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A PERSPECTIVE ON ETHNOMEDICINE RESEARCH FOR LIVESTOCK PRODUCTION: FOCUS ON BOTSWANA

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ABSTRACT **From time immemorial, communities used plants, herbs and shrubs to cure ailments in livestock and humans. Despite the advent of modern medicine, rural communities continued to rely on traditional medicine. This paper aimed to describe the rationale, benefits, and challenges associated with the use of ethnoveterinary medicines by African livestock farmers particularly in Botswana; and to propose an approach for conducting relevant research. This brief literature review has revealed that in Botswana and elsewhere, livestock farmers still make use of indigenous medicines to care about their animals. Several reasons explained this including ease of accessibility and availability as well as affordability. Similarly, several challenges are associated with the use ethnoveterinary medicines the issues of safety, quality, efficacy and dosing. These challenges call for more research to be conducted to validate practices to be encouraged and those that should be discouraged and outlawed. To do so, it is posited here that the starting point should be the involvement of traditional practitioners, farmers and healers; with the view of conducting studies that would establish the credibility about ethnoveterinary medicine; promote regional collaboration and the conservation of plants. Such endeavour requires multi-disciplinary and multi-institutional teams as well as shared values for it to succeed.**

KEYWORDS :Ethnoveterinary medicine, livestock, diseases; indigenous knowledge;

INTRODUCTION

From time immemorial, communities used plants, herbs and shrubs to cure ailments in livestock and humans. This paper aims to describe the rationale, benefits, and challenges associated with the use of ethnoveterinary medicines by African livestock farmers particularly in Botswana; and to propose an approach for conducting relevant research.

It should be remembered that the trends in livestock population in Botswana show that goat numbers increased from 1.6 million in 2006 to 1.8 million in 2008. Similarly, sheep numbers increased from 229 000 in 2006 to 303 000 in 2008 while cattle numbers were 2.1 million in 2006 to 2.2 million in 2008 (Statistics Botswana 2012). This can be attributed partly to the use of modern veterinary medicines.

However, before modernization of veterinary care during the pre-independence era, the use of ethnoveterinary medicines by livestock farmers to care for their animals was widespread. Such knowledge was passed on verbally and by example (van der Merwe 2001). Through Livestock Advisory Centres (LAC), the Ministry of Agriculture of Botswana sells modern veterinary medicines and drugs to livestock producers at subsidised prices. However, with the current government's policy of cost recovery and that of privatisation, this service is likely to not be available to farmers in the near future. This service mainly supports the majority of resource-limited farmers who still find vaccines and drugs out of their reach because they are relatively expensive (Danø and Bøgh 1999; Guèye 1999; Masika *et al.,* 2000; Abbas *et al.,* 2002; Ghotge *et al.,* 2002). Moreover, the government of Botswana provides free veterinary programmes for major livestock diseases like foot and mouth disease (FMD), quarter evil, anthrax and contagious abortion, but farmers still have to take care of other diseases themselves. For instance, farmers are expected to care for internal and external parasites as well as several other conditions. Below is an elaboration based on a brief literature review conducted to give a perspective on the rationale and challenges on the use of ethnoveterinary medicines and on research on the critical aspects of this area of practice.

Rationale for the use of traditional veterinary medicines

Despite the advent of modern medicines, rural communities continued to rely on traditional medicines for several reasons. For instance, it is known that the subsidy through LACs is still out of reach for some farmers. In some instances, LCAs are far from farming areas and so drugs are not easily accessible (Moreki *et al.,* 1997, Moreki 2003). Culturally, subsistence farmers do not readily sell their livestock to buy anything that they do not perceive as important. Hence, a farmer would not sell an animal in order to buy medicines for other animals since their goal is to increase flock or herd size. They would rather use traditional medicines which are readily available. Other reasons include the following. Some livestock farmers still use traditional medicines because of the value attached to the practice of ethnomedicine. This indigenous knowledge has been passed down from generation to generation (Guèye 1999; Masika *et al.,* 2000); and it is a way of life for some farmers. Moreover, there are recent concerns about human health being affected by contaminated animal products. Some farmers have the perception that some human diseases are introduced through animal food products from animals treated with modern medicines. This is echoed by Siddique *et* . (2004) who stated that due to the toxic and adverse reactions of synthetic and chemical medicines, herbal medicine has made a comeback as its products are considered less toxic and safe. Furthermore, conventional remedies, especially those used for controlling ticks and worms, have the potential to pollute the environment despite their decreasing efficacy. According to Diehl *et al.* (2004) gastrointestinal nematodes of sheep and goats have developed resistance to anthelmintic drugs. When interviewing poultry farmers in Botswana, Moreki *et al.* (1997) came to the conclusion that traditional farmers use traditional remedies due among other things, the belief that they are more effective against some diseases. The reason why traditional medicine should be promoted is because it is cheap (Diehl *et al.,* 2004), it is not alien to farmers and, according to Masika *et al.* (2000) it is linked to indigenous plant germplasm conservation and also forms a base for future drug development. Finally, there are instances of self-medicating behaviour by livestock consuming some plants as describe below (Danø and Bøgh 1999; Villalba and Landau 2012). Despite these reasons, there are concerns about the quality and safety of medicines.

Challenges of safety, efficacy and quality of traditional veterinary medicines

In Africa, plants used as medicines are widely assumed to be safe. However, from the literature there is contradictory information about safety of these plants. For instance, Danø and Bøgh (1999) report that most herbal remedies do not contain acute toxins, but according to Fennell et al., (2004b) many are potentially toxic. The efficacy, safety and quality of raw medicinal plant materials and plant products depend on intrinsic or external factors (Adewunmi and Ojewole 2004). Contamination by microbial, chemical agents or other plant species may compromise the quality, safety and efficacy. Medicinal plants collected in the wild may be rendered unsafe due to misidentification, accidental contamination or intentional adulteration (Adewunmi and Ojewole 2004). Masika *et al.* (2000) found that the application of a standard dose of very concentrated

preparation may be the cause of toxicity, or the use of too diluted medicines could be the reason for the herbal medicine being considered by farmers to be too weak and ineffective. According to Guèye (1999), large doses of infusion of barks of *Cassia sieberiana* resulted in intoxication leading to death in treated guinea fowls. Traditional medicines can cause damages to genetic materials; therefore, they have the potential to cause long-term effects (Fennell *et al.,* 2004b). Their indications for use also vary. For instance, Kunene *et al.* (2003) recorded *Ziziphus mucronata* as a remedy for worms and diarrhoea while van der Merwe *et al.* (2001) noted it for the enhancement of fertility and for treating for sores and burns. According to Fennel et al., (2004b) this same plant has mutagenic effects in a Salmonella/microsome assay.

In the same vein, the methods of extraction and preparation are not standardised. This affects the quality and even the quality of preparation. Concerns over the quality of herbal products are further compounded by demand which is outstripping the supply of good quality ingredients (Adewunmi and Ojewole 2004). Moreover, there is a growing tendency to adopt new and potentially dangerous practices that involve crude mixtures of modern, potentially harmful drugs and chemicals that are readily available in black market (Ghotge *et al.,* 2002). For instance, Moreki (2003) found that due to inaccessibility of vaccines, village poultry farmers in Botswana use human medication and potassium permanaganate to treat chickens. Such chemicals such as paraffin, automobile oil and Jeyes Fluid were used for external parasite control.

From the above overview, it can deduced that there are contradictory information about the usefulness, quality and efficacy of traditional veterinary medicines; this calls for detailed toxicological and clinical studies in order to validate and confirm the efficacy, mechanism of action, identification of active ingredients and the toxicity or safety of these products and to encourage appropriate or discourage inappropriate use of these products (Masika *et al.,* 1997; Moreki *et al.,*1997; Guèye 1999; Regassa 2000; Ghotge *et al.,* 2002; Fennel *et al.,* 2004b; Ademola *et al.,* 2005).

Role of research in ethnoveterinary medicines

Regardless of the reasons why farmers still use ethnoveterinary medicines, it is necessary to find ways to integrate ethnoveterinary practice into the mainstream science and animal health care systems. Before this can take place, there is a need for research in order to document indigenous knowledge and practices pertaining to its application to animal production. Studies should focus on identifying plants uses and their active compounds. Coupled with the above mentioned studies, *in vitro* and *in vivo* tests to validate the efficacy of the extracted compounds should be carried out.

For illustration purposes, let us examine the following studies. An earlier study by Larson (1981) documented the ethnobotany of the Hambukushu people in Botswana and showed that some of the plants used by animals as fodder such as *Ficus sycomorus* (L,) *Peltophorum africana* (Sond.) and *Ochna pulchra*, are also used for human medicine. A recent study in Botswana (Gabalebatse *et al.,*2013) chronicles knowledge in ethnomedicine of farmers in Ngamiland district and indicated several traditional plants such *Euphorbia inaequilatera, Senna italic, Boscia albitrunca, Croton megalobotrys, Boscia foetida, Terminalia sericea, Gnidia capitata, Ximenia Americana, Grewia flavescens, Ziziphus mucronata,* and *Ansellia Africana,* as have been used for treating cattle diseases. A study by Masika *et al.* (2000) in South Africa found that 73% of farmers interviewed used some form of traditional medicine. van der Merwe *et al.* (2001) also found that local farmers in South Africa have a rich heritage of ethnoveterinary knowledge. In Ethiopia, Regassa (2000) found that the most common methods practised by peasant farmers to control ticks were the use of traditional herbs. When evaluating knowledge on the use of trees, shrubs and herbs by communal livestock farmers in South Africa, Kunene *et al.* (2003) noted that some plants were used for medicinal purposes. van der Merwe *et al.* (2001) and Abbas *et al.* (2002) recorded important ailments where traditional medicine is used: retained placenta, diarrhoea, gall sickness, mastitis, uterine and vaginal prolapse, fractures, eye inflammation, fertility problems, heartwater, internal parasites, red water and tick infestation. Another recent study in Botswana (Moreki *et al.,* 2012) chronicled various plants used for treating retained placenta in cattle such as *Burkea africanum*, *Terminalia serecea* and *Spirostachys africanum*. According to Guèye (1999), village poultry are almost never vaccinated with standard western type vaccines, most farmers rely on indigenous medicines. Moreki *et al.* (1997) recorded the use of *Cassia abbreviata*, *Senna italica* and *Aloe marlothii* to treat village poultry diseases in Botswana. Poultry parasites were treated using ashes from the wood of *Peltophorum africanum* and *Combretum Imberbe* (Moreki *et al.,* 1997) Elsewhere, *Aloe spp* are reported to treat symptoms of sleeping sickness in chickens (Guèye 1999); while *Aloe marlothii* is used by farmers to treat gall sickness parasites, diarrhoea, and retained placenta in livestock in South Africa (van der Merwe *et al.,* 2001). In Honduras, *Cecropia spp* are used in the treatment of retained placenta (Ketzis and Brown 2002). Several other studies have recorded the diversity of plants and their use (Gueye 1999; Danø and Bøgh 1999; Masika *et al.,*2000; van der Merwe *et al.,* 2001; Ketziz and Brown 2002; Kunene *et al.,* 2003).

The above documented usages of traditional veterinary medicines call for further research in order to gather the evidence necessary for their widespread promotion and utilization. It should be noted that the mode of administration of ethnoveterinary medicines is also an aspect that requires research. Although, generally the plants or herbs are administered in a crude form, it is knonw that preparations may be in the form of fresh parts, exudates, ashes, teas or concoction (Diehl et al.,2004). Various plants parts are used, including bulbs, bark, leaves, fruits, roots and flowers (Guèye 1999, Masika *et al.,* 2000). If not used fresh, the plant materials may be dried before they are stored (van der Merwe *et al.,* 2001; Fennell *et al.,* 2004a). Dried materials are ground into powder (van der Merwe *et al.,* 2001; Masika *et al.,* 2000) or tied into bundles (van der Merwe *et al.,* 2001), and some are roasted (Masika *et al.,* 2000). In other cases, the plants parts are soaked in either cold or hot water and left for some time to allow the active ingredient to infuse into the water (Guèye 1999; van der Merwe *et al.,* 2001; Masika *et al.,* 2000). Water extracts are commonly used for oral application and powders may be placed in drinking water. According to van der Merwe *et al.* (2001) liquids are applied as lotions or eye drops. Liquids may be derived from pressing the sap out of fresh leaves, stems, flowers and other plants parts (Masika *et al.,* 2000). Applications for skin diseases utilise lotions or paste made from mashed fresh leaves, and glycerine (Masika *et al.,* 2000) or vaseline (Abbas *et al.,* 2002) may be used as carrier for ear, eye or wound remedies. Powder may be mixed with animal fat from pigs or sheep to make a paste for skin conditions. Sometimes two or three of plants are mixed together since it is believed that these mixtures are more potent. After testing the anthelminthic activity of several medicinal plants, Diehl *et al.* (2004) concluded that inactivity from a single plant extract cannot be dismissed as being completely inactive since activities resulting from mixtures of different plant species or from the special procedure used in the preparation of the plant may be absent in the single extracts.

Another aspect is the dosing of ethnoveterinary medicines. Usually a 750 ml or 1000 ml bottle is used for oral dosing of the medicine (van der Merwe *et al.,* 2001): 750 ml in cattle and 375 ml in small stock irrespective of the concentration of the remedies (Masika *et al.,* 2000). This observation brings in the important question of dosing level and concentration of traditional medicines and their safe

use. It is therefore understandable that, given the wealth of bio-resources, availability of indigenous knowledge and the importance of livestock diseases in the animal agriculture in Botswana, it is important to embark on a systematic research on ethnoveterinary medicines to establish their safety, efficacy and quality.

Benefits of embarking on ethnoveterinary medicine research

Documenting indigenous knowledge held by herbal practitioners and older farmers is an urgent task, since contemporary youth view traditional medicine as backward (Masika *et al.,* 2000). This will serve as a modern bank of knowledge on which future drug development would be based. Ghotge *et al.* (2002) found that in India knowledge about traditional medicine is the prerogative of males who pass the information to their sons. However, documentation of this knowledge will make information available to women who, in most parts of Botswana, are involved in raising small stock and poultry as evident in a recent study by Gabalebatse *et al.* (2013). Breakdown of the traditional systems of knowledge transmission is concurrently linked to rapid depletion of local bio-resources (Ghotge *et al.,* 2002) and both need urgent attention.

When interviewing farmers in South Africa, Masika *et al.* (2000) found that there were concerns over improper harvesting techniques and over-exploitation of plants in rural areas by employees of city-based commercial herbalists. Sustainable harvesting methods are not a priority for marginalized gatherers for whom short-term financial incentives from plant trade outweigh the long-term benefits of conserving wild plant species (Fennell *et al.,* 2004a). This observation points out to the need for studies whos findings would be used for advocacy for the development of sustainable conservation policies (Masika *et al.,* 1997; Guèye 1999; Masika *et al.,* 2000; Ghotge *et al.,* 2002). Protection and promotion of the biodiversity of valuable herbal medicines could be achieved through community herbal nurseries and gardens (Ghotge *et al.,* 2002) and this will support the Convention on Biological Diversity (Danø and Bøgh 1999), to which Botswana is a signatory. Organised cultivation of medicinal herbs can help create wealth and status for rural communities (Danø and Bøgh 1999) and probably reduce biopiracy of plants through mandated sharing of benefits accruing from use of these plants. Research can help divise ways on how this should be done. Such studies would create awareness of existing cultural diversity that reflect the people who use these plants (Danø and Bøgh 1999) and will also promote multidisciplinary/transdisciplinary collaboration within the country and the sub-region respectively. For instance, the study by van der Merwe *et al.,* 2001 about indigenous medicine of Setswana speaking people of South Africa showed that the same local names of plants, their methods of application, and the diseases, symptoms and their correlation with herbal plants, are also known and applied by Tswana people of Botswana.

Currently, in Botswana, ethnomedicine is viewed by modern medical practitioners (human and veterinary) with scepticism, since it does not follow western paradigms of scientific proof of efficacy. A point in case is a reluctance to incorporate traditional medicine in the human health care system and a resistance to investigating the possible efficacy of traditional herbs on AIDS related symptoms. So, systematic research in traditional herbal medicine in animal science will promote credibility of ethnomedicine and increased its applications (Guèye 1999; Ghotge *et al.,* 2002). It will also promote collaboration between traditional healers and veterinarians. For example, healers would benefit from the enhanced diagnostic capability of veterinarians, while the latter would benefit from the healers's knowledge of the natural history of disease as well as their wealth of phytotherapeutics (Abbas *et al.,* 2002).

Studies in ethnoveterinary medicine would help develop strategies for biological disease management that may reduce organism resistance and environmental pollution (Danø and Bøgh 1999; Schwalbach *et al.,* 2003). Locally produced remedies based on local plants and herbs would be cheap (Diehl et al., 2004). Advanced study of local plants will enhance teaching of natural product chemistry in tertiary education, creating an impetus for further research. This may lead itself to the discovery of beneficial chemicals for both livestock and human ailments.

Challenges relating to veterinary ethnomedicine research

Veterinary ethnomedicine is a very new area of academic study (Danø and Bøgh 1999). In Botswana, it may be viewed with doubt, even by local scientists, the majority of whom were trained abroad and can only accept results validated by modern modes of testing. According to Danø and Bøgh (1999), this view can be reversed by the production of acceptable evidence.

Seasonality of some plants and herbs is a challenge for a sustained research endeavour. It is argued that developing nurseries and herbal gardens would circumvent seasonality of plants and herbs. When working with farmers in South Africa, van der Merwe *et al.* (2001) found that the ability or inability of plants to adapt to garden environments determines whether or not they could be cultivated. This would pose a challenge when developing herbal gardens and, hence, there will be a need for agronomic/physiology/tissue culture studies to facilitate propagation. The potency of medicinal plants is affected by the biochemistry of individual species, climate, geographical location, season and other ecological and growth conditions (Fennel *et al.,* (2004a). Although farmers feel that there is no difference between cultivated and wild medicinal plants (van der Merwe *et al.,* 2001), traditional healers believe that there are differences in potency (van der Merwe *et al.,* 2001; Fennell *et al.,* 2004a). This point should not be trivialised, since according to Fennell *et. al.,* (2004a), changes in the growth environment of the plant associated with transplanting it from wild ecosystem to cultivated field can result in modifications in plant growth, development and natural product content. Therefore, the challenge is to study the physiology of these plants relative to soil and other environmental conditions. In addition, there are diurnal and seasonal variations as well as variations in the different parts of the plant in the degree of activity of compounds (Diehl *et al.,* 2004).

Studies in South Africa indicated that there are various traditional ways of processing herbal plants (van der Merwe *et al.,* 2001; Masika *et al.,* 2000). Fennell *et al.,* (2004a) cautioned about the changes in activity of plants due to storage and preparatory treatments after collection. Some chemicals in the material may undergo photodecomposition and oxidative polymerisation. The ineffectiveness of medicinal plants reported by some farmers surveyed by Masika *et al.* (2000) may have been due to reduced shelf life caused by post-harvest degradation of the active ingredient(s). In that respect, Fennell *et al.* (2004a) proposed a similar production protocol to preserve high value food products, such as fruits and vegetable to be applied in the production of medicinal plant products. Contamination of medicinal plants by microorganisms, which may be pathogenic, is a possibility, especially with material sold by street vendors in cities (Fennell *et al.,* 2004a). A challenge would be to teach farmers and healers hygienic handling and preparation methods. Another challenge is the fact that, generally, traditional healers are secretive about their knowledge; but Danø and Bøgh (1999) reported that in comparison to human healers, livestock herders readily share information among themselves. Unlike healers of human ailments, herders often possess some knowledge of gross pathology through post-mortem signs (Masika *et al.,* 1997; Danø and Bøgh 1999) and this would help in establishing ethnodiagnositic protocols. For example, Abbas *et al.,* 2002 reported that due to post-mortem examinations of dead or slaughtered-salvaged camels, farmers in Saudi Arabia were able to appreciate role of helminthiasis

in the aetiology of debilities.

Example of research using traditional plants

There are few reports of experiments carried out under controlled environments with the aim of scientifically validating ethnoveterinary practices (Guèye 1999) and amassed evidence exist only for the control of internal parasites in sheep and goats with traditional plants (Athanasiadou, *et al.,* 2007). Efficacy of ethnoveterinary plant products against nematodes of sheep and goats has been observed in Nigeria (Amemola *et al.,* 2004; Ademola *et al.,* 2005), Zimbabwe (Kahiya *et al.,* 2003), Ivory Coast (Diehl *et al.,* 2004), in South Africa (Bizimenyera *et al.,* 2006) and, recently, in Botswana (Madibela and Jansen 2003; Madibela and Kelemogile 2008) where faecal egg count of internal worm and/or worm burden had been shown to have decreased as a result of the use of traditional veterinary preparations.

Furthermore, in Botswana, *V. verrucosum* was used as part of the diet for goats that were naturally infected with internal parasites. It was demonstrated that diets containing this plant reduce faecal egg count in goats (Madibela and Jansen 2003, Madibela et al., unpublished data). Ripe fruits of *Melia azedarach* were also found to reduce faecal egg counts of *coccidia* in male Tswana goats (Madibela and Kelemogile 2008). Bizimenyera et al., (2006) documented *in vitro* inhibition of *Peltrophorum africanum* on egg hatching and larval development of *Trichostrongylus colubriformis*. Further testing is needed over extended periods of time, which should evaluate the efficacy of such preparations against other parasites such as *Haemonchus contortus* which, according to Diehl *et al.* (2004), is a hematophagous nematode of veterinary importance throughout the world. There is also a need to obtain data on worm populations by necropsy procedures since Hounzangbe-Adote *et al.* (2005) noticed significance reduction in excretion of *H. contortus* eggs by sheep when fed with *Zanthoxylum zanthxyloides* (Fagara) leaves in Benin. Ademola *et. al.* 2004 and Ademola *et al.* (2005) observed that both the aqueous and ethanolic extracts of *Khaya senegalensis* and *Spondias mombin,* respectively, had inhibitory effects on larval development and survival of nematodes in sheep and reduced faecal egg count in Nigeria. Alawa *et al.* (2003) also found that extracts of *Annona senegalensis* reduced *in vitro* egg hatchability and larval recovery of *H. contortus*. Gathuma et al., (2004) observed 77, 89.8 and 90% egg reduction for *Myrsine africana*, *Albizia antihelmintica* and *Hilderbrantia sepalosa,* respectively, when compared to controls. The mixed nematodes encountered were *Haemonchus spp*, *Trichostrongylus spp* and *Oesophagostomum spp*.

The above short overview of ethnoveterinary research from various parts of Africa shows that, as far as internal parasites are concerned, indigenous plants have a potential role to be used in their control. There is a need to adopt an approach to ethnoveterinary medicine research.

Proposed approach to ethnoveterinary medicine research in Botswana

It is posited here that the starting point for this research would be to consult with traditional practitioners, farmers and healers. It is important to establish contact with traditional healers producing medicines for humans' use because their knowledge can used to treat corresponding animal disorders with the same herbs (Danø and Bøgh 1999). Using a participatory approach, studies should also collect information on associated skills, practices, beliefs and social structures pertaining to the practice of ethnoveterinary medicine. Multi-disciplinary teams with a spread of complementary skills are required for the various task For instance, plant identification should be done during the growing season; this would require fieldwork with traditional practitioners as guides as well as scientists such as botanists (van der Merwe *et. al.,*2001). A database of the information collected should then be maintained. This would result in learning sustainable collection techniques from farmers which will, in turn, benefit the development of nurseries programmes. Students of ecology, botany and conservation would greatly benefit from these excursions.

In *vitro* and *in vivo* studies should follow thereafter. These would require the participation of veterinarians, microbiologists, pharmacologists, physiologists, pharmacists and clinicians with an emphasis that throughout the process, there should be feedback to farmers and traditional healers involved in the studies. In addition, healers or original possessors of knowledge should be given credit and acknowledged, as proposed by Gathuma *et al.,* (2004) in Kenya.

As an example, the Sebele Content farm, on the outskirts of Gaborone City, is acollaborative endeavour, providing easy contact between scientists relevant to this type of work. Its major advantage is the right mix of scientists found in the collaborating institutions. These institutions are: Botswana University of Agriculture and Natural Resources (BUAN), Department of Agricultural Research (DAR) and National Veterinary Laboratory (NVL) (Figure 2). BUAN in its previous status as Botswana college of Agriculture was a constituent institution of the University of Botswana (UB) and hence it is assumed that its staff members would still collaborate and have access to the sophisticated equipment at Biological Sciences and Chemistry departments of UB.

A Faculty of Health Sciences should be part of this network even though the proposed mandate is for veterinary research. This is because most often same active ingredients are applicable for both human and livestock. A national programme by these institutions would have the capacity to do pioneering work on the wealth of ethnoveterinary medicine in Botswana. The success of such arrangement would be based on mutual respect and change of mind-set since the scientists come from different training background and professions. The desire to contribute something novel to the scientific development of Botswana and preservation of indigenous knowledge should be the driving force for such an endeavour.

CONCLUSION

This brief literature review has revealed that in Botswana and elsewhere, livestock farmers still make use of indigenous medicines to care about their animals. Several reasons explained this including ease of accessibility and availability as well as affordability. Similarly, several challenges are associated with the use ethnoveterinary medicines the issues of safety, quality, efficacy and dosing. These challenges call for more research to be conducted to validate practices to be encouraged and those that should be discouraged and outlawed. To do so, it is posited here that the starting point should be the involvement of traditional practitioners, farmers and healers; with the view of conducting studies that would establish the credibility about ethnoveterinary medicine; promote regional collaboration and the conservation of plants. Such endeavour requires multi-disciplinary and multi-institutional teams as well as shared values for it to succeed.

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