Ethnoveterinary medicinal plants in rural settings of Bahir Dar district, Ethiopia

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ABSTRACT

Most Ethiopian farmers and pastoralists rely on locally available plants to treat diseases of their domestic animals. Such knowledge needs to be recorded and transmitted to generations before it is eroded. In this study, the ethnoveterinary medicinal plants and the associated ethnoveterinary knowledge of farmers in Bahir Dar City Administrative Zone, Ethiopia, was documented. Seventy two informants were purposively selected from six study sites (kebeles). Semi-structured interviews, field observations and focus group discussions were used to collect ethnoveterinary information. Data were analyzed using quantitative approaches. A total of 69 plant species were used in the treatment of 36 livestock ailments. Plant species belonging to families Fabaceae and Solanaceae were frequently used. Roots of 32 species followed by leaves of 29 species were often utilized for remedy preparation. The majority of medicinal plants (72.5%) were harvested from the wild. Herbs constituted the dominant growth form used accounting for 40.6%. Most remedies were prepared in concoction/blend form. The majority of preparations (64.4%) were orally administered. Knowledge of medicinal plants is positively correlated with age of informants. In this study, *Phytolacca dodecandra* was found to be the most frequently used medicinal plant followed by *Cucumis ficifolius*. However, *Cucumis ficifolius* and *Ipomoea simonsiana* were the best and equally preferred species in the treatment of the most frequent disease locally known as "Kumegna." It could be concluded that indigenous knowledge and the practice of using medicinal plants was still the major animal health care system in Bahir Dar rural community.

Keywords: Ailment, Ethnoveterinary, Indigenous knowledge, Medicinal plants, Livestock
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INTRODUCTION

Ethnoveterinary practice is as old as the domestication of various livestock species. According to the World Health Organization (WHO, 2010), at least 80% of the people in developing countries depend largely on indigenous practice for the treatment of animal ailments. Ethnoveterinary medicines are accessible, easy to prepare and incur little or no cost to the farmer. Conventional drugs are relatively expensive and sometimes unaffordable to resource-limited farmers. Therefore, plants are the most commonly used ingredients in the preparation of ethnoveterinary medicines.

Thanks to its diverse topography, Ethiopia has high diversity of plant species (Sultan Mohamed and Berhanu Abraha, 2013; Berhanu W. Meshesha *et al*., 2015) many of which are used in traditional medicines. The country is believed to be the home for about 6000 – 7000 species of higher plants with 1150 (about 19%) of endemism (USAID, 2008). This makes it one of the six plant biodiversity rich countries of Africa (Endashaw Bekele, 2007). About 60% of the plants that are said to be indigenous have healing potential (Mesfin Tadesse *et al*., 2005; Endalew Amenu, 2007). Plant remedies are still the most important and sometimes the only sources of therapeutics for nearly 90% livestock population (Tadesse Berhanu *et al*., 2014).

Modern livestock health care is still low in the country due to lack of adequate clinics and supply of drugs. Besides, most modern drugs are so expensive that they are not affordable to the majority of Ethiopian farmers and pastoralists, most of whom are, therefore, forced to rely on their traditional knowledge, practices and locally available materials (mainly plants) in the control of diseases of their domestic animals (Miruts Gidey and Gobena Ameni, 2003; Fekadu Fullas, 2010). However, such rich ethnoveterinary knowledge, which has been transferred orally from one generation to the next from time immemorial, is currently in danger of being lost due to continued environmental degradation as a result of deforestation, agricultural expansion, overgrazing and recurrent drought as well as overexploitation and destructive harvesting of the medicinal plants themselves (Endashaw

Bekele, 2007, Ermias Luekal *et al.*, 2008]. The loss of these plants also is succeeded by the loss of the traditional knowledge on ethnoveterinary medicinal practices. Thus, there is a need for documentation of the knowledge and the medicinal plants so that conservation measures could be applied. In this study, a survey of ethnoveterinary medicinal plants and the associated ethnoveterinary knowledge of people in rural kebeles of Bahir Dar city (Ethiopia) were conducted.

MATERIALS AND METHODS

Description of the study area

Samples were collected from six rural *kebeles* (the smallest administrative units in Ethiopia) of Bahir Dar city, northwest Ethiopia (Figure 1). The area lies between 11°28' - 11°39'N latitude and 37°15' - 37°40' E longitude. Based on the 2007 census conducted by the Central Statistics Agency of Ethiopia (CSA, 2008), the city administration had a total population of 221,991 of whom 108,456 were males and 113,535 females.

Livestock population in the study area

The total number of livestock in the rural kebeles of the city administration in 2013 was 139,596 consisting of 76,650 cattle, 18,214 ovine, 8,480 equines and 36,252 poultry (Bahir Dar City Administration Agriculture Office, personal communication). However, their productivity was very low due to various types of diseases and poor management. Except in satellite towns and at the center of the city, there were no veterinary clinics in the area. Even those found in satellite towns themselves were not well organized and equipped. Therefore, the rural people are forced to use traditional medicines for the treatment of their livestock. The major livestock diseases reported include anthrax, black leg, lump skin disease, coccidiosis, gastrointestinal disturbances, eye diseases and ectodermicones (personal communication with Bahir Dar Veterinary Clinic experts).

Selection of informants and data collection

The ethnoveterinary botanical survey was conducted between March 25, 2015 and June 30, 2015. A cross-sectional study with integration of rapid ethnobotanical appraisal (REA) was used (Martin, 1995). Seventy two (68 males and 4 females) informants were purposely selected, i.e., 10 to 14 from each kebele. All were traditional healers. Selection was based on information obtained from elders of the community, users and veterinary health officers. Inaccessibility to veterinary clinics was also considered. Ethnobotanical data were collected using semi-structured interview, field observation, and group discussion. Willingness of informants was first confirmed by creating awareness through discussion. During the field observation, plant specimens were collected and pressed for identification.

Specimens were identified by using taxonomic keys of 'Flora of Ethiopia and Eritrea' (Hedberg and Edwards, 1989; Edwards *et al*., 1995; Edwards *et al*., 1997; Hedberg *et al*., 2003; Mesfin Tadesse, 2004; Hedberg *et al*., 2006, Ermias Dagne, 2009). Specimen identifications were confirmed at Addis Ababa University National Herbarium.

Data analysis

Descriptive statistics were used for quantifying plant habit, plant parts used and methods of preparation, dosages and routes of administration. Pearson's correlation analysis was used to determine correlation of medicinal plant knowledge with age range or education level of informants. The level of homogeneity between information provided by different informants was calculated using informants' consensus factor for 10 use-categories. Preference ranking (Martin, 1995) was performed using seven selected key informants for 10 medicinal plants on the basis of healing power of gastrointestinal disease locally known as "Kumegna". Nine plants were ranked on the basis of their curative power of different ailments. Direct matrix ranking (Martin, 1995) was also done for six multipurpose medicinal plants in eight use-categories (medicinal,

fodder, food, firewood, construction, charcoal, fencing and furniture) using seven selected key informants

Finally, the average use-value for each category was calculated and then the mean values of each use-category were summed up for each plant species and ranked. Fidelity level (FL) (Alexiades, 1996) was calculated for medicinal plants used to treat "Kumegna" and eye disease that were frequently reported in the study area.

Research ethics

All respondents were not only voluntary to participate in the study but were also free to withdraw their information and quit their participation at any moment in time. The work was done in areas accessible by the rural community (not in protected areas).

RESULTS AND DISCUSSION

Indigenous knowledge of people on ethnoveterinary medicinal plants is a traditional and local knowledge developed by a given community (Cotton, 1996). In many communities, it is a means of survival that has been developed through practical experiences and continuous testing. Rural people of Bahir Dar City Administration have rich indigenous knowledge in several aspects of ethnoveterinary practices. For example, they have a wealth of knowledge on preparation of plant remedies for livestock health problems. They also have developed medicinal and ritual uses of plants for maintaining the health of animals. Informants who participated in this study were all traditional healers (herbalists). Majority of healers 51 (70.8%) reportedly received the knowledge of medicinal plants from their parents. A little over 25% of them said they obtained the skill from close relatives and a mere 3% of them from the general community. It is worth noting that in the study area knowledge and practice of ethnoveterinary medicinal plants was not documented in written form; it instead was transferred orally secretly.

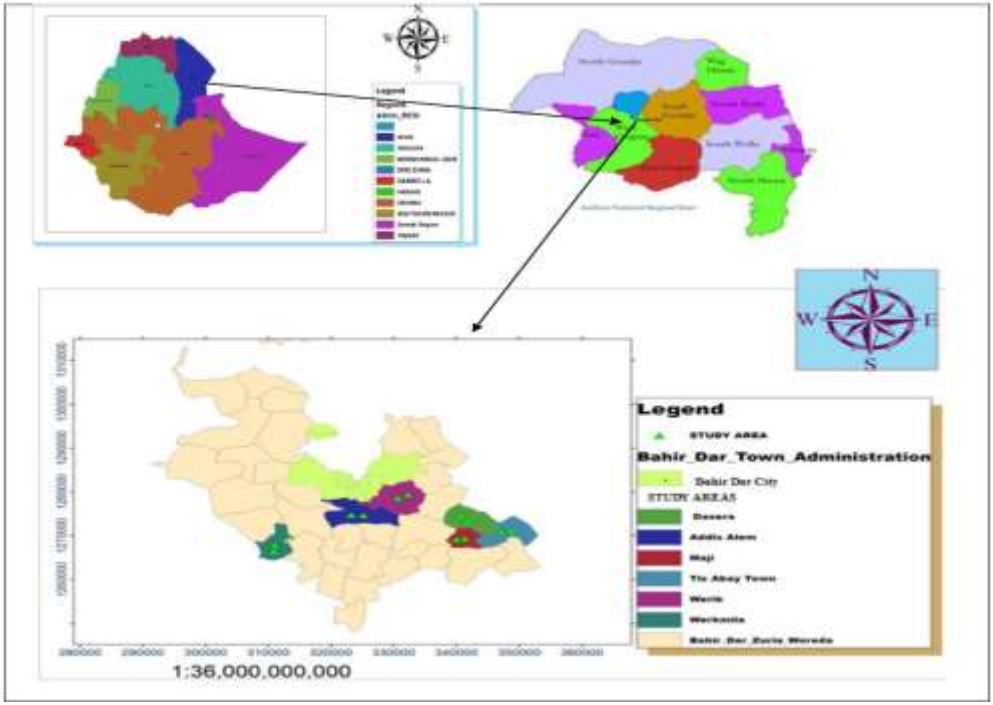

Figure 1. Location of sampling sites in the study area

Majority of the informants 41 (57%) were not willing to transfer their knowledge except to the honest and faithful son. The community and healers of the study area believed that there were livestock diseases that were curable by traditional medicine only. For example, diseases like 'Kumegna' (gastrointestinal disturbance), 'Wurja' (abortion), infertility of a cow, poor mothering, eye disease, 'Azurit' (coenurosis) and rabies were believed to be not cured by modern medication. Consequently, it was usually local herbalists who treated these diseases since the community believed that such diseases were cured only by traditional medicine.

Ethnoveterinary medicinal plant species in the study area

The community members used plants as source of medicinal remedies, food, fodder, fence, firewood, construction and furniture. A total of 69 veterinary medicinal plant species that were used as part of medicinal remedies were identified (Appendix 1). From the total documented veterinary medicinal plants, 54 (78.3%) were used by the local people as remedies for treatment of livestock ailments only, while 15 (21.7%) were used for both human and livestock aliments. The utilization of such high number of veterinary medicinal plants by the people indicated dependency of the people on traditional medicinal remedies for the treatment of their livestock.

Taxonomy of ethnoveterinary medicinal plants

The documented 69 veterinary medicinal plant species belonged to 62 genera and 42 families. Fabaceae and Solanaceae were represented by five (7.2%) species each, followed by Vitaceae and Asteraceae constituting four (5.8%) species each; Cucurbitaceae, Euphorbiaceae and Ranunculaceae with three (4.3%) species each; Moraceae, Asclepidaceae, Brassicaceae, Malvaceae, Polygonaceae and Apiaceae had two (2.9%) species each; and the rest twenty eight families constituted only one (1.4%) species each. Plant species in Fabaceae were being used as medicine in many parts of Ethiopia (Miruts Gidey and Gobena Ameni, 2003; Berhanu Admassu, 2001; Gebremedhin Gebrezgabiher *et al.*, 2013 and Gebremedhin Romha *et al.*, 2015).

Habitat of ethnoveterinary medicinal plants in the study area

Most ethnoveterinary medicinal plants were collected from the wild vegetation (Figure 2). Out of the 69 veterinary medicinal plants recorded, 50 (72.5%) species were collected from the wild vegetation.

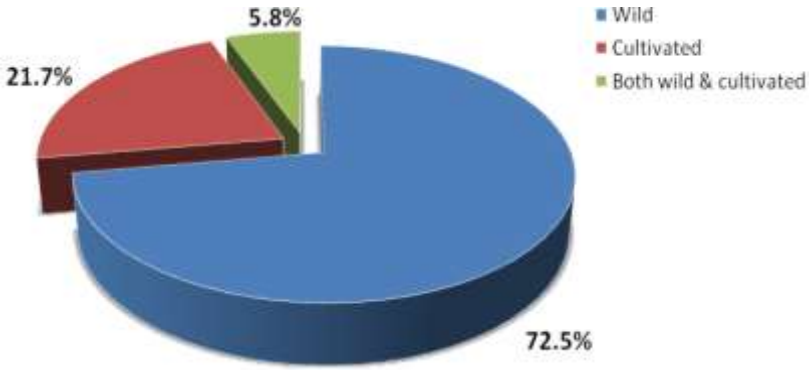

Figure 2. Habitat of ethnoveterinary medicinal plants in rural kebeles of Bahir Dar City Administration

Growth habit (form) of ethnoveterinary medicinal plants

Analysis of growth form (habit) revealed that herbs constituted the largest portion followed by shrubs (Figure 3). This was similar to other surveys made elsewhere in Ethiopia (Gebremedhin Gebrezgabiher *et al*., 2013; Tadesse Berhanu *et al*., 2014; Tadesse Berhanu and Dereje Abera, 2015; Gebremedhin Romha *et al*., 2015).

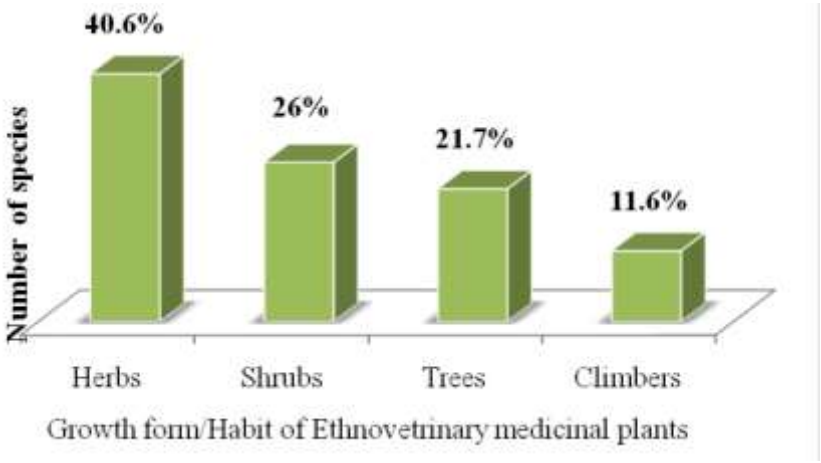

Figure 3. Habits/growth form of ethnoveterinary medicinal plants in Bahir Dar rural kebeles

Plant parts used to for the treatment of livestock and human diseases

In this study, roots were found to be the most widely used plant parts for the preparation of the remedies, followed by leaves (Figure 4).

Using roots could affect the future availability of the plants because uprooting destroys the plant completely. Currently, abundance of some species such as *Myrica salicifolia*, *Securidaca longepedunculata* and *Echinops kebericho* is highly diminished due to overharvesting of their barks and roots.

Methods of preparation of plant remedies for the treatment of livestock ailments

Based on the type of the disease, the local people employed several methods to prepare ethnoveterinary medicines. The highest mode of preparation was concoction (60 preparations, 36.3%), followed by

crushing/pounding and homogenizing with water (42 preparations, 25.5%) (Table 1).

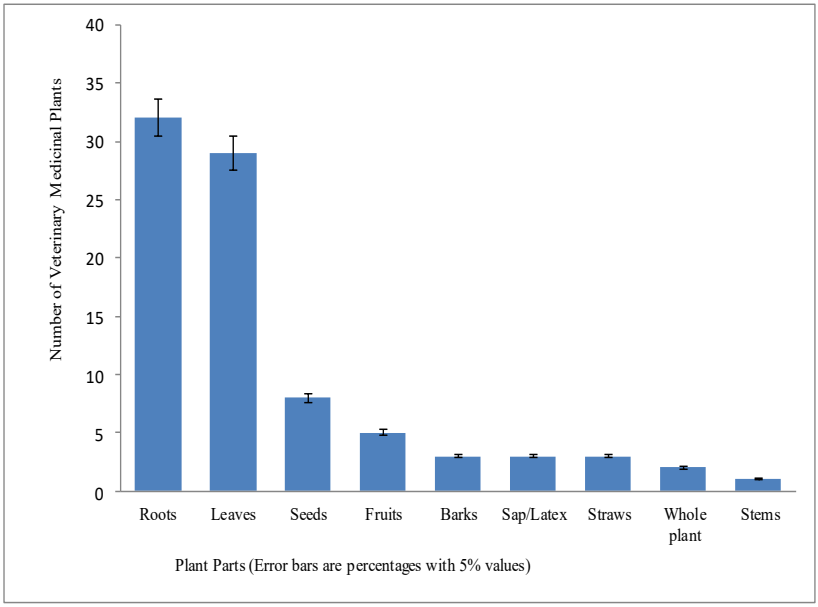

Figure 4. Plant parts used for the preparation of medicinal remedies

Among the total preparations, 22% were made from the mixture of two or more plant parts, which improved the efficacy of the remedies in treating different livestock ailments. In addition, the majority of the remedies were prepared by mixing different such additive substances as honey, sugar, milk, whey, butter, salt, and millet powder. These additive substances have double functions, i.e., they improve flavor, reduce adverse effects such as vomiting and diarrhea and enhance the efficacy of healing. The majority (75%) of the plant remedies were prepared from fresh plant parts.

Table 1. Method of preparation of ethnoveterinary medicines to treat livestock diseases

Methods of preparation	Number of remedy preparation	Percentage of preparation
Concoction	60	36.3
Crushing/ pounding & homogenizing	42	25.5
Squeezing	15	9.0
Crushing/chopping	11	6.6
Smoke bath	9	5.4
Chewing	8	4.8
Tying	8	4.8
Powdering	5	3.0
Decoction	3	1.8
Roasting	2	1.2
Steam bath	1	0.6
Heating	1	0.6

Routes of administration and dosage determination in treatment of livestock

The route of application depends on the kinds of diseases to be treated. The major routes of administration in the study area were oral, topical, nasal and optical. Both oral and topical administration routes permit rapid physiological reactions and increase curative power.

Major use categories of the medicinal plants

In this study, a total of 830 use reports (Ur) from 170 frequencies of occurrences among 69 ethnoveterinary medicinal plants species were recorded. In addition to medicinal values, the plants were used for other multiple purposes (use categories) by the indigenous community (Table 2). Analysis of informant consensus factor (ICF) revealed that there was uniformity in using plants (Table 2). In addition to their medicinal values, informants agreed that the medicinal plants played other multiple roles.

For example, such plants grown or harvested for sale as for firewood, timber, etc. took the highest ICF value of 0.82.

Table 2. Quantitative analyses of 10 use categories of the medicinal plants for the local people in the study area

Use category	No. of species (nt)	Species (%)	Use reports (Ur)	Use reports (%)	ICF
Medicinal	69	100	356	43	0.81
Food	10	14	47	6	0.80
Forage	14	20	57	7	0.77
Fence	12	17	60	7	0.81
Fire wood	18	26	67	8	0.74
Charcoal	9	13	19	2	0.55
Construction	15	22	68	8	0.76
Furniture	4	8	13	2	0.75
Commercial	20	29	110	13	0.82
Miscellaneous	7	10	33	4	0.81
		Mean ICF			0.76

Note: ICF = nUr – nt/nUr-1 where nUr is number of use reports from the informants while nt is the total number of medicinal plants used.

Types of livestock diseases and traditionally used medicinal plant species

In this study, a total of 36 livestock health defects were documented. Each health problem could be treated using only one or more types of medicinal plant species (Table 3). Among the recorded health defects, 28 (77.8%) were treated using two or more types of medicinal plant species in mixed form or separately while 8 (22.2%) were treated using only one species (Table 3). For instance, to treat 'Kumegna' the local people used 11 types of medicinal plant species. Similarly, rabies, bloating and eye diseases were treated by 10 types of plant species each. To treat anthrax and coccidiosis, the local people used nine plant species. This shows the availability of alternative sources of phytochemical species to treat the same type of disease.

Table 3. List of major livestock diseases and types of medicinal plant species used to treat livestock by the local people

No	Local (English name) of disease	Ethnoveterinary medicinal plants used	Species used (#)
1	'Kumegna' (Gastrointestinal disturbance)	*Cucumis ficifolius, Verbascum sinaiticum, Carissa spinarum, Aloe* spp., *Asparagus africanus, Ficus vasta, Thalictrum rhynchocarpum, Ipomoea simonsiana, Canarina abyssinica, Cyphostemma cyphopetalum, Kleinia* sp. (Local name)	11
2	'Yeayen himem' (Ocular disease)	*Eclipta prostrata, Gossypium barbadense, Zingiber officinale, Cynoglossum coeruleum, Maytenus senegalensis, Rhus vulgaris, Premna schimperi, Achyranthes aspera, Brucea antidysenterica, Phytolacca dodecandra*	10
3	'Yewusha lekfet'(Rabies)	*Phytolacca dodecandra, Carissa spinarum, Brucea antidysenterica, Calpurnia aurea, Justicia schimperiana, Croton macrostachyus, Euphorbia abyssinica, Capparis tomentosa, Ficus vasta, Cyphostemma pannosum*	10
4	'Hod menfat' (Bloating)	*Brassica carinata, Phytolacca dodecandra, Cyphostemma adenocaul, Justicia schimperiana, Allium sativumCoriandrum sativum,*	10

		Croton macrostachyus, Vernonia amygdalina, Lepidium sativum, Capsicum annuum	
5	'Kureba' (Anthrax)	*Phytolacca dodecandra, Calpurnia aurea, Cucumis ficifolius, Justica schimperiana, Brassica carinata, Ricinus communis, Verbasicum sinaticum, Rumix nepalensis, Carissa spinarum,*	9
6	'Maze' /'fengel' (Coccidiosis)	*Phytolacca dodecandra, Calpurnia aurea, Justicia schimperiana, Brucea antidysentrica, Nicotiana tabacum, Eucalyptus camaldulensis, Allium sativum, Melia azedarach, Croton macrostachyus*	9
7	'Kusel' (Wound /Myasis)	*Sida rhombifolia, Echinops kebericho, Ricinus communis, Brucea antidysentrica, Cyphostemma panosum, Buddleja polystachya, Clematis simensis*	7
8	'Yehod telatel' (Helementiasis)	*Phytolacca dodecandra, Croton macrostachyus, Justicia schimperiana, Nigella sativa, Allium sativum*	5
9	'Engeren' (Ascariasis)	*Phytolacca dodecandra, Ricinus communis, Momordica foetida, Brassica carinata, Justicia schimperiana*	5
10	'Kuro' (Equine strangle)	*Securidaca longepedunculata, Echinops kebericho,*	5

		Coriandrum sativum, Linum usitatissimum, Pisum sativum	
11	'Mich'(swelling of oxen neck)	*Ricinus communis, Momordica foetida, Microglossa pyrifolia, Cyphostemma cyphopetalum*	4
12	'Serail, (un known disease)	*Kanahia laniflore, Cyphostemma adenocaule , Calpurnia aurea, Cyphostemma molle*	4
13	'Wurja' (Abortion)	*Ficus cycomorus, Cucumis ficifolius, Gardenia ternifolia, Stereospermum kunthanum,*	4
14	'Tegen' (Bone fracture)	*Achyranthes aspera, Stephania abyssinica, Asparagusafricanus, Dichrostachys cinerea*	4
15	'Adef' (Placental retention)	*Cucuribita pepo, Grewia ferruginea, Linum usitatissimum*	3
16	'Aleket' (Leech infestation)	*Nigella sativa, Cyphostemma adenocaula, Nicotiana tabacum*	3
17	'Tefena' (Sheep Nasal-infection)	*Solanum marginatum, Solanum dasyphyllum, Vicia faba*	3
18	'Kemal' (Lice Infestation)	*Calpurnia aurea, Rumex nervosus , Millettia ferruginea*	3
19	'Shile maseyaza' (Cow infertility)	*Myrica salicifolia, Ferula communis*	2
20	'Yeaheya hodmenfat'(Equines bloat)	*Verbasicum sinaticum, Coriandrum sativum*	2
21	'Sal' /cattle cough/pneumonia	*Verbasicum sinaticum, Calpurnia aurea*	2
22	'Yetut himem' (Mastitis)	*Datura stramonium, Asparagus africanus*	2

23	'Kizen' (Cattle diarrhea)	*Cucumis ficifolius, Verbasicum sinaticum*	2
24	Sheep cough/pneumonia	*Securidaca longipedunculata, Echinops kebericho*	2
25	'Mawadeja' (Poor mothering)	*Myrica salicifolia, Asparagus africanus*	2
26	'Mich' (Black leg)	*Calotropis procera, Kniphofia foliosa*	2
27	'Yeaheya mich'(Equine septicemia)	*Echinops kebericho, Justica schimperiana*	2
28	'Getaba' Equines saddle sore	*Cyphostemma pannosum, Brucea antidysenterica*	2
29	'Awured' (Fascioliasis)	*Kalanchoe petitania*	1
30	'Mich' (Cattle septicemia)	*Cucumis ficifolius*	1
31	'Azurit' (Coenurosis)	*Justicia schimperiana*.	1
32	'Kemekem (Phymosis)	*Cucumis ficifolius*	1
33	'Aba kesha' (LSD)	*Zingiber officinale*	1
34	'Shekona kusel' (Foot rot)	*Cyphostemma pannosum*	1
35	Hyena bite	*Cyphostemma pannosum*	1
36	'Kurtet' (Abdomenal colic)	*Brassica carinata*	1

Knowledge distribution of ethnoveterinary medicinal plants

Age of informants was strongly correlated with knowledge on useful medicinal plants of veterinary importance (r= 0.98) (Table 4).

Table 4. Age categories of informants and average medicinal plants reported in rural kebeles of Bahir Dar City Administration

Age range	**Median age (x)**	**Average number of medicinal plants reported (Y)**	
17-31	24.0	3.00	*r= 0.98,*
32-46	39.0	3.65	*p=0.0017*
47-61	54.0	4.91	
62-76	69.0	5.00	
77-84	80.5	5.75	
Total	266.5	22.31	

However, informants' level of education did not correlate with their knowledge of veterinary plants such that the lower the educational level an informant had, the more knowledge of medicinal plants he/she possessed (r= -0.726). This means there is an inverse correlation between education and ethnoveterinary medicinal plant knowledge (Table 5). Illiterates and informally educated people were more knowledgeable than formally educated ones (Table 5). This might be due to negative impact of modernization and wrong perception of the youth about the knowledge of healers.

Similar research conducted by Ermias Lulekal *et al*. (2014) found no significant correlation between education status and ethnoveterinary medicinal plant knowledge in Ankober district. Over 90% of the traditional healers were males. The very good reason for this might be related to the local tradition of restricting these practices to men. Women were least involved in outdoor activities with livestock. The collected data in the current study revealed that female healer informants reportedly obtained the chance of becoming healers due to their special intimacy with their fathers.

Table 5. Educational status and ethnoveterinary medicinal plants reported by informants

Educational status	Grade	Grade value (x)	Average plant types cited (y)[b]	Correlation test
Illiterates[a]	0	0.5	4.8	
Primary	3	3.0	6.0	*r= - 0.72,*
education	4	4.0	4.5	*P=0.021*
	5	5.0	4.1	
	6	6.0	4.0	
	8	8.0	1.0	
Secondary	9	9.0	4.0	
Diploma	10+3	13.0	2.0	
Total		48.5	30.4	

[a]Illiterates stands for both illiterates and those who received irregular education; [b]plant types cited stands for average number of medicinal plant types cited by informants

Consensus of informants on the utilization of medicinal plants

In this study, *Phytolacca dodecandra* was cited by 21 (29.2%) informants as useful species to treat many diseases. *Phytolacca dodecandra* was reported to treat seven types of livestock aliments (anthrax, rabies, ascariasis, helminthiasis, coccidiosis, and bloating and eye disease) and was also abundant and accessible. *Cucumis ficifolius* was the second most cited by 19 (26.4%) informants treating six livestock ailments (Table 6).

Preference ranking of ethnoveterinary medicinal plants

Seven traditional healers ranked ethnoveterinary medicinal plants based on their efficacy to treat 'Kumegna.' These key informants gave 10 for the highest healing potential and least score 1 for the least effective species.

Table 6. List of ethnoveterinary medicinal plant species reported by four and more informants

Ethnoveterinary medicinal plant Species	**Number of informants reporting**	**%**
Phytolacca dodecandra	21	29.2
Cucumis ficifolius	19	26.4
Ipomea simonsiana	16	22.2
Justica schimperiana	13	18.0
Verbasicum sinaticum	10	13.8
Echnops kebercho	10	13.8
Premna schimperi	9	12.5
Myrica salicifolia	9	12.5
Cyphostemma adenocaul	9	12.5
Brassica carinata	8	11.0
Melia azedarach	8	11.0
Cucurbita pepo	7	9.7
Croton macrstachyus	7	9.7
Grewia ferrugineol	7	9.7
Linum usitatissimum	6	8.3
Momordieca foetida	6	8.3
Brucea antidysentrica	6	8.3
Ricinus communis	6	8.3
Nicotiana tabacum	5	6.9
Asparagus africanus	5	6.9
Cariss spinarum	5	6.9
Calpurnia aurea	5	6.9
Aloe spp	4	5.5
Capsicum annuum	4	5.5
Coriandrum sativum	4	5.5
Cyphostemma pannosum	4	5.5
Cyphostemma cyphopetalum	4	5.5
Nigella sativa	4	5.5
Kalanchoe petitania	4	5.5
Solanum dasyphillum	4	5.5

Accordingly, preference ranking of 10 selected ethnoveterinary medicinal plant species to treat Gastrointestinal diseases (GI), locally known as 'Kumegna', showed that both *Cucumis ficifolius* and *Ipomoea simonsiana* were equally best followed by *Verbasicum sinaticum* (Table 7). As there were more plants used to treat livestock ailments, it was necessary to check the most preferred plants to treat same ailment (Mohammed Adefa and Berhanu Abraha, 2011).

On the other hand, the local people showed their preference towards ethnoveterinary medicinal plant species having potential of healing various ailments. Preference ranking given by those seven key informants for the nine selected ethnoveterinary medicinal plants (Table 8) on the basis of treating multiple type of diseases revealed that *Cucumis ficifolius* is the most preferred followed by *Phytolocca dodecandra.* The highest score was 9 while the least preferred was 1.

Direct matrix ranking

In the study area, many of the ethnoveterinary medicinal plants were utilized for multiple purposes apart from their medicinal values. The major uses include medicine, food, fencing, forage, fire wood, charcoal, construction and furniture making.

Six commonly used multipurpose species and eight use categories were involved in direct matrix ranking exercises in order to evaluate their relative importance to the local people (Table 9).

Table 7. Preference ranking of 10 selected ethnoveterinary medicinal plants on the basis of healing GIP (Kumegna) by key informants

No	Plant species	Respondents							Total	Mean	Rank
		R3	R19	R35	R36	R47	R52	R65			
1	*Cucumis ficifolius*	9	10	8	8	9	10	10	64	9.1	1st
2	*T. rhychocarpum*	6	6	3	2	3	3	3	26	3.7	8th
3	*Verbasicum sinaticum*	8	8	7	6	7	9	9	54	7.7	3nd
4	*Carissa spinarum*	4	7	4	5	4	6	7	37	5.3	5th
5	*Aloe* spp.	7	5	6	7	8	7	6	46	6.6	4th
6	*Ficus vasta*	2	3	1	1	1	1	2	11	1.6	10th
7	*Asparagus africanus*	1	2	2	3	2	4	4	18	2.6	9th
8	*Canarina abyssinica*	5	4	5	4	6	5	5	34	4.9	6th
9	*Ipomoea simonsiana*	10	9	10	9	10	8	8	64	9.1	1st
10	*Kleinia* sp.	3	1	9	10	5	2	1	31	4.4	7th

Note: R stands for respondent; *T. rhychocarpum* stands for *Thalictrum rhychocarpum*

Seven key informants were requested to give average value score for the six species use value from 0 to 5 (5 to the best and 0 to the least used). The result showed that *Eucalyptus camaldulensis* was the most preferred. The plants were most used for firewood followed by for fencing purposes.

Fidelity level index

Analysis of the percentage of informants claiming the use of certain plant species for the same major purposes could not be taken as the only parameter in proving the efficacy of the medicinal plant species. For this reason, fidelity level index was calculated to check the medicinal value of each species.

Ipomoea simonsiana was reported to have the highest medicinal value against 'Kumegnna' and *Premna schimperi* against eye disease (Table 10). According to the consensus of informants (Table 6), *Cucumis ficifolius* received the higher rank (26.4%) than *Ipomoea simonsiana* (22.2%). In the fidelity level index analysis, *Cucumis ficifolius* (FL=0.74) ranked second to *Ipomoea simonsiana* with FL value of 1.0 in healing effect of 'Kumegna.'

Threats and conservation of ethnoveterinary medicinal plants in the study area

According to the score given by key informants and cross checked by focus group discussions, 17.4% of the informants believed that agricultural land expansion and fuel wood consumption were the major threats. Other factors such as source of construction materials (15.8%), urban expansion (13.1%), overharvesting (12%), over grazing (10.3%), and drought (9.8%) contributed much for the overall decline of the plant resource including medicinal plants. Minor factors include marketing medicinal plants (3.8%). This situation is accelerated by the rapid expansion of the city of Bahir Dar and its resultant population growth.

Table 8. Preference ranking of selected ethnoveterinary medicinal plants on the degree of healing multiple ailments of animals

Species	Respondents							Total	Rank
	R3	R19	R35	R36	R47	R52	R65		
Justica schimperiana	8	7	9	6	6	8	6	50	3rd
Cucumis ficifolius	7	9	7	8	9	9	9	58	1st
Verbasicum sinaticum	3	6	6	7	7	6	8	43	4th
Calpurnia aurea	1	5	5	4	3	5	5	28	5th
Phytolacca dodecandra	9	8	8	9	8	7	7	56	2nd
Asparagus africanus	2	1	3	1	2	1	4	14	9th
Brucea antidysentrica	5	4	4	5	4	4	1	27	6th
Croton macrostachyus	4	3	2	3	5	3	3	23	7th
Ricinus communis	6	2	1	2	1	2	2	16	8th

Note: R stands for respondent

Table 9. Mean scores for direct matrix analysis of selected medicinal plants based on a general use value[a]

Species	Use category[b]								Total	Rank
	MED	FOD	FEN	FOR	FWD	CHAR	CONS	FUR		
Ficus vasta	2	0	3	3	4	2	1	4	19	6th
C. macrostachyus[b]	5	0	4	0	4	4	3	4	24	2nd
E. camaldulensis[c]	1	0	4	2	5	4	5	4	25	1st
Ficus sycomorus	1	0	3	3	4	2	3	4	20	5th
Carissa spinarum	5	1	5	4	5	1	1	0	22	3rd
Calpurina aurea	5	0	4	2	5	1	4	0	21	4th
Total	19	1	23	14	27	14	17	16		
Rank	3rd	7th	2nd	6th	1st	6th	4th	5th		

[a](key: 5= best, 4= very good, 3= good, 2= less used, 1= least used, and 0= not used; [b]MED stands for medicine, FOD for food, FEN for fence, FOR for forage, FWD for firewood, CHAR for charcoal, CONS for construction, FUR for furniture; [c]*C. macrostachyus* stands for *Croton macrostachyus,* [c]*E. camaldulensis* for *Eucalyptus camaldulensis.*

Table 10. Fidelity level index for plant species used to treat gastrointestinal parasites (Kumegna) and eye disease in the study area.

Species used	% of informants	Np	N	Fidelity index (Np/N)
	'Kumegna' (GIP)			
Ipomoea simonsiana	22.20	16	16	1.00
Cucumis ficifolius	26.38	14	19	0.74
Verbasicum sinaticum	13.88	9	10	0.90
Aloe spp	5.55	3	4	0.75
	Ocular-disease			
Brucea antidysentrica	8.33	2	6	0.33
Achyranthes aspera	2.77	1	2	0.50
Premna schimperi	12.50	9	9	1.00

CONCLUSION

In rural kebeles of Bahir Dar, according to the information obtained from the current study, a total of 69 ethnoveterinary medicinal plants were utilized for the treatment of 36 types of livestock diseases. The study area was still rich in ethnoveterinary plants and in indigenous knowledge associated with each traditionally used plant species. The knowledge base was still the major and primary health care system of the local community because the plants were accessible and they were cost effective. However, the traditional knowledge base was dwindling because modernization, among other factors, seemed to have forced current generation, particularly the youth, to underestimate the indigenous knowledge and practices. Still worse, secrecy of elders in transferring knowledge of medicinal plants distorts and/or results in complete loss of the indigenous knowledge. It is, therefore, imperative to study and document the traditional knowledge base on ethnoveterinary medicinal plants. A possible remedy may include, but not limited to, making synergetic phytochemical and antimicrobial analyses of the plants to

develop drugs, determine dosage and mode of delivery, not to mention the necessity of conserving medicinal plants in gardens.

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Appendix 1. Ethnoveterinary Medicinal Plant Species Documented in Bahir Dar City Administration Rural Kebeles.

No	Local name	Scientific name	Family name	Life form
1	Degeta	*Calpurnia aurea* (Ait) Benth.	Fabaceae	Shrub /Tree
2	Zewie	*Cyphostema molle* (Baker) Desc.	Vitaceae	Herb
3	Yemider Embuay	*Cucumis ficifolius* A. Rich.	Cucurbitaceae	Herb
4	Daba Keded	*Verbascum sinaiticum* Benth.	Scrophulariaceae	Herb
5	Agam	*Carissa spinarum* L.	Apocynaceae	Shrub
6	Eret	*Aloe* spp	Aloaceae	Herb
7	Yekura Hareg	*Momordica foetida* Schumach.	Cucurbitaceae	Climber
8	Yeset Keset	*Asparagus africanus* Lam.	Asparagaceae	Shrub
9	Bamba	*Ficus sycomorus* L.	Moraceae	Tree
10	Ganbilo	*Gardenia ternifolia* Schumach. & Thonn.	Rubiaceae	Shrub/Tree
11	Semiza	*Justicia schimperiana* (Hochst. ex Nees) T. Anderson	Acanthaceae	Shrub
12	Neem	*Melia azedarach* L.	Meliaceae	Tree
13	Nech Shinkurt	*Allium sativum* L.	Alliaceae	Herb
14	Endod	*Phytolacca dodecandra* L. Herit	Phitolacaceae	Shrub
15	Yedega Abalo	*Brucea antidysenterica* J.F. Miller	Simaroubaceae	Shrub
16	Bahirzaf	*Eucalyptus camaldulensis* Dehnh.	Myrtaceae	Tree
17	Tobya	*Calotropis procera* (Ait). Ait. f.	Asclepiadaceae	Shrub
18	Telenji	*Achyranthes aspera* L.	Amaranthaceae	Herb
19	Kibe Ketel	*Stephania abyssinica* (Dillon. & A. Rich.) Walp.	Menispermaceae	Herb
20	Bessana	*Croton macrostachyus* Hochst .ex Delile	Euphorbiaceae	Tree
21	Gomenzer	*Brassica carinata* (A.) Braun	Brassicaceae	Herb
22	Feto	*Lepidium sativum* L.	Brassicaceae	Herb
23	Berberie	*Capsicum annuum* L.	Solanaceae	Herb
24	Kulkual	*Euphorbia abyssinica* J.F. Gmel.	Eruphorbiaceae	Tree
25	Gumoro	*Capparis tomentosa* Lam.	Caparidaceae	Shrub
26	Warka	*Ficus vasta* Forssk.	Moraceae	Tree
27	Denbelal	*Coriandrum sativum* L.	Apiaceae	Herb
28	Temenahi	*Securidaca longepedunculata.* Fresen	Polygalaceae	Shrub/Tree
29	Kebercho	*Echnops kebercho* Mesfin	Asteraceae	Herb
30	Ater	*Pisum sativum* L.	Fabaceae	Herb
31	Telba	*Linum usitatissimum* L.	Linaceae	Herb
32	Gulo	*Ricinus communis* L.	Euphorbiaceae	Shrub
33	Checho	*Premna schimperi* Engl.	Laminaceae	Shrub
34	Kamo	*Rhus vulgaris* Meikle	Anacardiaceae	Shrub/Tree
35	Kobba	*Maytenus senegalensis* (Lam.) Exell	Celastraceae	Tree
36	Chemegegit	*Cynoglossum coeruleum*	Boraginaceae	Herb
37	Zengible	*Zingiber offinale* Roscoe	Zingiberaceae	Herb
38	Tite	*Gossypium barbadens* L.	Malvaceae	Shrub

39	Yeberie Melas	*Rumix nepalensis* Spreng.	Poligonaceae	Herb
40	Gebre Embuay	*Solanum dasyphllum* Schumach.	Solanaceae	Shrub
41	Bakela	*Vicia faba* L.	Fabaceae	Herb
42	Astenager	*Datura stramonium* L.	Solanaceae	Herb
43	Duba	*Cucurbita pepo* L.	Cucurbitaceae	Climber
44	Lenkuata	*Grewia ferruginea* Hochst. Ex A. Rich.	Tiliaceae	Shrub/Tree
45	Andahula	*Kalanchoe petitania* A. Rich.	Crassulaceae	Herb
46	Anfar	*Buddleja polystachya* Fresen.	Loganciaceae	Tree
47	Gorjejit	*Sida rhombifolia* L.	Malvaceae	Shrub
48	Girawa	*Vernonia amygdalina* Del.	Asteraceae	Shrub
49	Tekur Azmud	*Nigella sativa* L.	Ranunculaceae	Herb/climber
50	Sire Bezu	*Thalictrum rhynchocarpum* Dill & Rich	Ranunculaceae	Herb
51	Wodel Asfese	*Cyphostemma adenocaule* (Stued.ex A. Rich) Desc.ex Wild & Drummond	Vitaceae	Climber
52	Kumagna Duba	*Ipomoea simonsiana* Rendle	Convolvulaceae	Herb
53	Yemaryam Wanicha	*Canarina abyssinica* Engl.	Campanulaceae	Climber
54	Tembaho	*Nicotiana tabacum* L.	Solanaceae	Herb
55	Shinet	*Myrica salicifolia* A. Rich.	Myricaceae	Tree
56	Doge	*Ferula communis* L.	Apiaceae	Herb
57	Hareg	*Microglossa pyrifolia* (Lam.) Kuntze	Asteraceae	Shrub
58	Yekemis kulfe	*Eclipta prostrate* L.	Asteraceae	Herb
59	Ashenda	*Kinphofia foliosa.* Hochest.	Asphodelaceae	Herb
60	Kebero Wanza	*Cyphostemma pannosum* Vollesen	Vitaceae	Herb
61	Zana	*Stereospermum kunthianum* Cham.	Bignoniaceae	Tree
62	Gorgoro	*Dichrostachys cinera* (L.) Wight & Arn.	Fabaceae	Tree
63	Teferiena	*Kanahia laniflora* (Forssk.) R. Br.	Asclepiadaceae	Shrub
64	Azo Harge	*Clematis simensis* Fresen.	Ranunculaceae	Climber
65	Embacho	*Rumex nervosus* Vahl	Poligonaceae	Shrub
66	Berbera	*Millettia ferruginea* (Hochst.) Bak.	Fabaceae	Tree
67	Wodel Asfes	*Cyphostemma cyphopetalum* (Fresen) Desc. Ex Wild & Drummond	Vitaceae	Climber
68	Zerich Embuay	*Solanum marginatum* L.F.	Solanaceae	Shrub
69	Enkela	*Kleinia* sp.	Asteraceae	Herb