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Ethnoveterinary Study Against Animal Trypanosomosis by Berta Community in Assosa Zone, Northwest Ethiopia

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Abstract*: *The Berta community has utilized local medicinal plants to manage various animal diseases, including trypanosomosis, which significantly impacts livestock productivity and rural livelihoods. Traditional medicine practitioners in the Assosa Zone of Northwest Ethiopia have used various ethnoveterinary practices to control animal trypanosomosis. Thus the purpose of the current study was to document these practices in the three districts of Assosa Zone Bambasi, Homesha, and Meng Woreds. An ethnobotanical study was carried out from February 2023 to September 2024. In total, 60 respondents (41 men's and 19 women's) were selected using a multistage random sampling method. Data was collected using semi-structured interviews, field observations, and preference ranking. Data were analyzed using descriptive statistics, preference ranking, and informant consensus factor. The study identified 35 medicinal plants used in ethnoveterinary practices to treat animal trypanosomosis in the district. The most common family is Solanaceae (3 spp.), followed by Asteraceae (2spp.), Aloaceae (2spp.), Barssiacea (2spp.), Fabaceae (2spp.) and Rutaceae (2spp.). The local people generally used the leaves, followed by root, and bark plant parts to prepare drugs for treating livestock trypanosomosis diseases. The great majority (48.5%) of the medicinal plant's growth form was herbs, which were mainly administered orally, and the method of preparation was crushing. The majority (65.4%) of the medicinal plants were gathered from the wild habitat. Documentation of the indigenous knowledge among medicinal plants on the treatment of animal trypanosomosis should be valuable for future phytochemical and pharmacological investigations of new veterinary.

Keywords: Assosa Zone, Berta Community, Ethnoveternary, Medicine Plant; Trypanosomosis

Abbreviations:
WHO: World Health Organization
SPSS: Statistical Package for Social Sciences

I. INTRODUCTION

Trypanosomiasis one of the world's most serious protozoan infectious diseases caused by the genus trypanosome parasites. It affects both animals and humans. African animal trypanosomiasis causes severe economic losses in the livestock sector [12].

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The disease is a serious, often fatal disease of mainly domestic animals that occurs in large areas of Africa, Latin America, the Middle East, and Asia [30].

Ethnoveterinary medicine refers to people's knowledge, skills, methods, practices, and beliefs about animal husbandry [4]. It is the knowledge that has been acquired through training and traditionally transmitted orally from generation to generation [5].

In the early 1980s, there was an interest in writing and validating ethnoveterinary practice [17].

The World Health Organization (WHO) estimates that due to their easy availability, low cost, and socio-cultural background, over 80% of the population in sub-Saharan Africa relies solely on traditional medicine derived from plants for their primary healthcare needs [25].

Ethiopia is home to about 6,000 species of vascular plants, probably due to its unique location and climate [35]. In this country [6], approximately 80% of the population and 90% of livestock are drug-dependent [20]. Plants are potential sources of new drugs due to the presence of countless secondary molecules that have pharmacological effects [28].

According to Abdeta [1] validation of medicinal plants for anti-trypanosomal activities would help society determine the best way to use their indigenous expertise while also providing hit compounds to fuel the pipeline for anti-trypanosomal drug production in the future [2]. A significant amount of new knowledge has become accessible in recent years [36]. Ethiopian traditional medicine is often used to treat many diseases of humans and animals [7]. Traditional healers, known by different names in different parts of the country are important people in traditional medicine [22].

Regardless of this fact, as far as our literature search, there are no ethnoveterinary medicinal plant studies and the associated knowledge in the study area [37]. Thus this study was designed to document ethnoveterinary practices that are used by traditional medicine practitioners in the Assosa zone of northwest Ethiopia for treatment of animal trypanosomisis [38].

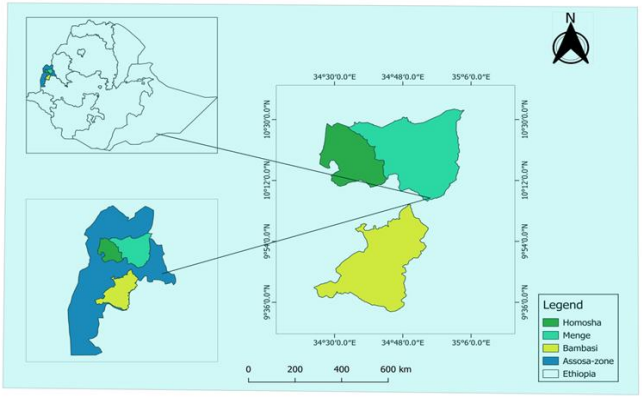
II. MATERIALS AND METHODS

A. Description of the Study Area

The Assosa Zone lies in the range of latitudes 10° 19′ 59″ N and longitudes 34° 39′ 589″ E and its altitude of 1300-1570m above sea level. The regional capital, Asossa is located at a distance of 687 km west of Addis Ababa, the capital city of Ethiopia "Fig. 1".

The mean annual rainfall and temperature of the study area are 219.7 to 1858.3 mm

and 14.7 to 30.100 C respectively and the soil types from the two agro-climatic zones are vertisol, sandy loam soil, and silt loam soil.



[Fig.1: Location of Study Area]

B. Reconnaissance Survey and Study Site Selection

A reconnaissance survey was conducted in the Assosa zone from February 2023 to September 2024. Among the three zones of the Benshangule Gumuze regional state Assosa zone was selected using random and purposive sampling methods based on the high distribution of tryposomosis diseases recorded and the lack of any research documentation in the study area.

Three districts (Bambasi, Homesha, and Menge) were purposively chosen from ten woreda because of the presence of Berta ethnic groups in the woreda that have different indigenous knowledge and culture and utilization of antitryposomesis. Among the three districts, six kebels were selected to the recommendations of older people, and local authorities.

We selected 60 participants (41 men's and 19 women's) in the representative peasant associations. Twenty key people were purposely selected based on the advice of knowledgeable elders, city leaders, and development representatives and also depending on the narrative quality provided by the interview participants.

C. Ethnoveterinary Data Collections

The ethnoveterinary data collection process [27] was based on local knowledge of local communities about medicinal plants. The methods used in data collection are semi-structured interviews as described [11] group discussions and field observation preference [3] Semi-structured interviews were based on a list of questions prepared in English and then translated into the Benishangule language of the study area. Interviews were conducted to cover the main points of the checklist.

Meeting places and times are determined according to the interests of the participants. With the help of local guides, the morphological features and habitats of all medicinal plants in the field were determined in situ. During interviews, data mainly regarding the demographic characteristics of respondents, local name of medicinal plants employed in the practice, plant part used, remedy preparation methods, route of administration, dosage schedule, and habitat of medicinal plants used were gathered.

D. Voucher Specimen Collection, Preparation and Identification

After every interview, walks were made with each informant to gather specimens of the claimed medicinal plants. The Flora of Ethiopia and Eritrea's taxonomy keys were used for specimen identification [19]. The collected specimens were properly pressed and dried and later identified by their scientific name with the help of botanists at the Ethiopia Biodiversity Institute, Assosa Biodiversity Center, and vouchers were deposited in a min-herbarium at Assosa Biodiversity Center.

E. Data Analysis

Ethnoveterinary data were entered into Microsoft Excel spreadsheets and analyzed using SPSS version 20 software. The most useful statistical data, on the medicinal plants, was summarized using descriptive methods such as percentages and frequency and presented in tables and figures. In addition, decision preferences and comparisons were used to analyze the data [3].

III. RESULTS

A. Demographic Characteristics of Informants in Study Area

Out of the total 60 informants who were identified for the interviews, 41(80.95%) were men and 19(19.05%) were women. Older informants (40–45 years old) who are senior members of the community reported significantly higher numbers of medicinal plants than young to middle-aged members. The majority (46.6%) of the informants were illiterate community knew significantly more medicinal plants than literate ones (see Table I).

Table- I: Demographic Characteristics of Informants in the Assosa Zone

Parameters	Frequency	Percent (%)
Sex		
Females	41	80.95
Males	19	19.05
Age years		
25–40	13	21
40–45	37	61.6
Above 55	20	33
Education level		
Illiterate	28	46.6
Elementary school	13	21.6
Secondary school	9	15
Diploma holder	7	11.6
Above	3	5

B. Composition of plant species used to treat animal Trypanosomosis

Moreover, 35 plant species and 34 genera from 27 families were recorded in the area of the Assosa zone, which treated animal trypanosomiasis. The most common family is Solanaceae (3spp.) followed by Fabaceae (2spp.), Asteraceae (2spp.), Rutaceae (2spp.), Aloaceae (2spp.) Barssiaceae (2spp.). The remaining 21 families are represented by only one species in each (Table II).

C. Habits and Habitats of Plants

Of the total report in the study area of medicinal plants, herbs

took the highest growth form and proportion 22 (34.38%), the trees took the least life form 10 (22.8%), whereas shrubs10 (28.5) were the next highest life form "Fig. 2".

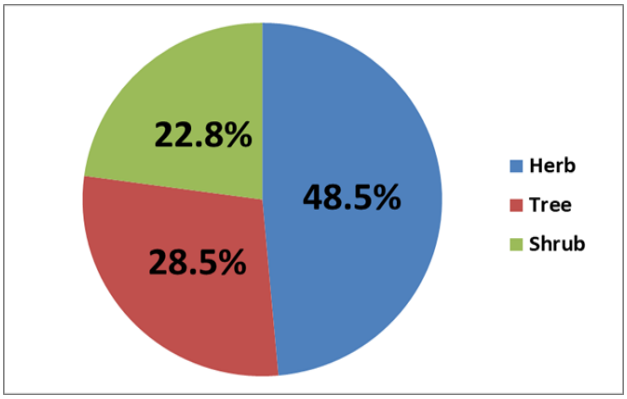
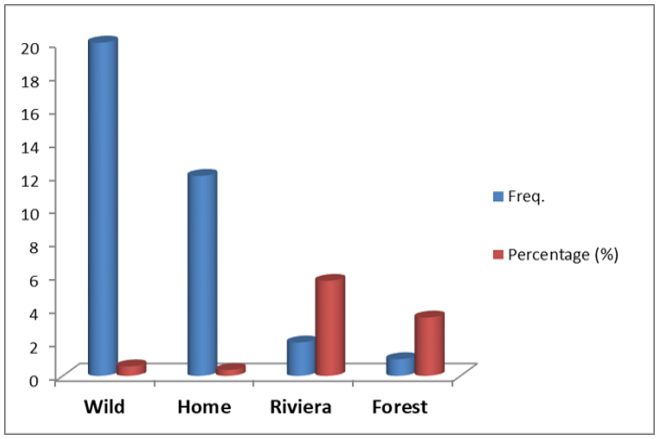


Fig.2: Proportions of Medicinal Plants Growth Forms in Percentage

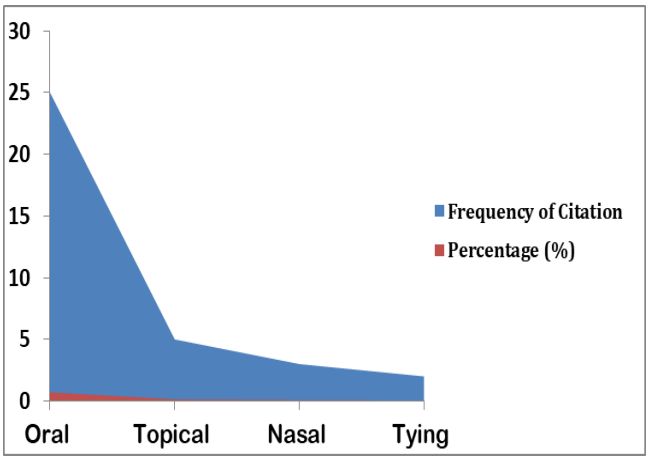
Most medicinal plants 20(57.1%) used in traditional medicine in the district were harvested from wild, home gardens, riverbanks, and forests. Some were grown in homestead gardens 12(35%), and a few were harvested from both reverie and forest 2(5.7%) and 1(3.5) "Fig. 3".



[Fig.3: Habitats of Medicinal Plants in the Study Area]

D. Routes of Remedy Administration

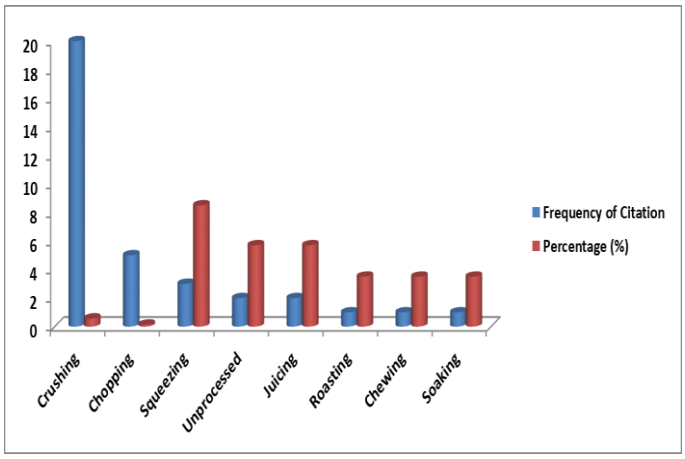
Moreover, the most common route of administration in the study area was reported oral which accounted for 25 (71.4%), followed by topical application and through the nasal and tying (14%), (8.5%) and (5.7) respectively "Fig. 4".



[Fig.4: Route of Plant Remedies Application]

E. Methods of Preparation

The highest proportion of remedies was prepared by crushing which accounted (for 57.14%) followed by chopping which accounted (for 14.28%), squeezing which accounted (for 8.5%), unprocessed form (5.7%), juicing (5.7%), roasting, chewing and soaking (2.8%) "Fig. 5".



[Fig.5: Percentages of Different Methods of Remedy Preparations]

F. Plant Part Used

The parts of the plants used for treatment were leaf which accounted for 14(40%) followed by root and Bark 17.6% (6) each, bark 14.28% (5) the whole part of the plant is 8.5% (3). (See Table II).

Table- II: Proportions in Percent of Plant Parts Used for the Treatment of Animal Diseases in Study Area Zone.

Plant part	Frequency of Citation	Percentage (%)
Leaf	14	40%
Root	6	17.1 %
Bark	5	14.28
Whole part	3	8.5%
Root and fruit	2	5.7%
Seed	2	5.7%
Bulb	1	3.5%
Sap	1	3.5
Tuber	1	3.5

G. Preference Ranking of Selected Medicinal Plants Used Against Trypanosomiasis

According to Simple preference ranking exercises the best ten randomly chosen key knowledgeable informants for the five medicinal plants were reported against the most prevalent ailment category among Trypanosomiasis ailments in the study sites. It is effectively used for treating Trypanosomiasis which was repeatedly reported in the study District. Samples of key informants were involved in the interview and asked to assign the number one for the least effective medicinal plant species and five for the most effective plant. As a result, *Echinops kebericho was ranked first and followed by Lepidium sativum*, *Cymbopogon citratus*, *Clutia abyssinica and Solanum anguivi* respectively (Table III).

Table- III: Preference Ranking of Selected Medicinal Plants Used Against Trypanosomiasis

Names of Plants	Informants Labeled A to J										Total Score %	Rank
	A	B	C	D	E	F	G	H	I	J		
Echinops kebericho M.	5	5	5	3	5	5	5	4	5	5	54(98.1%)	1
Lepidium sativum L	5	4	4	4	5	4	5	5	5	4	50(90.9%)	2
Cymbopogon citratus	5	5	3	5	3	3	5	5	4	4	46(83.6%)	3
Clutia abyssinica	3	3	4	3	4	3	5	5	4	3	38(69.09%)	4
Solanum anguivi Lam.	2	4	3	5	5	3	3	4	2	3	35(63.6%)	5

Note: Scores in the table indicate ranks given to medicinal plants based on their efficacy; the highest number (55) was given for the medicinal plant that informants thought most effective in treating trypanosomiasis, and the lowest number (35) was given for the least-effective plant

Table- IV: Lists of Medicinal Plants used for the Treatment of Animal Trypanosomiasis in Assosa Zone Northwest Ethiopia, with Their Local Name, Habit, Parts used, Habitat, Mode of Preparation, and Route of Administration

Family	Scientific Name	Local Name	Habit	Part used	Habitat	Methods Preparation	Route of Administration	Collection No.
Alliaaceae	*Allium sativum* L.	Bilia fudi	Herb	Bulb	Home	Crushing and mixing with water	Topical	AB03-2024
Aloaceae	*Aloe pubescent* Reynolds	Aloe	Herb	Sap	Reverie	Squeezing	Topical	AB04-2024
Aloaceae	*Aloe vera*	Aloe	herb	Leaf	Home	Using the gel	Oral, topical	AB05-2024
Amaryllidaceae	*Crinum ornatum* (L.f.ex Aiton) Bury.	Yejib shinkurt	Herb	Tuber	Forest	Crushing the root and mix with water	Oral	AB014-2024
Apocynaceae	*Carissa spinarum L.*	Ayunig	Shrub	Root	Rivera	Crushing and diluting	Oral	AB010-2024
Asteraceae	*Echinops kebericho. M*	Kebercho	Herb	Root	Wild	Crushing with water Smoking	Oral mix with food, Nasal	AB018-2024
Asteraceae	*Vernonia amygdalina* Delile	Eebicha	Shrub	Leaf	Wild	Crushing and squeezing	Oral	AB033-2024
Balanitaceae	*Balanites aegyptiaca* (L.) Del.	Qaha	Tree	Bark	Wild	Crushing and Diluting	Oral	AB07-2024
Bignoniaceae	*Stereospermum kunthianum* Cham.	Aquleqa	Tree	Bark	Wild	Crushing the bark and mix with water	Oral	AB030-2024
Brassicaceae	*Lepidium sativum* L.	Sambila	Herb	Seed	Home	Chopping and mixing with water	Oral	AB021-2024
Brassicaceae	*Brassica nigra* (L.) K. Koch	Search	Herb	Seed	Home	Roasting	Oral	AB09-2024
Combretaceae	*Anogeissus leiocarpa* (A. DC.) Guill. & Perr.	Qey	Tree	Bark	Wild	Crushing the bark and mixed with water	Oral	AB06-2024
Cucurbitaceae	*Cucumis ficifolius* A. Rich.	Holotoo	Herb	Root&fruit	Home	Crushing and diluting	Oral	AB015-2024
Cucurbitaceae	*Zehneria scabra* Sond.	Hiddaa adii	Herb	Whole part	Home	Unprocessed	Tying on the neck	AB035-2024
Euphorbiaceae	*Clutia abyssinica*	fyele fej'	Shrub	Leaf	Wild	Soaking the crushed leaves	Oral	AB013-2024
Fabaceae	*Acacia abyssinica* Benth.	Laaftoo	Tree	Leaf	Wild	Chewing the leaf	Nasal, oral	AB01-2024
Fabaceae	*Albizia schimperiana* Oliv.	Sisa	Tree	Leaf root	Wild	Crush leaves and roots and mix them with water	Oral	AB02-2024
Hypericacea	*Hypericum revolutum* Vahl	Hindhee	Tree	Leaf	Wild	Crushing and squeezing	Oral	AB020-2024
Lamiaceae	*Ocimum lamiifolium* Hochst. ex Benth.	Damakase	Shrub	Leaf	Home	Crushing and squeezing	Oral	AB023-2024
Malvaceae.	*Strculia afriana* (lour.) Fiori	Qombo	Shrub	Root	Wild	Crushing the root and mix with water	Oral	AB031-2024
Melianthaceae	*Bersama abyssinica* Fresen.		Tree	Leaf	Wild	Crushing and squeezing	Oral	AB08-2024
Menispermaceae	*Stephania abyssinica* (Quart.-Dill. & A.Rich.) Walp.	Kalalaa	Herb	Whole part	Wild	Crushing and diluting	Oral	AB029-2024
Piperaceae	*Piper. L*	Mitimita	Herb	Fruit	Home	Chopping with water	Oral	AB024-2024
Plantaginaceae	*Plantago lanceolata* L.	Qorxobbee	Herb	Leaf	Wild	Squeezing	Topical	AB025-2024

Poaceae	*Cymbopogon citratus* (DC.) Stapf	Teji sar	Herb	Whole part	Home	Crushing and squeezing	Oral	AB016-2024
Polygalaceae	*Securidaca longependuculant* Fresen.	Sheqet /sekida	Tree	Bark	Wild	Crushing the bark and mixed with water	Oral	AB028-2024
Ranunculaceae	*Ranunculus multifidus* Forssk.	Marfataa	Herb	Root	Wild	Unprocessed	Tying	AB026-2024
Rubiaceae	*Sarcocephalus latifolius* Sm. E.A.Bruce.	Aqudam	Tree	Root	Wild	Crushing and squeezing	Oral	AB027-2024
Rutaceae	*Citrus aurantifolia.*	Lomi	Shrub	Leaf	Home	Juicing with water	Oral	AB011-2024
Rutaceae	*Clausena anisata* (Willd.) Hook.f. ex *Benth.*	Ulummaa	Shrub	Leaf	Wild	Crushing and squeezing	Oral	AB012-2024
Scrophulariaceae	*Verbascum sinaiticum* Benth.	Yeahaye joro	Herb	Leaf	Home	Crushing powder leaf of *V. sinaiticum* mixed with water is given orally	Orally	AB032-2024
Solanaceae	*Datura stramonium* L.	Manjii	Herb	Leaf	Wild	Crushing and squeezing	Topical bathing	AB017-2024
Solanaceae	*Nicotiana tabacum* L.	Timbaq	herb	Leaf	Home	Chopping the leaves with water, Crushing and diluting	Oral, Nasal, oral	AB022-2024
Solanaceae	*Withania somnifera* (L.) Dunal in DC.	Gizewa,	Shrub	Root, Leaf shoot	Home	Chopping and mixing with water	Oral	AB034-2024
Tiliaceae	*Grewia mollis* A. juss.	Hornots	Tree	Bark	Wild	Crushing the bark and mixed with water	Oral	AB019-2024

IV. DISCUSSION

In the present study, the gender difference men are more knowledgeable than women as far as the use of medicinal plants is concerned in the study district. Similar Ethnobotanical inventories in Ethiopia researchers reported by [18]. This may reflect the fact that males are the most favored by practitioners in the district in the transfer of traditional medical knowledge across generations [29].

In the other study by [34] this is perhaps because, in most parts Ethiopia, the major responsibilities of women are restricted to the home and homestead areas while most of the outdoor activities are done by men.

As shown by the study, the majority of participants selected for participation in ethnoveterinary study in the district were illiterate. This may reveal the fact that illiterate people are more knowledgeable as they are less exposed to cultural change compared with literate ones [13]. Other studies carried out in other parts of the country also revealed that illiterate people held better traditional medical knowledge than literate ones [29].

In Ethiopia, locally available materials, mainly medicinal plants, are commonly utilized to manage livestock diseases. Trypanosomes are protozoan parasites affecting both humans and livestock. The current study establishes a total of 35 types of medicinal plants from 34 genera and 27 families were indicated for ethnoveterinary practices against animal trypanosomosis recorded in the study area. The result of this study is similar to previous findings [30] that showed the use of 18 plants against trypanosomosis in livestock from pastoral communities in Amaro district. Other similar study in the Ambo District belongs, revealed 60 medicinal plants to treat various livestock ailments [24]. This figure is comparable to the number of medicinal plants (68 species) documented from the Dallo Mana District that were used to manage several livestock ailments [26].

The analysis of our data also showed that Solanaceae (3spp.) followed by Fabaceae (2spp.), Asteraceae (2spp.) [15], Rutaceae (2spp.), Aloaceae (2spp.) Brassicaceae (2spp.) accounted for the largest share of the reported ethnoveterinary medicinal plant families. The result of this study is the line with due to Solanaceae were the highest number medicinal plants contribution of this family in the study area.

This study also showed that herbs were the most dominant medicinal flora in the study area, which might be because of their year-round availability, in contrast to trees that were exposed to selective cutting and herbs that blossom seasonally after the rainy season [8]. The dominance of herbs by medicinal plants has been observed in other parts of the country [9].

This indicated the wider distribution and abundance of these plant families in East Africa. Furthermore, the widespread use of species from these families could be linked to their more effective treatments against diseases [14]. The use of Leaves was the dominant plant part employed in remedy preparations for the treatment of trypanosomosis in the study area [16]. The result of this study is in line with another report in the different parts of the country [21], because leaves could be attributed to their perceived efficiency, accessibility, easy to harvesting and simplicity of preparation.

Another study is in line with [32] due to the harvesting of leaves has been reported to have a much less damaging effect on the mother plant compared to other parts such as root and bark the gathering of which could seriously affect the existence of individual plants.

Oral as the major route of application against the treatment of trypanosomosis in this study is consistent with

the study in Nigeria [23], Due to it allows the traditional medicinal actioners to reveres complication that may happen on the clients during the treatment of antidotes [30].

According to reports from previous studies carried out around the nation [33]. The other possible reason for this result could be creating favorable environmental conditions for a quick physical reaction of the preparation against to pathogen and by so doing boosting its healing power.

Crushing is frequently used in creating treatments, which may have something to do with its simplicity [10]. Most remedies in the study district are made from fresh plant materials. Fresh materials were also mentioned in other studies carried out in various regions of Ethiopia.

As shown by the, the majority of claimed medicinal plants were collected from the wild habitats by the results of other studies conducted elsewhere in different parts of the country [31].This may indicate poor cultivation practice of medicinal plants in the study area and might be related to their easy accessibility in the wild.

The preference ranking exercise (Table III), helped in determining which medicinal plant species are most used to treat Trypanosomiasis that is frequently reported in the study area. As a result, indicated that Echinops kebericho was ranked first and followed by Lepidium sativum, Cymbopogon citratus, Clutia abyssinica, and Solanum anguivi had respectively the highest scores and were identified as the most effective treatments for this disease. Future research on the bioactive components of these medicinal plant species against trypanosomiasis-causing germs may also lead to good results.

V. CONCLUSION AND RECOMMENDATIONS

This study showed that Assosa Zone is relatively rich in the diversity of ethnoveterinary medicinal plant species used to treat trypanosomiasis livestock ailments. In this investigation, 35 ethnoveterinary medicinal plants were documented to treat Trypanosomiasis livestock ailments in the study area. Family Solanaceae was the most important in ethnoveterinary uses (4spp.) Herbs were the most dominant life forms (17 spp.), followed by trees (10spp.). Leaves (40%) were the most sought after plant part in ethnoveterinary remedy formulation. The principal method of remedy preparation was crushing remedial parts (57.14%). The main route of administration was via oral application (71.4%). by drenching diseased livestock Based on the demographic characteristics of people who participated in the study, knowledge of herbal medicine is mainly held by males and illiterate people. Priority for further pharmacological and phytochemical investigations needs to be given to the plants *Echinops kebericho*, *Lepidium sativum*, *Cymbopogon citratus*, *Clutia* abyssinica *and Solanum anguivi* that scored the highest preference ranking values for their uses to treat Trypanosomiasis livestock ailments.Therefore, their documentation will be valuable as baseline data for future development of phytochemical constituents and pharmacological property and toxicological studies to confirm Ethnoveterinary uses different specialists including ethnobotanists, veterinarians, pharmacologists and biochemists, government and non-governments organization should work together to identify the best ethnoveterinary medicinal plants for future discovery of new veterinary pharmaceuticals.

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DECLARATION STATEMENT

I must verify the accuracy of the following information as the article's author.

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- **Funding Support:** This article has not been sponsored or funded by any organization or agency. The independence of this research is a crucial factor in affirming its impartiality, as it has been conducted without any external sway.
- **Ethical Approval and Consent to Participate:** The data provided in this article is exempt from the requirement for ethical approval or participant consent.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Authors Contributions:** The authorship of this article is contributed solely.

REFERENCES

1. Abdeta, D. Abay, SM. Kebede, N. Giday, M. Terefe. G, (*2021*). In vitro and in vivo anti-trypanosome activities of methanol extract of Echinops kebericho Roots. Evid Based Complement Altern Med 1–6. DOI: https://doi.org/10.1155/2021/1239379
2. Agize, M. Asfaw, Z. Nemomissa, S. Gebre, T. (2022). Ethnobotany of traditional medicinal plants and associated indigenous knowledge in Dawuro Zone of Southwestern Ethiopia Ethnobiolo Ethnomed, (Vol.18, Issue-1, pp. 48). DOI: http://doi.org/10.1186/s13002-022-00546-4
3. Alexiades, M. (1996). Collecting ethnobotanical data: An introduction to basic concepts and techniques. In: Alexiades MN (eds). Selected Guideline for Ethnobotanical Research: A Field Manual. Botanical Garden, New York https://www.academia.edu/446138
4. Appelgren, L. (2009).Veterinary drugs: yesterday, today and tomorrow. J Vet Pharmacol Ther, 32: 7-10. https://ribs.bib.slu.se/rb/?file=publ/show&id=44469&lang=se
5. Asfaw, A. Lulekal, E. Bekele, T. Debella, A. Debebe, E. & Sisay B. (2022). Medicinal plants used to treat livestock ailments in Ensaro District, North Shewa Zone Amhara Regional State, Ethiopia. BMC Veterinary Research, 18:235. DOI: https://doi.org/10.1186/s12917-022-03320-6
6. Bekele, M. Woldeyes, F. Lulekal, E. Bekele, T. Demissew, S. (2022). Ethnobotanical investigation of medicinal plants in Buska Mountain range, Hamar district, Southwestern Ethiopia. J Ethnobiol Ethnomed Vol.18, Issue-1, pp.60. DOI: http://doi.org/10.1186/s13002-022-00558-0
7. Berhanu, M. Tintagu, T. Fentahun, S. and Giday, M. (2020) Ethnoveterinary survey of medicinal plants used for treatment of animal diseases in Ambo District of Oromia Regional State of Ethiopia. Evidence-Based Complementary and Alternative Medicine 12 pages, Article ID 8816227, DOI: http://doi.org/10.1155/2020/8816227
8. Birhan S. Kitaw L. Alemayehu A. Mengesha M. (2018). Ethnobotanical Study of Medicinal Plants Used to Treat Human Diseases in Enarj Enawga District, East Gojjam Zone, Amhara Region. Ethiopia. SM J Med Plant Stud 1:1–20.

https://www.researchgate.net/publication/330089641
9. Birhanu, T. Abera, D. (2015).Survey of ethno-veterinary medicinal plants at selected Horro Gudurru Districts, Western Ethiopia. Afr J Plant Sci, (Vol. 9, Issue-3, pp. 185-192). DOI: https://doi.org/10.5897/AJPS2014.1229.
10. Chekole, G. Asfaw, Z. Kelbessa, E. (2015). Ethnobotanical study of medicinal plants in the environs of Tara-gedam and Amba remnant forests of Libo Kemkem District, northwest Ethiopia. J Ethnobiol Ethnomed, (Vol.11, Issu-1, pp.4). DOI: http://doi.org/10.1186/1746-4269-11-4
11. Cotton CM. (1996).Ethnobotany: Principles and Applications. John Wiley and Sons Ltd., Chichester, NY.375-399; ISBN 047195537X. https://www.wiley.com/en-us/Ethnobotany%3A+Principles+and+Applications-p-9780471955375
12. Emiru, A. Makonnen, E. Regassa, F. Regassa, F. Tufa, T.(2021).Antitrypanosomal activity of hydromethanol extract of leaves of Cymbopogon citratus and seeds of Lepidium sativum: in-vivo mice model.BMC Complementary Medicine and Therapies ,21:290 DOI: https://doi.org/10.1186/s12906-021-03449-1
13. Feyisa, M. Kassahun, A. Giday, M. (2021). Medicinal Plants Used in Ethnoveterinary Practices in Adea Berga District, Oromia Region of Ethiopia. Hindawi, Evidence-Based Complementary and Alternative Medicine 22. DOI: https://doi.org/10.1155/2021/5641479
14. Gazzaneo, LRS. Paiva, de. Lucena, R. de Albuquerque, UP. (2005). Knowledge and Use of Medicinal Plants by Local Specialists in a Region of Atlantic Forest in the State of Pernambuco (Northeastern Brazil). J Ethnobiol Ethnomed Vol.1,pp.1–9. DOI: https://doi.org/10.1186/1746-4269-1-9
15. Giday, M. Ameni, G. (2003). An ethnobotanical survey of plants of veterinary importance in two woredas of Southern Tigray, Northern Ethiopia. SINET: Ethiop J Sci. Vol. 26, pp.123–136. DOI: http://doi.org/10.4314/sinet.v26i2.18208
16. Gijan, M. Dalle, M. (2019). Ethnobotanical study of medicinal plants in Nagelle Arsi district, West Arsi zone of Oromia, Ethiopia. J Nat Sci Res,Vol. 9,Issue-13). https://www.researchgate.net/publication/336604442
17. Gobana, E. Telila, H. Jilo, A. (*2023).* Ethnobotanical study of medicinal plants used to treat livestock ailments in Dallo Manna District, Oromia State, Ethiopia. Asian Journal Of Ethnobiology,(Vol.6,Issue-2,pp.127).E-ISSN: 2580-4510. DOI: http://doi.org/10.13057/asianjethnobiol/y060203
18. Hankiso, M. Asfaw, Z. Warkineh, B. Abebe, A. Sisay, B. Debella, A. (2024).Ethnoveterinary medicinal plants and their utilization by the people of Soro District, Hadiya Zone, southern Ethiopia. Journal of Ethnobiology and Ethnomedicine, (Vol.20,Issue-21), DOI: https://doi.org/10.1186/s13002-024-00651-6
19. Hedberg, I. Friis, L. & Edwards, S. (2005.) Flora of Ethiopia and Eritrea the National Herbarium, Addis Ababa University, Department of Systematic Botany Uppsala University, Addis Ababa, Ethiopia. https://books.google.com.et/books/about/Flora_of_Ethiopia_and_Eritrea.html?id=xeklAQAAMAAJ&redir_esc=y
20. IBC, (2005). National Biodiversity Strategy and Action plan. Addis Ababa, Ethiopia. https://www.scirp.org/reference/referencespapers?referenceid=1890709
21. Kassa, Z. Asfaw, Z. Demissew, S. (2020). An ethnobotanical study of medicinal plants in Sheka Zone of Southern Nations, Nationalities and Peoples Regional State, *Ethiopia.* J Ethnobiol Ethnomed, (Vol. 16, Issue-1,pp.7). DOI: https://doi.org/10.1186/s13002-020-0358-4
22. Kassaye, K. Amberbir, A. Getachew, B. Mussema, Y. (2006). A historical overview of traditional medicine practices and policy in Ethiopia. Ethio J Heal Dev (Vol.20, Issue-2, pp.127-134). DOI: http://doi.org/10.4314/ejhd.v20i2.10023
23. Kidane, L. Gebremedhin, G. Beyene, T. (2018). Ethnobotanical study of medicinal plants in Ganta Afeshum District, Eastern Zone of Tigray, northern Ethiopia. J Ethnobiol Ethno med, (Vol. 14, Issue-1, pp.64). DOI: https://doi.org/10.1186/s13002-018-0266-z
24. Kitata, G. Abdeta, D. Amante, M. (2017). Ethnoknowledge of plants used in veterinary practices in Midakegn district, west Showa of Oromia region, Ethiopia. J Med Plants Stud, (Vol.5, Issue-5, pp.282-288). https://www.plantsjournal.com/archives/2017/vol5issue5/PartD/5-5-2-637.pdf.
25. Lee, JA. Uhlik, MT. Moxham, CM. Tomandl, D, Sall and DJ. (2012). Modern phenotypic drug discovery is a viable, neoclassic pharma strategy. J Med Chem, (Vol.55 Issu-10, pp.4527–4538). DOI: http://doi.org/10.1021/jm201649s
26. Martin, G. (1995). Ethnobotany: A Method Manual. A People and Plants Conservation anual. Champman and Hall, London. DOI: http://doi.org/10.1007/978-1-4615-2496-0_2
27. Newman, D.J. Cragg, G. M. Snader, K. M. (2002). Natural products as sources of new drugs over the period 1981−2002, *Journal of Natural Products* (Vol. 66, Issue-7, pp.1022–1037). Nat. Prod. 2016, 79, 629−661630. DOI: https://doi.org/10.1021/np030096l
28. Nuro, G. Tolossa, K. Giday, M. (2024). Medicinal Plants Used by Oromo Community in Kofale District, West-Arsi Zone, Oromia Regional State, Ethiopia. Journal of Experimental Pharmacology (Vol. 16, pp.81-109). DOI: https://doi.org/10.2147/JEP.S449496
29. Oda, B. Lulekal, E. Warkineh, B. Asfaw,Z. Debella, A. (2024).Ethnoveterinary medicinal plants and their utilization by indigenous and local communities of Dugda District, Central Rift Valley, Ethiopia. Journal of Ethnobiology and Ethnomedicine, (Vol.20,Issue-32. DOI: https://doi.org/10.1186/s13002-024-00665-0
30. Shilema, A. Zerom, K. Mus, A. (2013). Ethnoveterinary practices against animal trypanosomosis in Amaro district, Southern Ethiopia. *International Journal of Medicinal Plants Research, (Vol.* 2 Issue-7, pp. 238-241). ISSN: 2169-303X. https://www.researchgate.net/publication/257632351
31. Tadesse, A. Kagnew, B. Kebede, F. Kebede, M.(2018). Ethnobotanical study of medicinal plants used to treat human ailment in Guduru District of Oromia Regional State, Ethiopia. *J Pharmacogn Phytother*. (Vol.10, Issue-3, pp.64–75). https://www.researchgate.net/publication/325468554
32. Teka, A, Asfaw, Z. Demissew, S. Van Damme, P. (2022). Traditional uses of medicinal plants practiced by the indigenous communities in Gurage Zone, south central Ethiopia. Ethnobot Res Appl. 19:41. DOI: http://dx.doi.org/10.32859/era.19.41.1-31
33. Tolossa, K. Debela, E. Athanasiadou, S. Tolera, A. Ganga, G. Houdijk, JG. (2013). Ethno-medicinal study of plants used for treatment of human and livestock ailments by traditional healers in South Omo, Southern Ethiopia. Journal of Ethnobiology and Ethnomedicine,(Vol. 9, Issu-32, pp.1-15), http://www.ethnobiomed.com/content/9/1/32
34. Tura, HA. (2014). Women are Right to and Control over Rural Land in Wolaita Zone Southern Ethiopia. *SSRN Electron J.* 2:81–93). https://www.crdeepjournal.org/wp-content/uploads/2014/07/Vol-2-4-3-GJCR.pdf
35. WHO. (2013). Traditional Medicine Strategy 2014–2023. *World Health Organization*: 1–76 https://www.who.int/publications/i/item/9789241506096
36. Esirgapovich, S. J., Abduvaxitovna, S. S., Toshxodjaevich, D. G., & Ishmuxammat ugli, S. D. (2019). Sorption and Desorption of Medicinal Plants. In International Journal of Innovative Technology and Exploring Engineering (Vol. 9, Issue 2, pp. 685–688). DOI: https://doi.org/10.35940/ijitee.b6710.129219
37. Keskar, M., & Maktedar, Dr. D. (2019). Enhancing Classifier Accuracy in Ayurvedic Medicinal Plants using WO-DNN. In International Journal of Engineering and Advanced Technology (Vol. 9, Issue 1, pp. 6705–6714). DOI: https://doi.org/10.35940/ijeat.a2001.109119
38. Sharma, V., Verma, Dr. A., & Goel, Dr. N. (2020). Classification Techniques for Plant Disease Detection. In International Journal of Recent Technology and Engineering (IJRTE) (Vol. 8, Issue 6, pp. 5423–5430). DOI: https://doi.org/10.35940/ijrte.f9902.038620

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