixture was *Umpatisa inkosi* and the least toxic mixture was *Stameta™ BODicare®*. The herbal mixtures showed no mutagenic effects against *Salmonella typhimurium* test strains TA98, TA100, TA102, TA1535 and TA1537 in the Ames test when the assay was done without S9 metabolic activation. However, four herbal mixtures showed mutagenic effects against TA98 but not the rest of the tester strains after using S9 metabolic activation. *Umpatisa inkosi* also exhibited weak mutagenic activity against TA1535 after metabolic activation (Ndhlala et al., 2010b). This cytotoxic and mutagenic study reported by Ndhlala et al. (2010b) offers a step towards determining the safety of these commercial herbal mixtures common in KwaZulu-Natal province. In a separate study, Brandt et al. (1995) reported 40 names representing 24 different species forming approximately 11% of the plants used by herbalists that were toxic enough to patients to warrant admission to the Ga-Rankuwa Hospital in Gauteng province.

9. Economic prospects versus ethical and legal implications: conclusions and recommendations

"In the rural communities of Africa, Asia and Latin America where the majority of the world's people live, the dependence on biomaterials can run to over 90 percent of human survival requirements. In an increasingly urbanized world, it is difficult for those of us inside city gates to remember that more than half of the food humanity consumes is bred and produced by the people who eat it, and that eight out of ten members of the human family turn to community healers and medicinal plants for protection from illness" (Joyce, 1992). This has resulted in about 40% of the world's market economy to be based on biological products and processes (Gadbow and Richards, 1990).

As mentioned earlier in this article, it is estimated that 20 000 t of plant material is used per year in South Africa to produce herbal remedies (Mander et al., 2007) with a market value of 75 to 150 million USD per year (Mander and Breton, 2006; Mander and McKenzie, 2005). The market for plant-based drugs is growing every year throughout the world. Herbal drugs now account for over 50 billion USD of the total worldwide drug market of over 173 billion USD (Addae-Mensah, 2000). It should however, be noted that quantitative analyses on the natural products sector in South Africa and valid data are hard to get, making it difficult to accurately define the fiscal contribution of natural products to the economy (Makunga et al., 2008).

For the economy of South Africa to realise the benefits of such trade, both political will and scientific inputs are needed to support the development and global acceptance of these commercial herbal mixtures. For meaningful research into herbal medicine, dedicated funding will be required. The South African government has expressed a desire to support such research through the 'Farmer to Pharma' grand challenge (Department of Science and Technology (DST), 2007). DST has developed its Ten-Year Innovation Plan, which aims to establish South Africa as a world leader in biotechnology and pharmaceuticals, based on the nation's indigenous resources and an expanding knowledge base. Within the Ten-Year Innovation Plan (DST, 2007), five challenges have been identified and the Farmer-to-Pharma grand challenge has been prioritised as a value chain to strengthen South Africa's bioeconomy. The ten-year plan proposes to help drive the transformation of the South African economy from a resource-based economy to a knowledge-based economy in which science and technology, information and learning move to the centre of economic activity. The only challenge they are likely to face is to make research findings accessible to those who formulate laws and policies concerned with ATM, so as to develop evidence-based policies.

Research by the scientific community will support the rational basis for the use of herbal medicines. This can be achieved through the initiation of comprehensive programmes for the identification, evaluation, cultivation and conservation of medicinal plants used in traditional medicine as well as ensuring quality control of drugs developed from traditional plant remedies by using modern techniques and applying suitable standards and GMP. A pilot project in KwaZulu-Natal, driven by eThekwini Municipality in Durban has supported the cultivation and subsequent production, processing and packaging of indigenous medicinal plants thus creating standardised products as well as employment (Makunga et al., 2008).

Enacting policies such as the National Policy on ATMSA (2008), which is still at a draft level more than 2 years after it was first drafted and the Medicines and Related Substances Control Act 101 of 1965 are clearly inadequate when it comes to regulating and ensuring the safe use of medicinal plants. The modernization and acceptance of herbal mixtures into mainstream medical practice will depend on the outputs of scientific research aimed at providing the rationale for their usage and determining their safety. In this way, with time, some herbal mixtures may achieve the same recognition as western pharmaceutical drugs. However, there are a lot of challenges and obstacles that still prevents such developments from taking place. For example, the fact that the development of these commercial herbal preparations relies on the knowledge being passed by indigenous peoples and rural societies to scientists for further research. This can lead to a lot of questions concerning equitable sharing of the benefits of such knowledge as well as the intellectual property (IP) rights of those who volunteer to divulge their knowledge. This means that South Africa will continue to be deprived of any economic benefit from the informal trade of herbal preparations as well as any other plant resources under restrictive legislation such as NEMBA (2004).

For the South African economy to fully benefit from the commercial herbal preparations, the government should develop clear evidence-based legislation that govern all commercial herbal mixtures, their manufacture, wholesale and retail distribution, dispensing procedures, usage and registration. As stated in the Draft Policy on ATM (ATMSA, 2008), a complete South African pharmacopoeia is needed to answer questions such as

which plants are most important and which need the greatest effort in terms of research and conservation and which can be excluded all together. To achieve this, the government (in the Draft Policy on ATM) proposed the establishment of centres that will test the pharmacological, toxicological and clinical profiles through standardised tests and submit recommendations to an appropriate licensing centre before permission can be granted for any herbal preparation to be distributed and sold. It cannot, however, be denied that herbal mixtures harbour many potential life-saving capabilities and with urbanization, they will continue to be used by the local people. It is up to the government and the scientific communities to address any legal and ethical issues that may hinder the development of unregistered commercial herbal preparations thus continuing to expose the local communities to potentially dangerous practices.

Acknowledgements

Authors are grateful for the financial support from the University of KwaZulu-Natal Research Office and National Research Foundation (NRF), Pretoria, South Africa.

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Edited by B-E Van Wyk