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Study of Ethnoveterinary Medicinal Plants Used by Pastoralists in Northern Gombe State, Nigeria

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ABSTRACT

Ethnoveterinary is the total of all practices that enable man to prevent his livestock from diseases, alleviate and relieve suffering to bring about healing, and increase the production and productivity of livestock within a minimum cost. Overutilization, overexploitation, deforestation for fuelwood, and farmland expansion expose some of the plants to threaten. The study was carried out in three randomly selected districts in Northern Gombe State, Nigeria. Among all, 80% of the respondents are male among which 56% are 35 years and above. 43 plants were reported used as ethnoveterinary plants in the area (oral interview) among which only 28 were found to be present in the field (field assessment). *Guiera senegalensis* is the most abundant plant (7.85%) followed by *Piliostigma reticulatum* (7.23%), *Combretum collinum* and *Detarium microcarpum* (3.00% both). Fabaceae is the most abundant family (30.85%) of the identified plants followed by Combretaceae (15.25%). Plant bark is the most common part used in curing and preventing animals from diseases which subject some of the plants (*Burkia africana*) to nearly endangered states. 28 plant samples were collected, identified, pressed, and laid in Botany Department Herbarium, Gombe State University, among these, 2 plant samples were not successfully identified. It is recommended that regulatory bodies should be empowered to check the uncontrolled deforestation occurring in the area

INTRODUCTION

Livestock production in Sub-Saharan African countries is severely constrained by the presence of a wide range of animal diseases and is believed to be growing at half the rate required to make significant in-roads in reducing poverty [1]. These diseases not only affect the production and productivity of livestock but also seriously hamper any meaningful livestock trade. Potentially fatal diseases in cattle include Foot-and-Mouth Disease (FMD) and Contagious Bovine Pleural Pneumonia (CBPP). For many years, these diseases have been causing serious problems in livestock production, especially among the poor rural farming communities. This problem is exacerbated by the farmers' lack of access to conventional livestock management skills and financial resources to afford vaccines and curative substances [2]. But there is potential for increasing production if disease control and management strategies are appropriately undertaken.

Ethnoveterinary practice is referred to as a method of healing livestock traditionally using various parts of different species of plants, especially the roots, stem, leaves, and grasses. The utilization of ethnoveterinary medicinal plants for the treatment of various diseases has been part of human traditions since ancient times and still increasing in many developed and developing countries [3]. Ethnoveterinary plant medications play a great contribution and are the most important sources of therapeutics for more than 90% of the livestock population [4].

Most livestock farmers in Nigeria are resource-poor [5]. It is, therefore, important that disease control strategies aimed at making it affordable and readily available to farmers. This cannot be achieved by adopting disease control strategies that are dependent on imported veterinary drugs but those based on cheaper, safer, and sustainable such as the use of locally and naturally derived drugs from plants. In recent years, there has

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been a remarkable rise in medicinal plants' use, probably due to their local abundance, cultural significance, and inexpensive procurement [6]. According to [7], the medicinal plants used for the control and management of diseases are cheaper, readily available, and can be used as a complement for the expensive synthetic drugs that are often in short supplies. The knowledge of medicinal plants and traditional beliefs of diseases management techniques used among the pastoral herders is said to have been developed gradually over a period of practical experience.

Millions of people around the world have an intimate relationship with their livestock. Animals provide them with food, cloth, labor, fertilizers, cash and act as a store of wealth and a medium of exchange. Animal health could be managed traditionally via Ethnoveterinary medicine (EVM) practices which are practices that involve a solid amalgamation of herbal knowledge and ancestral experiences [8]. The ethnoveterinary systems are ecosystem and ethnic-community specific and therefore, the characteristics, sophistication, and intensity of these systems differ greatly among individuals, societies, and regions.

However, they are facing the threat of rapid erosion because of rapid socio-economic, environmental, and technological changes. Even though indigenous knowledge systems are rapidly disappearing under the influence of Western culture, 80% of the world's population exclusively relies on traditional medicine. Especially in developing countries, traditional medicine has remained the main alternative treatment due to the shortage of pharmaceutical products and their unaffordable prices [9].

In Nigeria, as in many tropical countries of the world, many rural households have limited access to conventional veterinary drugs. This is due to poor access to urban areas to purchase these drugs and their generally high cost [10]. Thus, many people resort to the use of medicinal plants in the treatment of their animals [11]. Medicinal plant extracts and their constituents have proved to be biodegradable, have low mammalian toxicity, and have low induction of resistance [12]. Biodiversity has always been of utmost importance for the provision and discovery of medical substances [13].

Some of the common methods for administering ethnoveterinary medicines include drenching, nasal, and eye drop: This involves the oral and drops administration of medicine in liquid form [14]. Fumigation: The use of smoke or fumes to drive away or kill insects and other pests. Powdered material or dried leaves, dung, and bark are burnt in clay pots or on the open ground [15]. The documentations of traditional veterinary care used for the control and management of livestock diseases are the appropriate means of identifying potential sources of new drugs. Many traditionally plant base animal healing give rise to an increase in the potential modern drugs as they mostly retain the same constituents and uses.

Seventy-four percent of plant-derived compounds currently used in pharmaceuticals, retained similar use as used by traditional healers [16]. The knowledge of ethnoveterinary plants is on the verge of irreversible loss and decline. However, an alarming loss of biodiversity is occurring, particularly in mountain regions as they are disproportionally vulnerable to land-use change and climate change [17]. Drought and conflicting activities result in the migration of pastoralists many of whom acquire knowledge of treating and preventing their livestock from diseases traditionally using plants [18]. The population of these plants is currently dwindling due to overutilization, overexploitation, deforestation for fuelwood and farmland. Due to these problems, the dependence on modern veterinary medicine alone cannot solve most of the animal health problems. Therefore, there is a need for identification and documentation of the diseases, plants, and methods of control to avoid the extinction of this knowledge. The study aims to assess the ethnoveterinary plants and ethnoveterinary practices in Northern Gombe State, Nigeria and to identify the plants use in curing some of the animal diseases. In addition, other aims are to determine the plant part used in treating the diseases and to determine the diversity and abundance of the plants in the locality.

MATERIALS AND METHOD

Study Area

The study was carried out in Northern part of Gombe State, Nigeria. Gombe State is located in the Savannah belt of North-eastern Nigeria, the Northern part of Gombe State is between latitudes 10^0 49'N and 10^0 46'E. It covers an area of 3815 square kilometers with a land area of 181,600 hectares. It has an estimated population of 207,658 as of March 2006, with 33% (68527) made of women of childbearing age (15–49years). The area is characterized by a mean annual rainfall range between 1200 mm-1500 mm and the temperature characteristics are typical of West African savanna climate [19].

Type and source of data

Both primary and secondary source of data was used in obtaining information and samples.
Primary sources are basically: Oral interview which was used in obtaining information about ethnoveterinary practices in the study area and Fieldworks carried out after the semi-structured interview which includes field assessment, plant sample collection, and pressing, and the determination of the occurrence, abundance, and diversity of the plants using appropriate ecological methods
Secondary sources are generally published journals, reviews, textbooks, Google Scholar e.t.c.

Equipment and materials used in data collection

Camera for clear photographs of the plants during data collection, GPS coordinate: for the determination of elevation of each collected plant sample, Datasheet, pencils and razor blade for labeling, pruning shear/scissors for cutting plant part, Newspaper and Plant press for pressing of collected plant samples.

Research procedure/method

Three districts were randomly selected in the Northern part of Gombe State. Information about ethnoveterinary plants and practices in each of the districts was obtained using oral interviews. A field assessment of the plants mentioned during the interview was conducted and data was recorded. The abundance and diversity of the plants were determined using appropriate ecological methods. Plants collected were pressed, identified, and laid in the Herbarium of the Department of Botany, Gombe State University.

Data Analysis

Data obtained were analyzed for Frequency, Abundance, Density, relative frequency, relative abundance, and Simpson diversity index using the following formulas;

Frequency (F) = × 100
Relative frequency (RF) = × 100
Density (d) =
Relative density (RD) = × 100
Abundance (A) = × 100

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Relative abundance (RA) = × 100
Important value index = RF + RD + RA

Where RF=Relative frequency, RD = Relative density and RA =

Relative abundance
Simpson Index (D) =
To get the actual value, Simpson index adopted 1-D
Whereby
n_i = number of plants of each particular species
N= number of plants of all species. That is, Total number of all plants in each transect.

RESULT

A total number of 50 randomly selected respondents were interviewed, 44 males and 6 females. Majority of the respondents are males (88.0%) with only a few females (**Table 1**). Among all, the older individuals (with 35 and above years) represent the highest respondents, and this may be attributed to their knowledge of the ethnoveterinary plants and practices, whereas the younger ones know the plants but do not specifically know their ethnoveterinary roles.

Table 1. The Number and frequency of respondents with gender and age.

	Number of respondents		Frequency of respondents	
Age group	Male	Female	Male	Female
15-25	6	0	12.00%	0.00%
25-35	10	2	20.00%	4.00%
Above 35	28	4	56.00%	8.00%
Total	44	6	88.00%	12.00%

A total number of 43 plants belonging to 15 families were used by the pastoralists as ethnoveterinary medicinal plants in curing 24 animal diseases in the study area (Table 2). Among all, 28 plants belonging to 15 families were found present in the field, the number of Occurrences, Frequency, Relative Frequency, Density, Relative Density, Abundance, Relative Abundance and Important Value Index in all the transects studied have been determined. The most abundant plants are *Guiera senegalensis, Piliostagma reculatum* and *Combrettum collinum* (Table 3).

The life form (habit) of each plant found in the field is shown in **Table** 4 below. The most abundant family among all the studied ethnoveterinary medicinal plants is Fabaceae followed by Combretaceae and the least abundant are Mimosaceae, Moraceae, and Sapotaceae (**Table** 5). It appears that most of the plants are trees with few annual undershrubs and shrubs.

The plant part used shows that bark is the highly used ethnoveterinary plant part followed by leaf (uncrushed) and leaf & bark. The low-used parts are seeds, bark & root, and crushed seed (**Table** 6). The species diversity was determined using Simpson's diversity. It is known that Simpsons value/index close to 1 represents a high diversity and vice versa. Therefore, the ethnoveterinary plants are more diverse in the area as the value of the Simpson index is almost or nearly close to 1 (**Table** 7).

Table 2. The orally interviewed/assessed plant species, the plant part used, animal disease cured, animal cured, and the method of preparation of the ethnoveterinary medicine.

Plant name	Plant Part used	Animal disease	Animal cured	Method of preparation
Vitellaria paradoxa	Bark	Snake bite	Sheep & ram	decoction
Guiera senegalensis	Bark	Snake bite	Cow, sheep & ram	decoction
Ceiba pentandra	Bark	Placental retention and fever	Cows	decoction
Dichrostachys cinerea spp. africana	Crushed leaf	Diarrhea	Cow, sheep & ram	decoction
Commiphora africana var. africana	Bark	Fever	All ruminants	decoction
Sclerocarya birrea	Bark	Appetizer	Cow, sheep & ram	decoction
Borassus aethiopum	Root	Breathing problem	Cows	decoction
Acacia nilotica	Seed crushed	Food and mouth diseases	Cow, sheep & ram	infusion
Anogeisus leiocarpa	Bark	Stomachic worm	Sheep & ram	infusion
Tamarindus indica	Leaf	Placental retention	Cows	decoction
Adansonia digitata	Leaf	Placental retention	Sheep & ram	eat fresh
Balanites aegyptiaca	Leaf	Eye problem	Cow, sheep & ram	infusion in drop
Crossopteryx febrifuga	Crushed Seed	Brucellosis	Cow, sheep & ram	Infusion
Securidaca longepedunculata	Leaf & bark	Stomachic worm	Sheep and ram	decoction
Acacia Senegal	Leaf & bark	Joint pain	Cows	decoction
Daniellia oliveri	Crushed bark	Milk ejection	New born	add powder to feed
Khaya senegalensis	Bark	Stomachic worm	Cow, sheep & ram	decoction or infusion
Azadirachta indica	Leaf	Fever	Cow, sheep & ram	decoction
un-identified (baucihi)	Bark & root	No enough milk	Cow, sheep & ram	decoction
Senna singueana	Flower	Helmintosis	Cows	decoction
Steculia setigera	Flower	Blood stimulant	Cow, sheep & ram	decoction
Ficus platyphylla	Bark	Appetizer	Sheep & ram	decoction
Acacia albida	Leaf & bark	Immunization	Cow, sheep & ram	decoction
Burkia africana	Bark	Blood stimulant	Cows	decoction
Vitex simplicifolia	Bark	Mastitis	All ruminants	decoction
Combretum collinum ssp. geitonophyllum	Bark	Cancer	Cows	decoction
Epiphyte of kapok	Leaf	Cancer	Cow, sheep & ram	decoction
Steculia setigera	Bark	Blood stimulant	All ruminants	decoction
Bombax costatum	Bark	Eye problem	All ruminants	decoction drop
Euphorbia convolvuloides	Leaf	Breathing problem	All ruminants	decoction
Kalanchoa pinnata	Seed	Poultry fever	Chickens	Infusion
Mangifera indica	Bark	Poultry immunization	All poultries	Infusion
Prossopis africana	Bark	Poultry diarrhea	Chickens	Infusion
Cassia arereh; C. sieberana	Bark	Cancer and breathing problem	Cow	Decoction
Parkia biglobosa	Bark	Snake bite and cancer	All ruminants	Decoction
Annona senegalensis & G. senegalensis	Leaf	Stomach cancer	All ruminants	Decoction
Ficus platyphylla	Crushed bark	Stomach problem	Cows	Decoction
Anogeisus leiocarpa	Seed + potash	Cold and cough	Small ruminants	mix powder with feed
Piliostigma reticulatum	Root	Stomachic worm	New born	Infusion
Unidentified *and Vitex simplicifolia*	Bark	Stunted growth	All ruminants	Decoction
Striga hermontheca	All parts	Gastrointestinal problem	All ruminants	Infusion
Aristolochia albida; A. bracteolata	All parts	Snake bite	All ruminants	Decoction
Vitex doniana	Leaf	Stomachic worm	Cow, sheep & ram	Decoction

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Table 3. Important Value Index for each of the plant studied.

Plant species	NI	F	RF	D	RD	A	RA	I.V.I
Acacia seiberiana	1	3.57	0.51	0.17	0.52	1	1.88	2.91
Adansonia digitata	8	28.57	4.1	1.33	4.08	2.66	5.02	13.2
Anogeisus leiocarpus	1	3.57	0.51	0.17	0.52	1	1.88	2.91
Balanite aegyptiaca	6	21.42	3.07	1	3.07	2	3.77	9.91
Bombax costatum	3	10.71	1.53	0.5	1.53	1.5	2.83	5.8S9
Borassus aethiopum	3	10.71	1.53	0.5	1.53	1.5	2.83	5.89
Burkia africana	1	3.57	0.51	0.17	0.52	1	1.88	2.91
Ceiba pentandra	1	3.57	0.51	0.17	0.52	1	1.88	2.91
Combrettum collinum	15	53.57	7.69	2.5	7.68	3	5.66	21.04
Detarium microcarpum	12	42.85	6.15	2	6.14	3	5.66	18
Dichrostachys glomerata	1	3.57	0.51	0.17	0.52	1	1.88	2.91
Euphorbia convolvuloides	4	14.28	2.05	0.67	2.05	1.33	2.51	6.61
Ficus sur	1	3.57	0.51	0.17	0.52	1	1.88	2.91
Guiera senegalensis	25	89.28	12.82	4.17	12.81	4.16	7.85	33.53
Khaya senegalensis	1	3.57	0.51	0.17	0.52	1	1.88	2.91
Mangifera indica	6	21.42	3.07	1	3.07	2	3.77	9.94
Parkia biglobosa	18	64.28	9.23	3	9.22	3	5.66	24.11
Piliostigma reticulatum	23	83.14	11.79	3.83	11.77	3.83	7.23	30.77
Prosofis africana	10	35.71	5.12	1.67	5.13	2	3.77	14.05
Sclerocarya birrea	9	32.14	4.61	1.5	4.61	3	5.66	14.88
Senna occidentalis	1	3.57	0.51	0.17	0.52	1	1.88	2.91
Senna singueana	11	39.28	5.64	1.83	5.62	2.75	5.19	16.45
Sterculia setigera	4	14.28	2.05	0.67	2.05	1.33	2.51	6.61
Tamarindus indica	10	35.71	5.12	1.67	5.13	2	3.77	14.05
Un-identified	12	42.85	6.15	2	6.14	2.4	4.53	16.87
Vitellaria paradoxa	3	10.71	1.53	0.5	1.53	1.5	2.83	5.89
Vitex doniana	2	7.14	1.02	0.33	1.01	1	1.88	3.91
Vitex simplicifolia	3	10.71	1.53	0.5	1.53	1	1.88	4.94
Grand Total	195	697.32	99.88	32.53	99.86	52.96	99.85	299.82

KEYS
NI: Number of individual plants
F: Frequency
RF: Relative frequency
A: Abundance
RA: Relative Abundance
D: Density
RD: Relative Density
I-V-I: Important Value Index

Table 4. The field determined ethnoveterinary plant species and their growth habits.

Plant species	Plant growth habit
Acacia seiberiana	Tree
Adansonia digitata	Tree
Anogeisus leiocarpus	Tree
Balanite aegyptiaca	Tree
Bombax costatum	Tree
Borassus aethiopum	Tree
Burkia africana	Tree
Ceiba pentandra	Tree
Combrettum collinum	Tree
Detarium microcarpum	Tree
Dichrostachys glomerata	Tree
Euphorbia convolvuloides	Herbaceous
Ficus sur	Tree
Guiera senegalensis	Shrub
Khaya senegalensis	Tree
Mangifera indica	Tree
Pakia biglobosa	Tree
Piliostigma reticulatum	Tree
Prosofis africana	Tree
Sclerocarya birrea	Tree
Senna occidentalis	Annual undershrub
Senna singueana	Annual undershrub
Sterculia setigera	Tree
Tamarindus indica	Tree
Un-identified (Dogi)	Tree
Vitellaria paradoxa	Tree
Vitex doniana	Tree
Vitex simplicifolia	Tree

Table 5. The families of the studied ethnoveterinary plants.

Family	Number of occurence	Abundance	Relative Abundance
Anacadiaceae	15	3	6.53
Arecaceae	3	1.5	3.26
Combretaceae	42	7	15.25
Euphorbiaceae	4	1.33	2.89
Fabaceae	85	14.16	30.85
Lamiaceae	2	2	4.35
Malvaceae	15	3	6.53
Meliaceae	1	1	2.17
Mimosaceae	1	1	2.17
Moraceae	1	1	2.17
Sapotaceae	3	1.5	3.26
Steculiaceae	2	2	4.35
Verbenaceae	3	3	6.53
Zygophyllaceae	6	2	4.35
Unidentified	12	2.4	5.22
Grand Total	195	45.89	99.88

Table 6. Plant part used, the number of occurrences used in curing animal diseases, and the relative frequency of each.

Plant part	Number of occurrence	Relative Frequency
All parts	2	4.65%
Bark	18	41.9%
Bark and Root	1	2.32%
Crushed Bark	2	4.65%
Crushed Leaf	1	2.32%
Flower	2	4.65%
Leaf	8	18.6%
Leaf and Bark	3	6.97%
Root	2	4.65%
Seed	1	2.32%
Seed + potash	1	2.32%
Crushed Seed	2	4.65%
Total	43	100%

Table 7. Simpson's diversity index of the ethnoveterinary plant species in each of the six (6) laid transects.

Transect	N(N-1)		1-D	
1	92	1056	0.087	0.91
2	54	992	0.054	0.94
3	130	2550	0.051	0.95
4	30	380	0.079	0.92
5	35	552	0.063	0.94
6	66	1190	0.055	0.95
Average	67.83	1120.00	0.06	0.94

DISCUSSION

A total number of 50 respondents all of which are Fulani were interviewed among which 46 are males with only 4 females. About 28 of the respondents fall within the range of 35. This result is in agreement with [20] and [21] who reported the age range of 21-50 being the major herdsmen in their study. Among all, only the older peoples (35 and above) with few below 35 years were found to be self-practitioners. The frequency and relative frequency, density and abundant of the plants shows that; *Gueira senegalensis* is the most frequent, dense and abundant ethnoveterinary plant species in the study area followed by *Pilliostigma reticulatum, Parkia biglobossa* and *Acacia seiberiana, Balanite aegyptiaca, Burki africana, Ceiba pentandra, Euphobia convolvuloides* e.t.c are the less frequent, dense and abundant plants. Also, Family Fabaceae represent the largest family with abundant plants species followed by Combretaceae and Moraceae, Mimosaceae, and Sapotaceae. This is in agreement with [22] who report Fabaceae as the most abundant ethnoveterinary plant family.

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The percentage of plant parts used in curing animal diseases shows that; plant bark represents the highest percentage followed by leaf. This is not in agreement with [23] who reported root and leaf as the most plant part used with the root being the most frequent. Based on this, most of the bark overused plants were threatened (*Burkia africana*) with others endangered (*Crossopteryx febrifuga*), others are in a state of danger due to deforestation and overexploitation activities for farmland (*Combrettum collinum, Piliostigma reticulatum*) and timber by industries (*Parkia biglobosa*). This is in agreement with [24] who reported that there is an increasing threat to wild plant resources and their habitats because of overexploitation.

CONCLUSION

In conclusion, 43 plant species belonging to 15 families were used as ethnoveterinary plants in the study area for curing 24 animal diseases. The frequency of plant parts used as ethnoveterinary shows that bark is the highly used plant part followed by leaves in the study area. The most abundant plants are *Gueira senegalensis, Pilliostigma reticulatum, Parkia biglobossa, Combrettum collinum* e.t.c. The ethnoveterinary plants are more diverse (0.94) as calculated using Simpson's diversity index). It is recommended that regulatory bodies shall be empowered to check the uncontrolled deforestation occurring in the area. It is also recommended that the conservational status of these plants should be frequently observed to avoid the extinction of the plants in the areas.

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