http://dx.doi.org/10.4314/ajtcam.v10i3.16

ETHNO-VETERINARY PRACTICES AMONGST LIVESTOCK FARMERS IN NGAMILAND DISTRICT, BOTSWANA

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Abstract

We carried out a study to determine ethno-veterinary knowledge used to treat and prevent livestock diseases in Toteng Village in Ngamiland District, northwestern Botswana. Primary data were collected through simple random sampling of 45 households in Toteng. Respondents were either livestock owners or cattle herders. Respondents were interviewed using a structured questionnaire which had both open and closed-ended questions. Cattle ownership or herdership in Toteng is an inter-generational occupation with people ranging from 15 to 94 years old. Cattle were acquired either through inheritance, buying, *mafisa* (reciprocal exchange) system or government scheme. Women in the study area were more involved in livestock farming activities. Eleven livestock diseases were reported to be prevalent in the study area. The top six diseases were *tlhako le molomo* -foot and mouth disease (FMD), *matlho* - eye infections, *letshololo*-diarrhea, *madi* -pasteurollosis, *mokokomalo* - aphosphorisis and *pholoso*- contagious abortion. At least nine medicinal plant species having ethno-veterinary applications were recorded in the study area. Single plants are mostly used rather than a combination of plants. A number of social strategies were mentioned such as '*go fetola mafudiso*' - to change grazing areas, and '*go thaa lesaka*' – to ritualistically 'protect a kraal' or livestock against evil spells and predators (lions). Although the intervention of conventional veterinary medicine is pervasive in Toteng, and many livestock owners are resorting to it, there is evidence, however, of generalized ethno-veterinary knowledge used to treat and prevent livestock diseases. Local farmers and their herders in Ngamiland are not only knowledgeable and experienced in treating a range of livestock diseases, but also in performing other veterinary tasks such as assisting in births, treating fractures and range management strategies to mitigate particular threats from their local environment. The efficacy of ethno-veterinary knowledge for preventing and treating livestock diseases and range management strategies identified in this study need to be fully investigated and integrated in veterinary extension services.

Key words: Okavango Delta, ethnoveterinary medicine, livestock diseases, indigenous Knowledge, traditional medicinal Plants, ethnodiagnostic skills.

Introduction

Livestock contribute up to 80% of agricultural GDP in developing countries, including those in Africa, and 600 million rural poor people rely on livestock for their livelihoods (ILRI, 2011). Therefore, livestock diseases are a major threat to sustainable livelihoods of rural communities in the continent. In Botswana, cattle are not only an important source of food and cash, but also a symbol of social and political power (Peters, 1994). Cattle are extremely vulnerable to impacts of contagious diseases and hydro-climatic changes (drought, floods and extreme temperatures) in Botswana (Scott Wilson Resource Consultants, 2000). In 1995, the country experienced the outbreak of the cattle lung disease or Contagious Bovine Pleuropneumonia (CBPP) in Ngamiland District. In an effort to eradicate the disease, about 220,000 cattle were culled in 1996. Post CBPP restocking started in 1998, and it is estimated that the current district herd stands at 350 000 cattle, and has surpassed pre-culling stock (personal communication, Scientific Officer, Department of Veterinary Services, Maun, 2011).

In Botswana, disease management is partly achieved through the construction of a network of veterinary cordon fences, quarantine camps and cattle crushes used by veterinary services. Veterinary cordon fences divide the country into disease control/prevention zones between which livestock movements are restricted. In the Okavango Delta, particularly the CBPP veterinary fences include the Ikoga, Samochima, Northern and Southern Buffalo and Setata. These fences make it easy to isolate livestock in case of disease outbreak incidences in any particular district/locality in the country. However, during drought episodes, fences have been noted to compound water and fodder stress levels of already distressed animals. Although the Northern Buffalo Fence (NBF) was erected primarily to control foot and mouth disease (FMD), and for separating buffalos (known to be transmitting FMD) from the cattle

population, the fence induces unwanted convergence of wildlife (especially buffalos) during the dry season at the western end where permanent water exists (Mbaiwa and Mbaiwa, 2006).

In Africa, farmers have indigenous methods to treat diseases using medicinal plant compounds, manipulative techniques and herd management socio-cultural procedures. The application of indigenous knowledge to treat animal diseases is also known as ethno-veterinary medicine, defined as an indigenous animal healthcare system that includes the traditional beliefs, knowledge, skills, methods and practices of a given society (McCorkle 1986; Yineger et al., 2008). Ethno-veterinary medicine comprises the traditional management of veterinary diseases, their remedies, and the spiritual elements associated with the healing procedures practiced by a local community (Mathias, 2004; Mathias-Mundy and McCorckle, 1996; Yineger et al., 2008). The modality involved in the production of ethno-veterinary medicines varies according to the active ingredients to be extracted, the route of administration and the medical intent (prophylaxis or therapeutics). Livestock owners and herders prepare infusions, decoctions, powders, drops, fumes, pastes and ointments from medicinal plant, animal, mineral and other non-plant substances. These could be administered topically as drenches, vaccinations or suppositories, through smoke, vapors or massages or intra-nasally.

In many developing countries, farmers and herders interface indigenous ethno-veterinary knowledge and modern veterinary health care systems to treat their livestock. However, the later is often unavailable due to either staffing problems in agriculture extension services or because synthetic drugs are expensive (McCorckle, 1986). Ethno-veterinary medicine therefore plays an important role in the animal health care system in Africa (Mathias-Mundy and McCorckle, 1996). It is perceived as simple, cost-effective, environment friendly, contextually appropriate and culture-based (Kolawole et al., 2007). Notwithstanding, there are several threats undermining its relevance in contemporary African societies. These include *inter alia,* ecological and technological changes, access to modern health facilities, anthropogenic and natural factors, threaten the existence of many plant species of veterinary importance (Hamilton, 2003; Yineger et al., 2008). Because the mode of transfer and documentation of indigenous veterinary knowledge has been, and still is, oral and apprenticeship specific, partial or total loss of accumulated medical heritage is likely (Longuefosse and Nossin, 1996; Yineger et al., 2008). In southern Africa generally and Botswana in particular, rapid socio-economic and outward rural migrations, and paucity of research on ethno-veterinary uses of medicinal plants in treating livestock diseases further undermines its relevance (Moreki, 2010; Matekaire and Bwakura, 2004; Maposa and Masika, 2010; Masika et al. 2000). There is, thus, an urgent need for documentation, preservation and protection of ethno- veterinary practices and medicinal plant resources for future generations in Botswana.

The objectives of this study were, therefore, to: (i) investigate the local knowledge of pastoralists on common/rare livestock diseases; (ii) investigate the type of diseases livestock farmers perceive to be able or unable to treat; (iii) investigate the types of treatment livestock farmers treat and prevent/control different diseases; and (iv) investigate collaborative relations between livestock owners and veterinary extension workers.

Materials and methods

Study area

The study was carried out in Toteng Village (Figure 1) in Ngamiland District (19 – 21° S and 21 – 25° E), northwestern Botswana, which had a population of 509 residents in 2001 (CSO, 2001). The average household size is five, about 45% of residents are illiterate, 23% can speak or write English, 27% can speak and or write other languages and 5% can speak English. About 60% of households in the village are headed by women (SRIC Consulting, 2009). Different ethnic groups are found in the village. Livestock farming is the major livelihood activity, and 46% of households breed and consume cattle while 6% are engaged in marketing them. The village is near Lake Ngami, which has abundance of water. The village is at the confluence of the Nhabe and Kunyere Rivers, which separates the village into two residential areas (wards). With regard to physical infrastructure development, there is a primary school, a health post, social welfare office, trading store and a veterinary extension services facility. There is also a *kgotla* (traditional court) and a *matimela* (stray) cattle holding kraal.

Sampling and data collection

Toteng is one of the main livestock rearing areas in Ngamiland. According to recent figures from the Department of Veterinary Services, the population of cattle in Toteng and the surrounding localities is 26 876 cattle (Department of Veterinary Services, Maun, 2011) and there are 127 cattle crushes. Baherero/Banderu and Batawana ethnic groups represent the majority pastoralists in the surrounding, and the land is used primarily as grazing land intermixed with small scale arable fields.

Ethical clearance for the study was obtained from the Department of Veterinary Services in Maun, Botswana, and verbal consent from the respondents. Then, primary data were obtained from a total of 45 households in Toteng selected through simple random sampling. Either a livestock owner or cattle herder (*modisa sing. badisa pl.*) was interviewed using an interview schedule. Both open- and closed-ended questions were used. The interview schedule

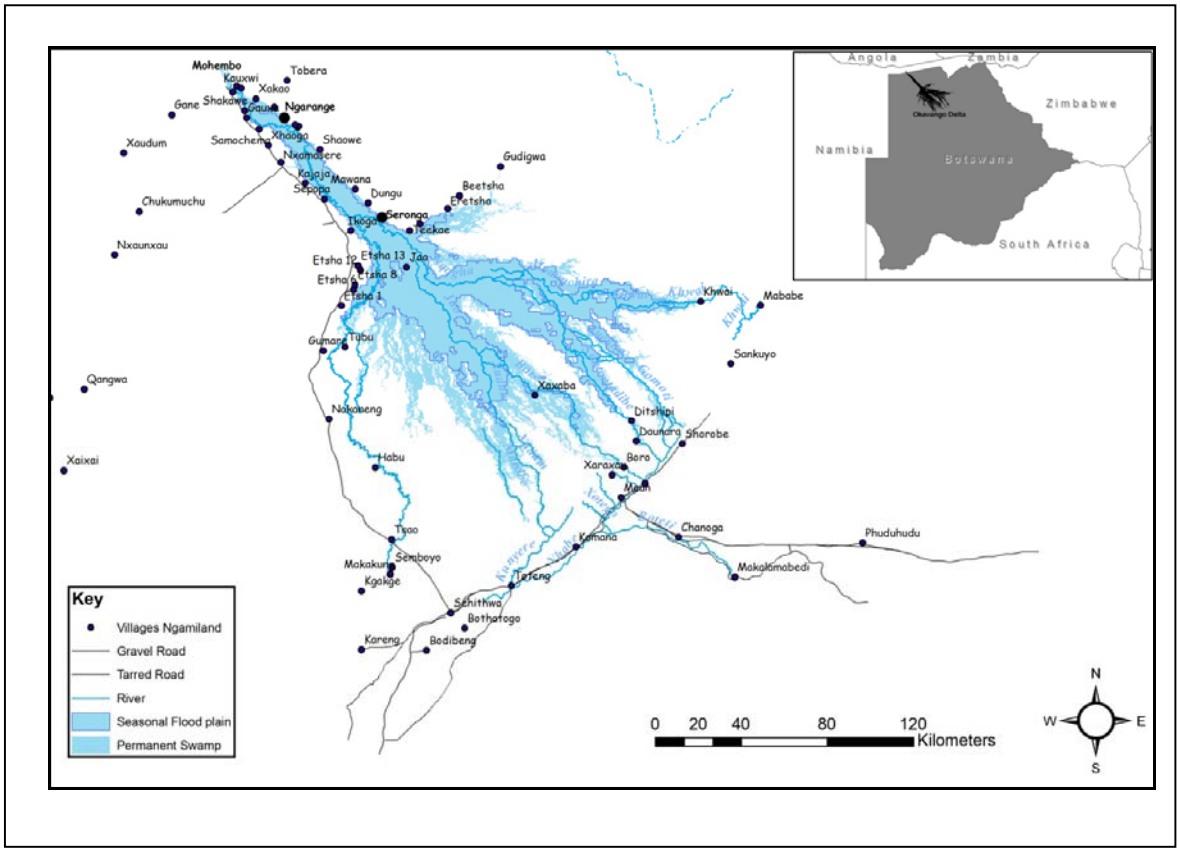

Figure 1: Village settlement and study site – Toteng in Ngamiland District (source: CSO, 2002).

was pre-tested among pastoralist in Sexaxa settlement, which is approximately 25 km from Maun. Pre-testing was meant to identify omission, and determine clarity, sequence and comprehensiveness of questions. After pre-testing, the questionnaire was revised and some new questions were added.

Data analysis

Quantitative data from the pre-coded survey instrument was entered into SPSS V16 and analyzed descriptively for frequency distributions and cross tabulations.Qualitative data from open-ended questions and discursive interviews were reduced into themes, which then provided the basis for the analysis (Miles and Huberman, 1994).

Results

Demography characteristics

Of the total respondents, 83 and 17% were males and females, respectively (Table 1). The majority of respondents had never been herders (89%). While about 33% of the respondents claimed they acquired their herds

through inheritance, 40% cent of them bought their production stocks. Also, 9% of them acquired some cattle through inheritance and bought some more, 10% got them through *mafisa (*exchange of cattle for labor to initiate and or increase the breeding pool*)* or *go tshwaelwa*, a system of premortem (rather than postmortem) earmarking animals ideally for each son born. Progeny of these cattle are his. The rest of the respondents acquired their herd through a government scheme.

1. Table 1. Ethnicity and gender of respondents

Ethnicity	Gender				Total	
	Female		Male		Number	Proportion (%)
	Number	Proportion (%)	Number	Proportion (%)		
Tawana	1	2	9	20	10	22
Banderu	3	7	7	16	10	23
Wayei	1	2	7	16	8	18
Baherero	2	4	4	9	6	13
Sarwa	1	2	4	9	5	11
Xhereku	-	-	4	9	4	9
Kgalagadi	-	-	1	2	1	2
Other	-	-	1	2	1	2
Total	8	17	37	83	45	100

The respondents belonged to different ethnic groups, namely Tawana, WaYei and Banderu. Banderu women were more involved in livestock farming activities (Table 1). The age range of cattle owners or herders was between 15 years and 94 years, with those aged between 45 and 84 in the majority (Table 2). The respondents acquired ethno-veterinary knowledge through direct observation as a young man/woman from adults, direct field observation at home and as herders, direct practice under guidance of adults and ecological knowledge by virtue of having been born and lived in the area. Sources of information on conventional veterinary knowledge included direct contact with veterinarians and veterinary extension service workers commonly known as *bakenti,* popular radio and Botswana television agricultural programs and through word of mouth.

Common livestock diseases and the symptoms recognized by farmers

Eleven livestock diseases were reported by the respondents to be prevalent in the study area (Table 3). The top six diseases, were *tlhako le molomo* [foot and mouth disease (FMD)], *matlho* (eye infections), *letshololo* (diarrhea), *madi* (pasteurollosis), *mokokomalo* (aphosphorisis) and *pholoso* (contagious abortion) (Table 3).

Table 2: Proportions of respondents in each age range group

Group No.	Age Range	Proportion of Respondents (%)
1	15-24	8.9
2	25-34	20.0
3	34-44	11.1
4	45-54	15.6
5	55-64	11.1
6	65-74	13.3
7	75-84	15.6
8	85-94	4.4
	Total	100

Various symptoms were reported for the prevailing animal diseases in the study area. All respondents indicated that they recognize FMD symptoms through observation of salivation, cracked hooves, mouth sore, loss of appetite and weight. Shedding of tears and pale coloration of the eyes were reported as the most known symptoms of eye diseases. More than half of respondents were conversant with the attack of diarrhoea in calves. The symptoms included frequent soft or watery faeces and loss of appetite. The presence of blood or worms in the faeces was also a widely known symptom for diarrhoea. Restlessness and sudden death were reported as symptoms of pasteurollosis. The symptom that was widely known for aphosphorisis was painful shoulders followed by difficulty in grazing, self isolation and stiffness of shoulders. Respondents identified lumpy skin by the presence of coarse textured sores in the skin of the animals and the spreading of fur (Table 3).

Table 3: List of the common animal diseases in the study area with their local names, number of respondents and symptoms with the numbers and proportion of respondents

Disease	Local Name	No. of Respondents	Symptoms	No. Of Respondents	Proportion (%)
Foot and mouth disease (FMD)	Tlhako le molomo	27	➢ Salivating	45	100
			➢ Cracked hooves	24	53
			➢ Sores on the mouth	24	53
			➢ Loss of appetite	22	49
			➢ Loss of weight	20	44
Eye diseases	Matlho	26	➢ Pale colouration	22	49
			➢ Tears	22	49
			➢ Lacrimation	13	29
Diarrhoea	Letshololo	23	➢ Frequent soft or watery faeces	30	67
			➢ Loss of appetite	30	67
			➢ Blood or worms on the faeces	26	58
Pasteurollosis	Madi	23	➢ Restlessness	17	38
			➢ Sudden death	16	36
Aphosphorisis	Mokokomalo	22	➢ Painful shoulders	23	51
			➢ Unable to graze	18	40
			➢ Isolation	15	33
			➢ Stiff shoulders	15	33
Lumpy skin	Morokologo	15	➢ Coarse textured sores	10	22
			➢ Spreading out of fur	9	20
Anthrax	Kwatsi	12	➢ Reluctance to stand up	18	40
			➢ Body stiffness	16	36
			➢ Sudden death	15	33
			➢ Shivering	12	27
			➢ Blood stained meat observed after death	11	24
Blackleg	Serotswana	12	➢ Stiff shoulders	29	64
			➢ Loss of weight	23	51
			➢ Bad smell from the carcass	22	49
Calf diphtheria	Sebete	9	➢ Loss of weight	9	20
			➢ Yellowish urine	9	20
			➢ Diarrhoea comprising of dark faeces	8	18
			➢ Salivating	8	18
Placenta retention	Mothana	7	➢ Retention of the afterbirth	13	29
Dystokia	Go harelwa	5	➢ Cow breathes fast and heavily	11	24
			➢ Cow moves from time to time	11	24
			➢ Unable to give birth	11	24

For *kwatsi* (anthrax), the most common symptom known to the respondents included reluctance to stand up followed by body stiffness, shivering, sudden death, and blood stained meat after death. Stiff shoulders were indicated by respondents as the common symptom of blackleg followed by loss of weight and a bad smell of a carcass. Symptoms of calf diphtheria mentioned included loss of weight and yellowish urine followed by diarrhea comprising dark feces and salivating. The retention of the placenta afterbirth was another condition. Finally, *go harelwa* (dystokia) symptoms mentioned were fast and heavy breathing, constant movement and inability to give birth (for cows) (Table 3). Infectious diseases mentioned by respondents were FMD (67%), *serotswana* (blackleg) (37%) and aphosphorisis (20%).

Causes of livestock diseases

Several causes were attributed to animal diseases by the farmers and herders (Table 4). Many respondents expressed that diarrhoea is caused by calves drinking too much milk. Feeding on grass infested with worms and drinking contaminated water were also suggested as other causes of diarrhoea. Almost half of the respondents indicated that FMD is caused when the cattle mix with wild animals, especially buffalos. Eye diseases were caused by insects, flies, dust, pricking by sharp objects and poor blood circulation. Considerable number of respondents thought that high temperatures and overfeeding caused aphosphorisis. Blackleg and pasteurollosis were both attributed to overweight and high temperatures. In addition, too much blood was also reported to contribute to pasteurollosis. Too much blood in the body of the animals and ingestion of insects were reported to cause anthrax. Respondents were of the opinion that birth complications as well as lack of pastures and water resulted in dystokia while contagious abortion caused placenta retention in cows (Table 4).

Table 4: Perception of farmers about the causes of livestock diseases

Disease	Causes	No. Of Respondents	Proportion (%)
Diarrhoea	➢ Calves drinking too much milk	31	69
	➢ Feeding on grass containing worms	22	49
	➢ Drinking poisoned water	9	20
FMD	➢ Mixing with wild animals	22	49
Eye disease	➢ Insects, flies or dust	21	47
	➢ Sharp objects pricking the eye	17	38
	➢ Poor blood circulation	4	9
Aphosphorisis	➢ High temperatures	19	42
	➢ Overfeeding	14	31
Blackleg	➢ Too much weight of cows	19	42
	➢ High temperatures	17	38
Pasteurollosis	➢ High temperatures	18	40
	➢ Too much weight	17	38
	➢ Too much blood	10	22
Anthrax	➢ Too much blood	14	31
	➢ Ingestion of insects	2	4
Dystokia	➢ Difficult birth	11	24
	➢ Lack of pastures and water	7	16
Placenta retention	➢ Contagious abortion	8	18

Modes and routes of administration of treatments against livestock diseases

Farmers apply various traditional treatments, including the use of different parts of some medicinal plants, against livestock diseases. Different preparations, modes and routes of administration of treatments of livestock diseases were reported by respondents (Table 5). Farmers pounded and chopped roots of five different plant species (Table 5), mix them with water and administer the infusion to the sick animals to treat diarrhoea. For treatment of blackleg, respondents indicated that a careful insertion of a thin wire of a considerable length into the throats of the ill calves was done. For aphosphorisis, respondents indicated that they use traditionally made boy's underwear, locally known as '*tshega*' (made of skins of mainly goats) and a stick to hit the ill animal so that it can straighten its body. To address dystokia, farmers thoroughly wash their hands up to the elbows with water and washing powder and place soapy hands inside the womb to tract the calf. Also, the cow is fed with kraal manure mixed with water so that the calf can get out easily.

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	➢ Poor blood circulation	4	9
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	➢ Overfeeding	14	31
Blackleg	➢ Too much weight of cows	19	42
	➢ High temperatures	17	38
Pasteurollosis	➢ High temperatures	18	40
	➢ Too much weight	17	38
	➢ Too much blood	10	22
Anthrax	➢ Too much blood	14	31
	➢ Ingestion of insects	2	4
Dystokia	➢ Difficult birth	11	24
	➢ Lack of pastures and water	7	16
Placenta retention	➢ Contagious abortion	8	18

Four different modes of treatment were used by the respondents to treat eye diseases, i.e. use of a hot metal to massage the eye, placing sugar and tobacco leaves in the eye, cutting the artery below the eye to release blood and, in turn, pouring it in the eye and placing infusion of roots of *Euphorbia inaequilatera* Sond. (*loestane*). To treat calf diphtheria, farmers use the infusion of chopped roots of *Senna italica* Mull. (*sebete/okatare*). The treatment against anthrax included cutting the tail of the animal to allow bleeding and feeding it with the barks of *Boscia albitrunca*

(Burch.) Gilg & Ben. Leaves of *Croton megalobotrys* Müll. Arg. are chopped and applied topically on the sores to treat lumpy skin (Table 5). Diseases treated only topically are placenta retention, eye diseases and lumpy skin. Diarrhea, black leg and calf diphtheria are treated orally. Aphosphorisis, dystokia, placenta retention and anthrax could be treated either topically or orally (Table 5).

Analysis of qualitative data from open ended questions suggests innovative methods of mixing medicinal plant and non-medicinal treatments. For eye treatment these include mixing blood with infusion of roots of *E. inaequilatera*, sugar with tobacco leaves, tobacco leaves with salt and sugar, ash or sugar with crushed leaves of *Boscia foetida* Schinz (*mopipi*), sugar and ash, and infusion of roots of *E. inaequilatera* with dry millipede. For placenta retention, powdered soap was mixed with salt, cow manure (*motshotelo)* and water or cow manure was mixed with ash and water. For relief of mastitis*:* the adder was gently massaged with petrol using a cloth.

Interesting, only two respondents mentioned the treatment of fractures (*thobega*) and treatment of infertility (perceived to be caused by continuous mounting by a bull leading to abortions or infertility - *moriba*). The respondents pointed out that the treatment of fractures is usually administered by traditional medicine practitioners (*Dingaka pl. Ngaka sing*). To prevent continuous mounting by a bull, the cow is deliberately injured around its genetalia with a hot stirrup (*setobele*). The injury makes the cow instantaneously avoid the bull mounting it, and thus prevents incidences of continuous abortion.

One of the plant species widely used by all ethnic groups to treat diarrhoea was *Terminalia sericea* Burch. ex DC. (*mogonono*). The other species used by two to three ethnic groups were *Gnidia capitata* L. *f.,* (*mokaikai*), *Ximenia americana* L.(*moretologana*), *Grewia flavescens* Juss. (*mokgompata*) and *Ziziphus mucronata* Willd. (mokgalo) while *Ansellia africana* Lindl. (*palamela*) was only known to BaKgalagadi and BaSarwa ethnic groups (Table 6). At least nine plant species having ethno-veterinary applications were recorded in the study area (Tables 5 and 6). Single plants are mostly used rather than a combination. Where a combination is mentioned, it is likely to be with non-plant material.

Table 6: Medicinal plants used to treat diarrhea by the different ethnic groups

Plant Species	Ethnic Groups and Number of Respondents					
	Wayei	Baherero and Banderu	Tawana	Xhereku	Kgalagadi and Sarwa	Total
Gnidia capitata L. *f.*	1	2	2	-	-	5
Terminalia sericea Burch. ex DC.	6	8	5	2	5	26
Ximenia americana L.	**1**	**3**	**-**	**-**	**-**	4
Grewia flavescens Juss.	1	1	2	-	-	4
Ansellia africana Lindl.	-	-	-	-	1	1
Ziziphus mucronata Willd.	-	1	2	-	-	3
Total	9	15	11	2	6	43

Mode of prevention and/or control of livestock diseases

Different modes were recorded as being used to prevent and/or control livestock diseases in the study area (Table 7). For example, calf diphtheria was the disease that was mentioned by most respondents as being preventable by using infusion from the root of *S. italica*. Treating all newly born calves with medicine made from *Terminalia sericea* was suggested as a preventive measure from diarrhoea by more than half of the respondents. Also, extensive milking of cows was suggested by some of the respondents as a preventive measure for diarrhea. Some of the respondents believed that blackleg can be prevented by cooking all the meat of a calf that had blackleg, eating it all at once in one place and burying the bones in a deep pit. This practice is commonly referred to as *go fitlhela.* Careful insertion of wires of a considerable size into the throats of all calves was suggested by some of the respondents as another means of preventing blackleg. To prevent pasteurollosis, the movement of animals is monitored and regulated to ensure that they do not become too fat by grazing pastures that are nutritionally very rich. It was indicated that placenta retention could be avoided in a pregnant cow by feeding it with ashes mixed with water. Pouring of infusion of roots of *E. inaequilatera* in a kraal is believed to prevent infection of animals by eye diseases (Table 7).

Table 7: Mode of prevention and/or control of livestock diseases by farmers

Disease	Prevention and/or Control	No. of Respondents	Proportion (%)
Calf diphtheria	➢ Feeding *Senna italica* medicine to the calves	23	51.1
Diarrhoea	➢ Giving all the newborn calves *Terminalia sericea* medicine	23	51.1
	➢ Milking cows extensively	14	31.1
	➢ Leaving calves to go out with their mothers	9	20.0
Blackleg	➢ Inserting wires into throats of all calves in case one calf is found infected	16	22.2
	➢ Cooking all the meat of a calf that had blackleg, eating it all in one place and burying the bones in a pit	14	31.1
Pasteurollosis	➢ Changing from pastures that have plenty of grass into ones with just enough grass	7	15.6
Placenta retention	➢ Oral administration of fire ashes mixed with water	7	15.6
Eye disease	➢ Pouring *Euphorbia inaequilatera* medicine in the kraal	8	17.8

Socio-cultural methods used to control/protect loss of livestock

A number of social methods were used to control herd loss (Table 8). To minimize drought impacts, some respondents practiced a strategy referred to as *go fetola mafudiso* - to change grazing areas by herd movement from most degraded areas to better pastures. Another strategy involved *go thaa lesaka* – to 'protect a kraal' – rituals are usually done by a traditional medicine practitioner (*Ngaka*) using medicinal plants to either cast away malevolent forces (witches, widows and women who had miscarriage) whose evil spell/curse is believed to result in loss of livestock.

Table 8: Social methods used to control loss of livestock

Social control	Purpose	No. of Respondents	Proportion (%)
Go fetola mafudiso	➢ To avoid drought impacts	22	49
	➢ To look for greener pastures	5	11
Go thaa lesaka	➢ To protect cattle evil forces (witches/women who miscarried) and attack by predators	17	38
	➢ To avoid cattle from going astray	16	37
	➢ To enhance regenerative capacity of cows	11	24
Go fetola lesaka	➢ To move out cattle from a muddy kraal, which can cause hooves of calves to fall out or cause foot rot	14	31
Go kgaola tsebe	➢ To cut ears of cattle to distinguish them from cattle of other people and	10	22
	➢ To allow for bleeding of lose "bad blood"	9	20

Medicinal plants are also believed to protect livestock against wild predators (lions). Approximately 49% of the farmers subscribed to *go thaa lesaka* practice. Some respondents used *go thaa lesaka* as a preventive intervention against stock theft, the propensity of cattle to go astray (*matimela)* and also as a mechanism enhancing herd regenerative capacity and for reducing incidence of *pholotso* (contaminated abortion). However, although 49% of the farmers acknowledged *go thaa lesaka* practice, when asked a follow up question whether they have ever consulted a *ngaka,* only 15% were affirmative.

Another strategy known as *go fetola lesaka* – to change the kraal - was reported especially, when the cattle kraal becomes too muddy. *Go fetola lesaka* is deemed necessary mainly to prevent the hooves of calves falling out, which can cause foot rot. Another method is *go kgaola tsebe* - earmarking. Farmers cut the ears of their cattle to remove "bad blood" (Table 8) and also for branding ownership (*letshwao*).

Modern veterinary medicine, livestock diseases and veterinary extension services

The respondents admitted that there are some diseases that cannot be totally treated or effectively treated by ethno-veterinary methods. About 70% agreed that FMD can only be treated by modern veterinary medicine since it is a fatal disease with serious economic effects and psychological trauma. A few respondents suggested that modern veterinary medicine is required to treat lung disease and '*dibokwana*'- worms, which are also less prevalent.

With the exception of very few respondents (4%), the majority of them indicated that they buy modern veterinary medicines to treat their livestock. The medicines bought included terramycin (91%), sulphur (67%), pasturella vaccine (29%) and eye ointments (27%). About 86% of the respondents who own up to 100 cattle contact veterinary extension workers either when their animals were ill or during scheduled vaccinations. This category of cattle owners were more sensitive to loss of food (high milk yielding cows) and income when a livestock farmer has to buy extra animals in order to replace the dead ones) due to disease outbreaks. One respondent with over 300 heads of cattle suggested that loss of livestock due to disease outbreaks was not a major threat to household wellbeing (Table 9), perhaps due to the respondent's strong socio-economic strength.

Table 9: Impact of livestock diseases on households and contact with veterinarians by number of cattle owned

Impact of diseases and Time of Contact with Veterinarians	Number of Animals Owned by Farmers				
	1 – 100	101 - 200	201 - 300	301 - 400	Total
A. Impact					
Loss of income	21	2	1	-	24
Loss of high milk yielding cows	5	-	-	-	5
High reduction in the number of herds	7	1	-	-	8
No impact	6	1	-	1	8
Total	39	4	1	1	45
B. Contact with Veterinarians					
When the animals are ill	28	2	1	1	32
During vaccination	11	2	-	-	13
Total	39	4	1	1	45

Thematic analysis of open ended questions indicated livestock cattle post (*moraka* sing. *meraka* pl.) in Toteng are individual or family oriented as there are no syndicates or farmers associations. Relationships were established with veterinary extension workers regarding annual schedule interventions such as vaccinations or in response to individual requests whenever an animal is sick. Furthermore, few cattle are kept in kraals in the main village just as most cattle stay in disperse locations at the cattle posts. Because these are dispersed and access is only through 4 x 4 wheel drives, *bakenti* (veterinary extension officers) are only available at designated cattle crush pans and specified schedules.

Discussion

Herd ownership in Toteng was either through inheritance or purchase, and livestock farming as livelihood activity in Toteng village is age- and gender-based. However, respondents between the ages of 45 and 84 demonstrated rich ethno-veterinary knowledge regarding treatment and prevention of livestock diseases in the area. Although ethno-veterinary knowledge is said to be dynamic and innovative, orality as a method of knowledge acquisition is often valorized and simply presented in a passive voice, with the recipients seen as empty vessels

(*tabula rasa*). This study has demonstrated that farmers have agency and have different pathways to acquire ethno-veterinary competence.

More men own more livestock than women in Toteng. Ethno-veterinary knowledge is gendered. Men and women possess different knowledge domain systems in different aspects of livestock production. Among Banderu ethnic group, women were involved in livestock farming and skilled to carry several tasks such as milking, slaughtering and treating sick animals. In parts of Botswana, where women and men together raise small ruminants and women are supposedly not involved in cattle production, women's knowledge of the management of all animals is equal to that of their sons and husbands (Peters, 1986). Detailed reports of women's IKS with regard to production are rare. Rural extension service workers and development planners rarely ask women about indigenous knowledge. This, thus, becomes a development problem.

Common diseases mentioned by most respondents were eye disease, diarrhea, foot and mouth and pasteurollosis. Eye disease is very prevalent due to thick vegetation, which gives rise to insects and flies. Although eye diseases were regarded as a less serious threat, respondents were quick to point out that if left untreated, these could have serious consequences such as permanent blindness. The outbreak of foot and mouth disease is a major village outcry. The disease is prevalent in this area because of the presence of buffaloes, which often cross veterinary cordon fences and come in contact with livestock. This is because FMD has very devastating socio-economic and psychological effects and cultural identity crisis.

At least nine plant species having ethno-veterinary applications were recorded in the study area. These are relatively few. Few farmers mentioned specialized treatment such as fractures. One farmer for instance, pointed out to the use of roots of *E. inaequilatera* (loetsane) in a kraal to prevent infection of animals with eye diseases administered by traditional medicine practitioners. Clearly, livestock farmers in this study held general rather than specialized ethno-veterinary knowledge. The study of Shen et al. (2010) carried out among the Nu pastoralists in North West China concluded that there were no publicly recognized specialists. Knowledge was derived from daily practice of livestock production although it does not mean that there are no ethno-veterinary specialists.

In an ethno- survey of 87 Traditional Medicinal Practitioner(TMP) in five districts, Andrea Marobela et al. (2010) found that 45% treated both human and livestock diseases. Furthermore, informal follow-up interviews in Maun revealed that there are ethno-veterinary specialists. A discursive interview with one of the ethno-veterinary specialist in Maun regarding treatment of cow infertility revealed that an infusion and oral administration of a combination of *Harpagophytum zeyheri* Decne.(*sengaparile*), *Commelina african* L. (*tshoo-la-khudu/tshegajakhudu*) and *S. italica* (*sebete*) roots was mentioned (p.c Ngaka TT, Maun, /03/2011). The mixture enables the cow to pick up weight and go on heat soon after. Also, root infusion of *S. italica* is given to women in confinement (*motsetse*). What is also interesting from the Andrea-Marobela et al. (2010) study is that some of the medicinal plants used for treating human diseases were also mentioned in the Toteng study for treating animal diseases. For instance, roots of *Terminalia serecea* (*mogonono*), mixed with other plants, are used for treating diarrhoea, sexually transmitted diseases, anemia, kidney and bladder problems (Ngwenya at al., 2008) and for treating placenta retention in cows (Moreki et al., 2012). The multi-purpose usage of some medicinal plants for treating both livestock and human diseases in the District could imply traditional bioprospecting (among herders and or traditional medicine practitioners). Pointers to traditional bioprospecting that often lead to new herbal development (Ole-Miaron, 2003; Makhubu, 1998), therefore, need further investigation.

Whereas under western veterinary science, diseases are named according to aetiological information, Toteng farmers' nomenclature of some diseases describes symptoms of those diseases. For example, *mokokomalo* (aphosphorisis) refers to the swelling and deformation of the animal body structure. *Madi* (pasteurollosis) is marked by too much blood in the skin. In Uganda, Tabuti et al. (2003) also found that the naming of diseases by local people is based on symptoms of the disease.

Causes of livestock diseases were associated with climatic conditions particularly high temperatures which give rise to disease bearing insects. The other causes mentioned were drought and poor feeding patterns. As elsewhere in Africa, ethno-veterinary medicine in Toteng is dynamic and adapt to various purposes through experimentation and generalizations about other situations

For most of the diseases mentioned as common, farmers were able to provide free, locally available treatments using medicinal plants and non-plant materials. A variety of medicinal plants used such as infusions, macerations and, seldom, decoctions have also been observed elsewhere (Mathias-Mundy and McCorkle, 1996). Treatments are normally administered orally, but in some cases medicines are also applied topically. Farmers in Toteng use powdered soap, ash, kraal manure (*motshotelo)*, tobacco leaves, salt, petrol and special methods such as massaging with hot metals, making cuts for blood-letting, use of wires and wood to treat cattle. The use of non-plant materials have also been observed elsewhere in Africa, e.g. the use of soap in Nigeria (Alawa et al., 2002).

Prevention and control of the various diseases and protection of cattle involve the use of medicinal plants and ritualized non-medicinal social practices involve burying the bones (a traditional practice known as *go fitlhela*), changing pastures (*go fetola mafudiso*), protecting the kraal (*go thaa lesaka*), changing the kraal (*go fetola lesaka*) and bloodletting by cutting of the ears (*go kgaola tsebe*). These strategies have also been used by Fulani in Nigeria, e.g. to control CBPP outbreaks (St Croix, 1972). Masika et al. (2000) observed the use of pastes and powders to treat livestock diseases in Central Eastern Cape in South Africa. Although a significant proportion of farmers reported that they have not consulted traditional medicine practitioners, the practice of *go thaa lesaka* is a specialized intervention. Farmers often see correlations and understand causality, but where they find gaps, they depend on spirituality or

value their belief systems to explain the phenomenon. This is the case not only with go *thaa lesaka* but also the use of *tshega* for aphosphorsis. *Go kagola tsebe* is also used as *lotshwao* (marker) of herd identifier in addition to branding (*tshipi*). Livestock owners understand the long- and short-term impacts of grazing along gradients of land use/land cover by using changing pasture indicators, *go fetola mafudiso.* Similarly, Roba and Oba (2009) reported that herders interpret vegetation changes in terms of rainfall variability, utilitarian values and intensification of land use in Kenya.
Diseases such as foot and mouth, pasteurollosis and CBPP are fatal. Hence, pastoralists in Toteng prefer western veterinary medical interventions for their treatment. However, most farmers have become dependent on veterinary medicine to treat diseases such as anthrax and blackleg although they have the indigenous knowledge to treat them. This is partly because farmers in Toteng have easy access to veterinary services from Maun town, which is located about 50 km away.

Conclusions

Although the intervention of conventional veterinary medicine is pervasive in Toteng, and many livestock owners are resorting to it, there is evidence however, of generalized ethno-veterinary knowledge used to treat and prevent livestock diseases. Local farmers and their herders in Ngamiland are not only knowledgeable and experienced in treating a range of livestock diseases, but also in performing other veterinary tasks such as assisting in births, treating fractures and range management strategies to mitigate particular threats from their local environment.
Diseases such as diarrhea of calves, calf diphtheria, placenta retention and eye infections were perceived treatable and preventable/controllable among the livestock farmers in Toteng village. Different medicinal plants and topical treatments are applied when treating cattle or preventing diseases. There are other socio-cultural methods that are applied by farmers to prevent the loss of their livestock. These include *go thaa lesaka*, *go fetola mafudiso*, *go fetola lesaka* and *go kgaola tsebe*. Other diseases such as foot and mouth, CBPP and pasteurollosis are fatal, and, hence, western veterinary medicine is regarded as effective means of treating them by farmers. Livestock farmers meet with veterinary extension workers if their cattle display symptoms associated with these diseases. They also buy veterinary medicines in order to treat their cattle at the comfort of their cattle posts. For diseases such as anthrax and blackleg, which are age long, most farmers have now perceived veterinary medicine as the last resort even though they can be treated traditionally.

Our results demonstrated that livestock diseases impact negatively on the households of farmers since livestock farming is their major livelihood activity. This impact is in the form of loss of income, reduction of the herd number and loss of high milk yielding cows. However, richer farmers are able to cushion themselves from cattle diseases and drought impacts because they have more financial means to develop water points and move cattle posts away from the congested communal areas.

The efficacy and effectiveness of either mono or multi-purpose use of medicinal plants or “esoteric” non-medicinal treatment modalities of livestock diseases by cattle farmers and herders in Toteng village is based on biological resources/natural products. These can provide pharmacologically active entities that could be developed as drugs or serve as the basis for mainstream drug discovery efforts in Botswana. There is a long standing precedent of natural products serving as a source of novel drugs and drug-like compounds (Guantai and Chibale, 2012:103). Patwardhan et al (2008:1) argues that typically reductionist approach of modern science is being revisited in the context of systems biology and holistic approaches of traditional practices. Innovative approaches such as reverse pharmacology and systems biology are based on traditional medicine knowledge (Guantai and Chibale, 2012:107). The integration of natural product drug discovery into modern drug discovery paradigms using innovative approaches (such as reverse pharmacology) could be used to scientifically validate and technologically standardize medicinal plants used by cattle owners and herders in Botswana.

The efficacy of ethno-veterinary knowledge for preventing and treating livestock diseases and range management strategies identified in this study need to be fully investigated and integrated in veterinary extension services. More research from a gender perspective is needed to document specialized ethno-veterinary knowledge not only of cattle but also of small stock such as goats and chickens. It is important that livestock farmers share ideas on traditional knowledge with modern veterinarians in order to optimize productive capacity of herds and enhance sustainable rural livelihoods. More research is needed to explore untapped reservoir of women’s ethno-veterinary knowledge so that it can be integrated into extension service provision.

Acknowledgements

The assistances received by the first author from Professor D.L. Kgathi, Mr. Khaneguba, farmers, people of Toteng, the Director of Veterinary Services in Maun, Dr. Motshegwe and the Scientific officer Ms. T. Chilume, the Toteng Veterinary Extension Officer, Mr. C. Murangi and staff members of Okavango Research Institute, are gratefully acknowledged.

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