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An ethnoveterinary survey of medicinal plants used by local informants in selected districts of Jimma Zone, Ethiopia

Tesfa Mossie and Beksisa Urge

Abstract
Herbal therapies are still preferred in primary health care for livestock in Ethiopia. Local traditional health care workers of a given community have their own specific knowledge of medicinal plants to manage livestock health problems. The objectives of the study were to document veterinary use of medicinal plants and associated indigenous knowledge of local users in Jimma zone, Ethiopia. Data was collected between April 2017 and May 2018. Individual-based field interviews were done with 210 purposively selected informants via a semi-structured questionnaire. The questionnaire elucidated information on harvesting, preparation, routes, use, types, and parts used. The study identified 110 species belonging to 55 families as being used to treat 30 livestock ailments. Asteraceae had the highest number of species, constituting 19.1% of the total, followed by Fabaceae (12.9%) and Rutaceae (4.5%). Herbs were the dominant growth form of these plant species, followed by trees and shrubs. Leaves and roots were the most frequently utilized plant parts, accounting for 75% and 10.83%, respectively. The current findings indicate the presence of abundant plant species in the study area. This rich plant diversity is the primary source of their medication. Herbs are popular as a source of herbal therapies due to their higher pharmacologically active ingredients, availability everywhere, and ease of collection when compared to trees and shrubs. Therefore, traditional healers should be encouraged to transfer their indigenous knowledge to their families and relatives to preserve it for the next generation. Phytochemical and pharmacological screening of plant species has the highest fidelity level needed to extract bioactive compounds and test them through *in vitro* and *in vivo* assay methods.

Keywords: Diseases, ethno veterinary, fidelity level, informant consensus factor and Jimma zone

1. Introduction
Ethiopia's livestock industry is a significant constituent of farming that can assist society in several developing countries, including Ethiopia, with their livelihoods and food security (Shapiro *et al*., 2017; Mengistu *et al*., 2021) [40, 36]. Although the livestock sector contributes to the national economy, its growth is hampered by various constraints such as disease, feed shortages, and low genetic potential (Mengistu *et al*., 2021; Aman *et al*., 2020) [36, 5]. The disease is the primary cause of livestock underperformance and causes significant economic losses in the country (Feyera *et al*., 2017) [21]. Because of the scarcity of modern veterinary services and the high cost of synthetic chemicals, numerous rural farm animal owners depend on ethnoveterinary medicinal practices for disease control measures (Kemal *et al*., 2020; Feyisa *et al*., 2021) [32].
Many developing countries, including Ethiopia, have embraced ethnoveterinary medicine (Eiki *et al*., 2021) [18]. The medicinal plant-based livestock health care system persists and remains the main alternative for different ailments in Ethiopia. This is due to limited access to modern veterinary services; a prohibitive distance from the health service stations; the scarcity of modern veterinary drugs; the emergence and re-emergence of diseases; and the appearance of drug-resistant pathogens (Tolossa *et al*., 2013; Abdeta, 2020; Khan *et al*., 2021) [47, 1, 33]. Medicinal plants are also widely used due to their efficacy against certain types of diseases, availability, economic affordability, and cultural beliefs/cultural acceptability (Rehman *et al*., 2022) [39]. Farmers and herders in Africa have indigenous knowledge of treating livestock diseases with medicinal plants where they use their perception and experience to categorize plants and plant parts to be used when dealing with different aliments (Feyera *et al*., 2017; Selogatwe *et al*., 2021) [21].

Traditional veterinary medicines are less expensive and easier to obtain than modern therapeutic drugs. Therefore, ethnoveterinary medicine plays an important role in Africa's livestock health care system (Tchetan *et al*., 2021) [45].

The method for making ethnoveterinary medicines differs depending on the active ingredients to be extracted, the route of administration, and the medical purpose (prophylaxis or therapeutics). Infusions, decoctions, powders, drops, fumes, pastes, and ointments are made from medicinal plants, animals, minerals, and other non-plant substances by livestock owners and herders. These might be administered topically as drenches, vaccinations, or suppositories, or subcutaneously as smoke, vapors, massages, or intra-nasally as an intra-nasal injection (Eiki *et al*., 2021) [18]. Traditional medicinal plants play an important role in primary health care delivery in Sub-Saharan African countries, where traditional medicine is used to care 90% of the livestock population (Tchetan *et al*., 2021; Eiki *et al*., 2021; Abdeta, 2020; Alemneh, 2021; Eshete and Molla, 2021) [45, 18, 1, 4, 19].

Several threats are undermining the traditional plant's relevance in modern African societies. These include ecological and technological changes; access to modern health care; as well as anthropogenic and natural factors that endanger many plant species of veterinary importance (Aziz *et al*., 2020) [9]. Deforestation, overgrazing, habitat loss, degradation, and agricultural land expansion are all ongoing threats to Ethiopia's traditional medicinal plants (Asefa *et al*., 2021; Chen *et al*., 2016; Usmane *et al*., 2016) [6, 16, 49]. In Ethiopia, knowledge of traditional medicinal plants that have been developed for millennia is now at risk of extinction because it has primarily been stored in the memories of elderly people and passed down primarily through word of mouth, which is susceptible to losses at each point of transfer (Feyera *et al*., 2017; Tadesse *et al*., 2018) [21, 43]. Therefore, unless properly documented and investigated, valuable medicinal plants and indigenous knowledge of local informants are endangered. Ethnoveterinary investigation has been carried out in Ethiopia's Oromia region (Feyisa *et al*., 2021; Yigezu *et al*., 2014; Abdeta, 2020; Eshete and Molla, 2021) [22, 1, 50, 19]. However, there has been no study of medicinal plants used to treat livestock diseases in the districts of Sokoru, Mancho, Shebe Sombo, and Omo Beyan. As a result, researching, documenting, and analyzing traditional knowledge on medicinal plants and curative plant reservoirs, which are typically remnants of natural forests, is a timely endeavor. Therefore, the study's objective was to document indigenous knowledge of ethnoveterinary plants used to treat and prevent livestock diseases in four selected districts of Jimma Zone, Ethiopia. And to generate a concise baseline data set that can be used as a foundation for future research.

2. Materials and methods

2.1 Study area

The study was conducted from April 2017 to May 2018 in selected districts (Shebe Sombo, Mancho, Sokoru, and Omo Beyan) of the Jimma zone of the Oromia regional state, which geographically lies at a latitude of about 7013'-805' N and a longitude of about 35052'-37037' E. Four districts were chosen based on agro-ecological differences (Figure 1), with the assumption that vegetation type varies with agro-ecological differences, which may influence the type of medicinal plants present. Sixteen kebeles (administrative centers) were chosen from selected districts, four from each district. The study districts were chosen using a purposive sampling technique based on the availability of traditional medicine practitioners as recommended by elders, religious leaders, and local authorities. Furthermore, the agro-climatic zones were taken into account when choosing the districts. A mixed farming system is the mode of agriculture in the region, with domestic ruminants being the major livestock kept for the livelihood of the local population in the rural areas. The area is rich in floral biodiversity.

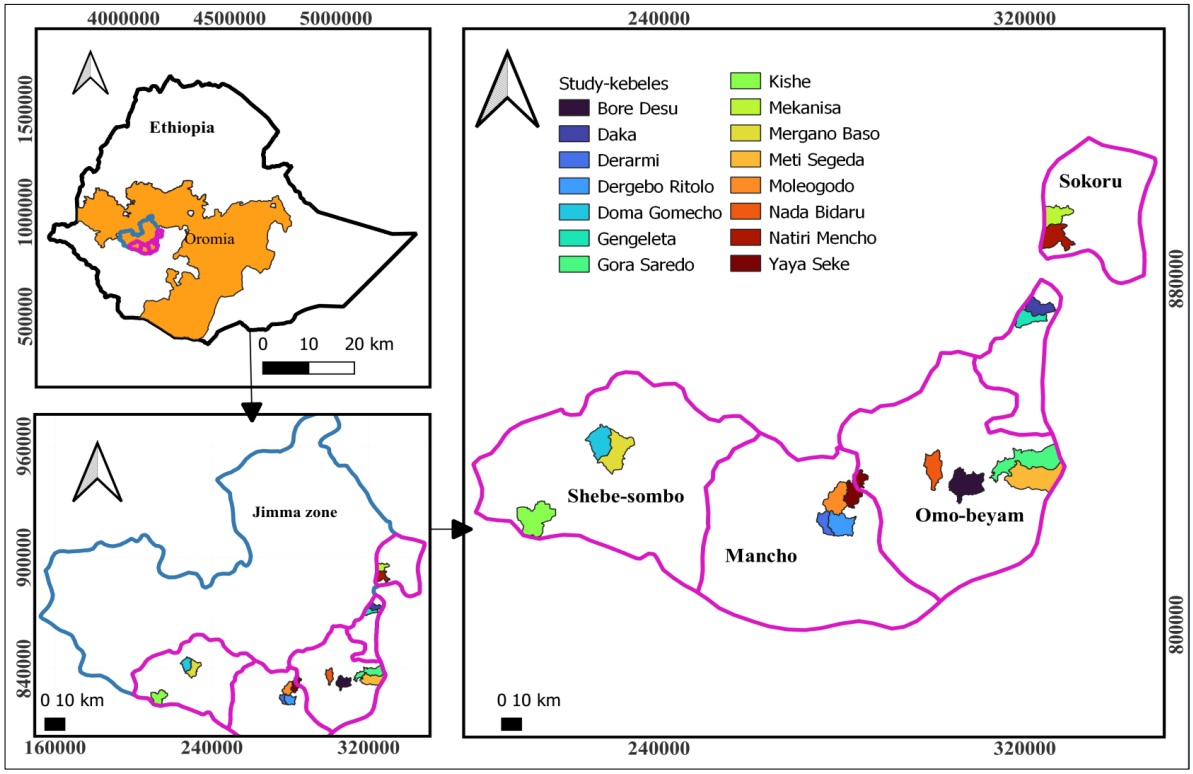

Fig 1: Study area map

2.2 Selection of informants and interviewing process

Participants were elderly and traditional healers who volunteered and varied in age, gender, occupation, and educational level. Two hundred and ten informants (208 males) were randomly and purposefully selected from ethnic groups of various ages (15–82 years), religion, educational status, livestock farming experience, and years of service with the help of local elders, agricultural and health extension workers, and administrative personnel for our study units. The selected healers were well-known in the community due to their long history of providing traditional health care services to the community. Before the start of the interviews, informed consent was obtained from each informant who participated in this study after explaining the objective of the study and assuring them of the most responsible judicial use of the resulting information. Then, indigenous knowledge of selected informants about ethnoveterinary medicinal plants used to treat livestock diseases was extracted using semi-structured questionnaires, field observations, and group discussions. Different informants' skills in the preparation of medicines were reported. These include plant composition, plant condition, and preparation methods such as crushing, infusion, rubbing, pasting, and pounding.

2.3 Data collection

Individual interviews were conducted with informants using semi-structured questionnaires written in English and translated into the local Afan Oromo and Amharic languages. Each informant's name, age, gender, level of education, occupation, and religion were gathered. The ethnoveterinary medicinal plants' local/vernacular names, methods of preparation, diseases treated with traditional remedies, route of administration, ingredients used, the habitat where the plant is adapted, type of plants, and parts of the medicinal plants used were all recorded.

2.4 Plant specimen collection and identification procedures

Field trips were conducted with local informants to collect and record reported medicinal plant specimens from wild and home gardens following standard procedures (Queensland Herbarium, 2016). Plant specimens were collected by including vegetative parts, leaves, floral, fruiting, and/or seed parts that were suitable for taxonomic identification. The collected plant specimens were dried and pressed onto herbarium sheets made of cardboard or newspaper. Plant voucher specimens and the necessary documentation were delivered to Addis Ababa University's Arta Kilo Campus National Herbarium, Plant Biology and Biodiversity Department, and the College of Natural Sciences for taxonomic identification. Scientifically identified medicinal plants were classified as wild, cultivated, herbs, shrubs, and trees based on the source and growth forms of plants, respectively. Plant specimens were identified according to the flora of Ethiopia and Eritrea documentation (Demissew *et al*., 2021) [17], and vouchers were deposited in the national herbarium of Ethiopia at Addis Ababa University.

2.5 Statistical analysis

The data were entered into SPSS version 21 and, summarized using descriptive statistical methods (frequency and percentage). The informant consensus factor (ICF) and fidelity level (FL) were used to validate the importance of medicinal plants. The ICF was calculated to determine informant agreement for a plant species in treating a specific disease using the following formula (Heinrich *et al*. 1998) [28]. ICF = (nuc – ns)/(nuc – 1), where nuc = number of use citations and ns = number of species used for each use citation. The fidelity (FL) values of medicinal plants were used to estimate the relative healing potential of each medicinal plant based on the proportion of informants who agreed on its use for a given ailment category (Friedman *et al.* 1986) [23]. Fidelity values determine the effectiveness of medicinal plants and are used to recommend further analysis of their bioactivity and therapeutic properties. Fidelity values were calculated using the following formula: FL (%) = SF/TF*100, where SF represents the frequency of citation of a given species for a specific aliment and TF represents the total number of citations of that species for any ailments. A statistically significant difference was determined when the P-value is less than 0.05 using the Chi-square test.

3. Result

3.1 Informants Demographic Profiles

The study included 210 participants, 208 (99.1%) of whom were male (Table 1). The respondents' age ranged from 15 to 82 years, with their experience in livestock farming ranging from 7 to 70 years. The majority of the informants were between 31 and 46 years old (40.9%) and 47–62 years (30.9%) (Figure 2). According to the educational status analysis, 114 (54.2%) of the informants were illiterate, while 74 (35.2%) and 19 (9.0%) completed grades 1-6 and 7-9, respectively. The remaining three (1.4%) respondents were college graduates or higher. The informants learned about medicinal plants from their elders 94 (44.8%), traditional healers 16 (7.6%), and both elderly and traditional healers 100 (47.6%) (Table 1, Figure 2). The distribution of informants by the district revealed that 60 informants came from Mancho, 24 from Omo Beyan, 59 from Shebe Sombo, and the remaining 67 from Sokoru.

Table 1: Demographic data of the informants

Variables	Categories	Number of respondent	Percent (%)
Gender	Male	208	99.0
	Female	2	0.9
Age	15-30 years	28	13.3
	31-46 years	86	40.9
	47-62 year	65	30.9
	>/ =63 years	31	14.7
Religion	Orthodox	14	6.6
	Muslim	196	93.3

Educational background	Illiterate	114	54.2
	completed 1-6	74	35.2
	Completed 7-9	19	9.0
	College diploma and above	3	1.4
Experience in livestock farming	7-22 years	84	40
	23-38 years	79	37.6
	39-54 years	38	18.1
	>/=55 years	9	4.2
Years of service as traditional healer	8-25 years	104	49.5
	26-42 years	81	38.6
	43-59 years	12	5.7
	>/=60 years	13	6.2
Source of knowledge	Elder's	94	44.8
	Traditional healers	16	7.6
	Elder's and traditional healers	100	47.6

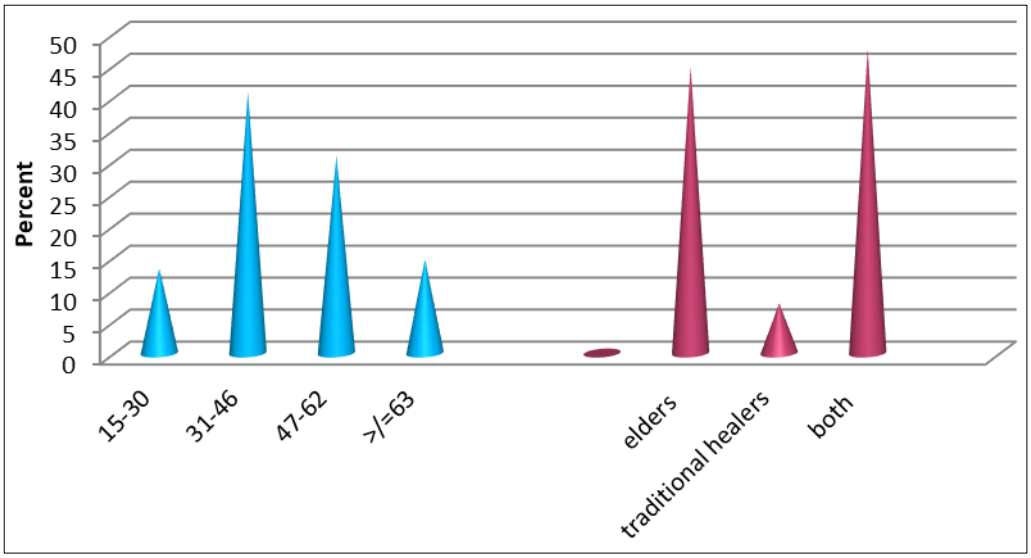

Fig 2: Age groups in years (left) and source of knowledge (right) of informants

3.2. Habits, parts used and source of medicinal plants

Scientifically identified medicinal plants were classified as herbs, shrubs and trees, wild and cultivated based on growth forms and source of plants, respectively. Herbs were the most commonly used medicinal plants, accounting for 47 (39.17%), followed by trees 43(35.83%) and shrubs 30 (25%) (Figure 3). For herbal preparations, the most commonly used plant parts were leaves, followed by roots, seeds, fruit, all parts, and stem bark (Figure 3). The principal sources of medicinal plants were wild 107 (89.17%) and cultivated 13 (10.83%) (Figure 3).

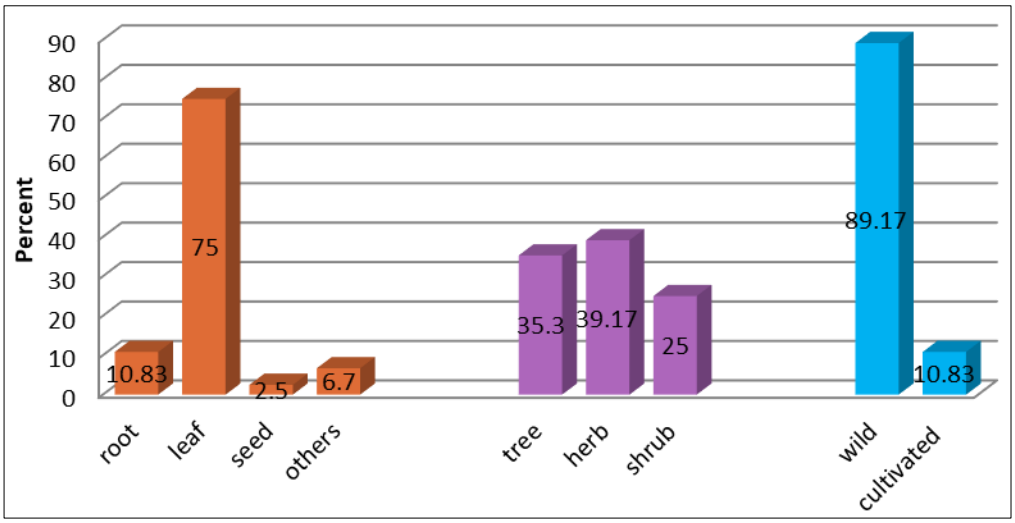

Fig 3: Diagramatic representation of parts used, growth forms and source of medicinal plant

3.3. Condition, route and preparation method

Traditional healers utilized different conditions of plants, such as fresh, dry, and both dry and fresh. Herbal treatments were mainly prepared from fresh materials of plant species, accounting for 86 (78%), followed by dry 14 (13%). The remaining nine (9.7%) plant species were prepared both from fresh and dry materials. The most common routes of administration were oral (92.8%), followed by aerosol/nasal (4.2%), and topical (2.4%). Different methods of medicinal plant preparation were identified by different informants. These include crushing, infusion, decoction, and rubbing. The main preparation methods used by local healers were crushing/grinding and soaking in water. The main ingredients used in the preparation of herbal remedies were water, salt, and milk.

3.4. Diversity of species used

One hundred and ten species belonging to 55 families were documented for the ailments of different types of livestock diseases (Table 2). The majority of these medicinal species occur in the wild (Figure 3). The medicinal plant families that had the highest number of species were Asteraceae (21 species, 19.1%), Fambaceae (12 species, 10.9%), Rutaceae and Solainaceae (5 species, 4.5% each), Vitaceae (4 species, 3.6%), Acanthaceae, Asparagaceae, Cucurbitaceae, and Euphorbiaceae (3 species, 2.7% each) (Figure 4). The remaining families were represented by two or one species each. The most commonly used plant species for livestock disease treatment by informants were *N. tabacum L.*, *E. kebericho*, *H. mystacinus (Ait.) E. Mey. ex Steud*, and *C. macrostachyus Del*. Most of medicinal plants were available every time, and some were found seasonally in the study area.

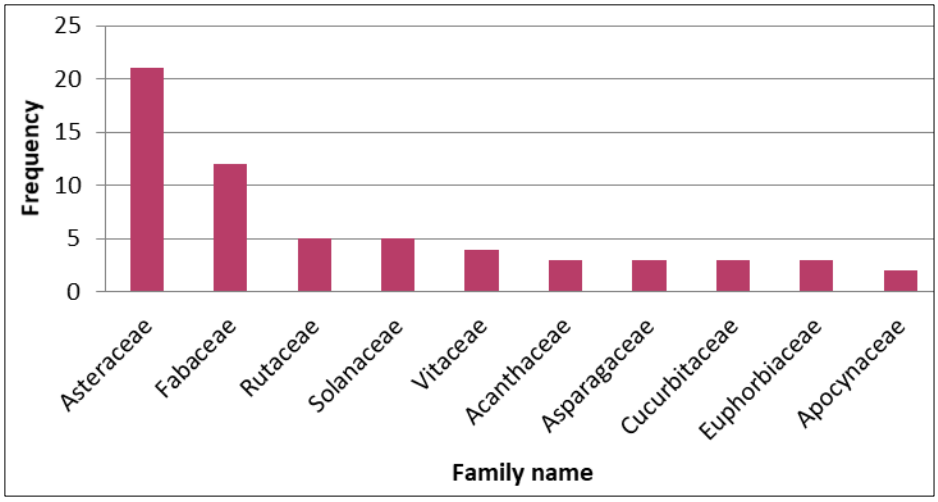

Fig 4: A graphical representation of the number of species within each family

Table 2: Medicinal Plants Species, Families, Parts used, Habit and Indication

Botanical Name	Family name	Local name	Type	Parts used	Source	Indication
Ehretia cymosa Thonn.	Boraginaceae	Ulagaa	tree	Leaf	wild	blackleg
Kalanchoe sp.	Crassulaceae	busokie	herb	Leaf	wild	Actinobacillosis
Justicia schimperiana (Hochst. ex Nees) T Anders.	Acanthaceae	sensel/ummuga	Shrub	leaf	wild	Rabies
Grewia ferruginea Hochst. ex A. Rich.	Tiliaceae	lenquata	Tree	leaf	wild	Retained placenta
Ipomoea cairica (L.) Sweet	Convolvulaceae	mecharia	Tree	leaf	wild	External parasite
Brucea antidysenterica JF. Mill.	Simaroubaceae	Tolo	Tree	Leaf	wild	Fasciola
Solanecio sp.	Asteraceae	whashint	Tree	leaf	wild	Snake bite
Indigofera spicata Forssk.	Fabaceae	tasota	Tree	leaf	wild	blackleg
Clematis longicauda Steud ex A. Rich.	Ranunculaceae	segu	Herb	leaf	wild	blackleg
Vernonis sp.	Asteraceae	derash	herb	leaf	wild	Diarrhea
Senna septemtrionalis (Viv.) Irwin & Barneby	Fabaceae	makisem	Shrub	leaf	wild	Internal parasiste
Momordica foetida Schumach.	Cucurbitaceae	hideminan bofa	Herb	leaf	wild	Internal parasite
Datura stramonium L.	Solanaceae	asangra	Herb	leaf	wild	Wound
Helinus mystacinus (Ait.) E. Mey. ex Steud.	Rhamnaceae	fechaa	Herb	root	wild	Blackleg, bloat, colibacilosis, colic
Kosteletzkya sp	Malvaceae	hide jeb	Herb	leaf	Wild	Diarrhea
Fagaropsis angolensis (Engl.) Dale	Rutaceae	siglu	Tree	leaf	wild	Bloat, tryp
Allophylus sp.	Sapindaceae	gursedi	Shrub	leaf	wild	Bloat, colic, LSD, tryp
Celtis africana Burm. f	Ulmaceae	qaci/qeye/qa'ee	Tree	leaf	wild	leech
Ficus carica L.	Moraceae	balon sofi	Tree	leaf	wild	Constipation
Millettia ferruginea (Hochst.) Bak	Fabaceae	askira	Tree	leaf	wild	External parasite, leech

Cyphostemma sp.	Vitaceae	hide rifa	Herb	leaf	wild	colic
Continued						
Hypericum quartinianum A. Rich.	Hypericaceae	mukefeni	Shrub	leaf	wild	Diarrhea, tryp
Withania somnifera (L.) Dunal	Solanaceae	gizawa	Shrub	leaf	wild	Dyspnea
Solanecio sp.	Asteraceae	yerio garo	Herb	All parts	wild	Diarrhea
Apodytes dimidiata E. Mey. ex Arn.	Icacinaceae	wendebiyo	Tree	leaf	wild	Blackleg, bloat, external parasite, leech
Rhus sp.	Anacardiaceae	sio	Tree	leaf	wild	Dermatophilosis, papiloma virus, LSD
Laggera crispata (Vahl) Hepper & Wood	Asteraceae	timatimbo	Shrub	leaf	wild	Colic, diarrhea
Solanecio gigas (Vatke) C. Jeffrey	Asteraceae	domuborokko	herb	leaf	wild	blackleg
Asparagus africanus Lam.	Asparagaceae	sariti	Herb	Leaf and seed	wild	blackleg
Cyathula uncinulata (Schrad.) Schinz	Amaranthaceae	q/ummo	Shrub	Leaf	wild	tryp
Verbena bonariensis L. subsp. officinalis R. Fernandes & Verde.	Verbenaceae	sarinebii	Shrub	leaf	wild	tryp
Piper capense L.f	Piperaceae	tunjo	Shrub	Leaf and seed	wild	Blackleg, bloat, parasite
Plumbago zeylanica L.	Plumbaginaceae	omera	Shrub	leaf	wild	Pasteurellosis
Dalbergia lactea Vatke	Fabaceae	hide boso	Shrub	Leaf	wild	Pneumonia
Bersama abyssinica Fresen.	Melianthaceae	lonches	Herb	leaf	wild	Mastitis
Tagetes minuta L.	Asteraceae	xirooftu	Tree	leaf	wild	bloat
Acacia sp.	Fabaceae	qorati adii	Herb	Root/all parts	wild	Blackleg, colic
Ipomea sp.	Convolvulaceae	idda oolaa	Shrub	All parts	wild	Pus forming bacteria
Triumfetta tomentosa Boj.	Tiliaceae	lenqeno	Shrub	leaf	wild	Internal parasite
Solanecio sp.	Asteraceae	aqarqara	Tree	leaf	wild	Diarrhea
Acacia sp.	Fabaceae	ambelta	Tree	leaf	wild	bloat
Gardenia ternifolia Schumach. & Thonn.	Rubiaceae	qenbelo	Tree	leaf	wild	Mastitis
Albizia schimperiana Oliv.	Fabaceae	sesa	Tree	leaf	wild	Wound
Amorphophallus sp.	Araceae	qiccu	Herb	root	wild	Blackleg, bloat, colibacillosis,
Clematis longicauda Steud ex A. Rich.	Ranunculaceae	fitii	Herb	leaf	wild	leech
Acmella caulirhiza Del.	Asteraceae	gororsa	Herb	leaf	wild	bloat
Bidens prestinaria (Sch. Bip.) Cufod.	Asteraceae	derbata	Herb	leaf	wild	bloat
Tagetes minuta L.	Asteraceae	a/muda	Herb	leaf	wild	Anthrax, bloat, colic, diarrhea
Schrebera alata (Hochst.) Welw.	Oleaceae	Dham'ee	Tree	root	wild	Internal parasite
Echinops sp.	Asteraceae	duche	Herb/shrub	root	wild	Internal parasite
Euphorbia tirucalli L.	Euphorbiaceae	cedaa/kincheb	Shrub	leaf	wild	Internal and external parasite
Sida rhombifolia L.	Malvaceae	girnche	Herb	root	wild	Pasteurellosis
Laggera crispata (Vahl) Hepper & Wood	Asteraceae	buke faki	Herb	leaf	wild	Internal parasite
Laggera crispata (Vahl) Hepper & Wood	Asteraceae	bukee faki	Herb	leaf	wild	Internal parasite
Cynoglossum lanceolatum Forssk.	Boraginaceae	metene	Herb	leaf	wild	Leech, snake bite, wound
Croton macrostachyus Del.	Euphorbiaceae	bisana	Tree	leaf	wild	Blackleg, bloat, diarrhea, parasite,
Olinia rochetiana A.Juss	Oliniaceae	Nolee	Tree	leaf	wild	Blackleg, tryp, FMD
Brucea antidysenterica Fresen	Simaroubaceae	qumogno	Tree	leaf	wild	Blackleg, diarrhea, mastitis, LSD, pink eye, tryps
Calpurnia aurea (Aiton) Benth	Fabaceae	Cheka	Tree	leaf	wild	Bloat, dermatophilosis, diarrhea, parasite, pneumonia
Ricinus communis	Euphobiaceae	gulo	Tree	Leaf and root	cultivated	Anthrax, babesia, blackleg, bloat, colic, diarrhea, rabies
Momordica foetida (Ao) Schumach	Cucurbitaceae	Iddaa minaan bofa	Herb	leaf	wild	Blackleg, internal parasite
Ocimum lamiifolium Benth	Lamiaceae	damakese	Herb	leaf	wild	Blackleg, fever

Dieliptera acanthaceae C.B.el	Acanthaceae	Togo	Tree		wild	blackleg
Ekebergia capensis Sparm.	Meliaceae	Sombo	Tree	bark	wild	Blackleg, colic
Lepidium sativum L	Brassicaceae	feto	Herb	seed	outlived	Anthrax, blackleg, constipation, leech
Echinops kebericho Mesfin	Asteraceae	Kebericho	Herb	root	wild	Blackleg, bloat, parasite, snake bite, tryps
Viscum tuberculatum A.Rich	Viscaceae	Harmo	Herb	leaf	wild	Mastitis
Vernonia amygdalina Del.	Asteraceae	ebicha	Tree	leaf	wild	Diarrhea
Calpurnia aurea (Aiton) Benth	Fabaceae	digita	Tree	leaf	wild	Diarrhea, internal and external parasite, LSD
Solanum marginatum L.f	Solanaceae	hiddi	Shrub	fruit	wild	Blackleg, diarrhea, leech, pneumonia, tryp, fasciola
Curcumis ficifolius A. Rich	Cucurbitaceae	Faca' aa	Herb	root	wild	blackleg
Nicotiana tabacum L.	Solanaceae	Tambo	Shrub	leaf	wild	Babesia, blackleg, dermatophilosis, leech
Citrus Sinensis (L.) Osb	Rutaceae	birtukan	Shrub	leaf	cultivated	blackleg
Clausena anisata Benth	Rutaceae	Urgesa	Tree	leaf	wild	blackleg
Hagenia abyssinica (Bruce) J.F. Gmel.	Rosaceae	koso	Tree	seed	wild	Internal parasite
Vernonia auriculifera Hiern	Asteraceae	Rejii	Shrub	leaf	wild	Babesia, bloat, pneumonia, wound
Phytolacca dodecandra L' Herit.	hytolaccaceae	endod	Shrub	leaf	cultivated	Diarrhea, external parasite, NCD, leech, pink eye, rabies
Urtica simensis L. **	Urticaceae	Sama/dobi	Herb	root	cultivated	Mastitis, rabies
Podocarpus falcatus Thunb.) Mirb	Podocarpaceae	zigba	Tree	leaf	cultivated	Bloat
Vernonia amygdalina Del.	Asteraceae	girawa	Tree	leaf	cultivated	Blackleg, bloat, colic, dermatophilosis, diarrhea
Acacia abyssinic Hochst ex.Benth.	Fabaceae	laftoo	Tree	leaf	wild	Internal parasite
Acacia negrii Pic.Semi	Fabaceae	laftoo	Tree	leaf	wild	Internal parasite
Allium sativum L	Alliaceae	nech shenqurt	Herb	root	cultivated	Anthrax, blackleg, parasite, leech, tryp
Carica papaya L	Caricaceae	papaya	Tree	leaf	cultivated	Blackleg, constipation
Carissa spinarum L	Apocynaceae	Hagamsa	Shrub	leaf	wild	Fasciola
Clerodendrum myricoides	Lamiaceae	Maraasisaa	Shrub	leaf	wild	Mastitis
Dodonaea angustifolia L.f	Sapindaceae	Ittacha	Shrub	leaf	wild	Colic, diarrhea
Erythrina Oral brucei Schweinf	Fabaceae	Waleensuu	Tree	leaf	wild	Colic, diarrhea, internal and external parasite, pink eye
Indigofera hochstetteri Bak.	not id	Qoricha hadha'a	not id		wild	Internal and external parasite
Justicaschimperiana (Hochst.ex.Nees) T. Andres	Acanthaceae	dhumuugaa	Shrub	leaf	wild	Pasteurellosis, rabies, fasciola, foot root
Linum usitatissimum L	Lineaceae	telba	Herb	seed	cultivated	Constipation, pica
Lippia adoensis Hochst.ex.Walp Var. adoensis.	Verbenaceae	Kusaayee	Shrub	seed	wild	Internal and external parasite
Pavonia urens Cav. Premna resinosa	Asteraceae	Maxxanne	Herb	leaf	wild	Diarrhea, leech
Bidens pilosa L.	Asteraceae	Maxxanne	Herb	leaf	wild	Diarrhea, leech
Bidens biternata (Lour.) Merr.& Sherff.	Asteraceae	Maxxanne	Herb	leaf	wild	Diarrhea, leech
(*Premna resinos*a (Hochst.)Schauer	Verbenacea	Urggeesaa	Tree	leaaf	wild	blackleg
Snowdenia polystachya (Fresen.) Pilg	Poaceae	*muja*	Herb	leaf	wild	Oestrus ovis
Artemisia abyssinica Sch. Bip. ex A. Rich.	Asteraceae	kodoo	Herb	leaf	wild	blackleg
Asparagus africanus Lam.	Asparagaceae	saritii	Herb	leaf	wild	Internal parasite
Asparagus racemosus Willd.	Asparagaceae	sariti	Herb	leaf	wild	Internal parasite
Brassica carinata A. Br.	Brassicaceae	gomenzer	Herb	seed	cultivated	Parasite, pasteurellosis,

						pneumonia
Cheilanthes farinosa (Forssk.) Kaulf.	Sinopteridaceae	karkaro	Herb	root	wild	Diarrhea
Clausena anisata (Willd.) Benth	Rutaceae	ulumayii	Shrub	leaf	wild	External parasite, pneumonia, tryp
Cyphostemma adenocaule (Steud. ex A. Rich.) Des. ex Wild & Drum.	Vitaceae	hidda boffa	Herb	leaf	wild	Foot root
Cyphostemma cyphopetalum Fresen.) Des. ex Wild & Drum	Vitaceae	hidda boffa	Herb	leaf	wild	Foot root
Cyphostemma dembianense (Chiov.) Vollesen)	Vitaceae	hidda boffa	Herb	leaf	wild	Foot root
Euphorbia dumalis S. Carter	Euphorbiaceae	gurii	Shrub	seed	wild	blackleg
Hagenia abyssinica (Bruce) J.F. Gmel.	Rosaceae	hexxoo	Tree	leaf	wild	Babesia, diarrhea, leech, wound
Juniperus procera Hochst. ex Endl.	Cupressaceae	Tsed	Tree	leaf	cultivated	bloat
Olea europaea L. subsp cuspidata (Wall. ex G.Don) Cif.	Oleacea	ejersa	Tree	leaf	wild	Snake bite
Olinia rochetiana A.Juss.	not id	Solee/dalachoo	Shrub	leaf	wild	Colic
Podocarpus falcatus (Thunb.) R.B. ex Mirb	Podocarpaceae	birbirsa	Tree	root	wild	Babesia, colic, internal parasite
Salix mucronata Willd.	Salicaceae	alaltuu	Tree	leaf	wild	Rabies
Zingiber officinale Roscoe	Zingiberaceae	gingble	Herb	root	cultivated	Blackleg, pink eye, tryp
Carissa spinarum L.	Apocynaceae	agam	Shrub	leaf	wild	wound
Embelia schimperi Vatke	Myrisinaceae	hanquu	Shrub	seed	wild	Colic, diarrhea
Withaniasomnitera	*Solanaceae*	Mixmixa	Herb	fruit	wild	Bloat and internal parasite
Maesallanceolataforssk	*Myrsinaceae*	*abayi*	Tree	leaf	wild	Bloat, diarrhea, internal and external parasite, leech
Zehneria scara	*cuccurbitaceae*	*hidda reefaa*	Herb	leaf	wild	blackleg
Citrus aurantifolia	Rutaceae	loomi	Tree	fruit	wild	Internal parasite

3.5. Livestock disease treated and diagnoses

Thirty livestock diseases were identified as being treated with local medicinal plants. Among these reported livestock diseases, blackleg, internal parasites, bloat, leech infestation, colic, and external parasites were found to be the most frequent (Figure 5). Healers diagnose livestock diseases based on observation and/or information obtained by interviewing the livestock owner about major symptoms shown by the diseased animal. Symptoms can be seen in its mouth and foot parts, throat, eyes, nose, ear, and/or skin. Medicinal plants are prescribed after diseased animals are visually examined by traditional healers. Rubbing and pasting herbal preparations were the most commonly reported treatment methods for handling dermatological diseases. The highest percentage of species was indicated by informants to treat blackleg disease (70.9%) (Table 3). The highest number of medicinal plant uses was recorded for Croton macrostachyus Del. (against 12 ailments), Echinops kebericho Mesfin (against 11 ailments), Calpurnia aurea (Aiton) Benth (against 10 ailments), and Withania somnifera (L.) Dunal (against 9 aliments).

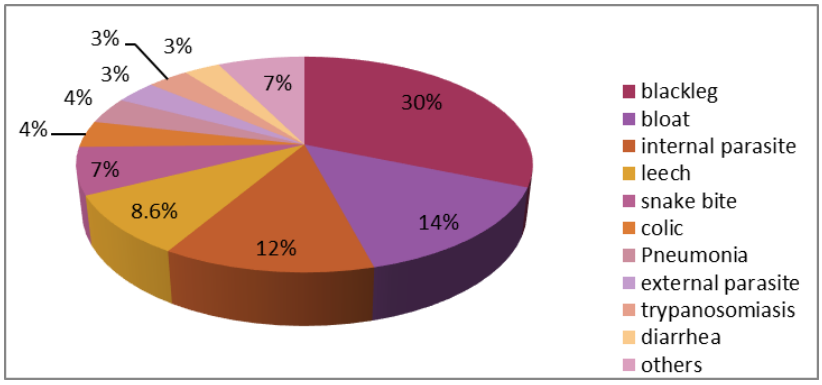

Fig 5: Diseases treated by locally available medicinal plants in the study areas

3.6. Informants consensus factor and fidelity level index of medicinal plants

The highest ICF values were found in diarrhea (0.84), leech infestation (0.81), snake bite (0.75), bloat (0.7), and blackleg (0.7) disease categories (Table 3). The highest plant use citations were found in rabies (85.7%) and pink eye (77.7%). The most ethnomedicinal species were used to treat blackleg disease, internal parasites, bloat, and colic, with only one or two species documented to treat oestrus ovis and foot rot conditions. Fidelity level values of selected medicinal plants were calculated against frequently reported livestock diseases (Table 4). It was calculated based on the

number of users of a given plant species to treat a major ailment in the current study, the fidelity values of medicinal plants ranged from 41.7% to 86.7%. The medicinal plants Helinus mystacinus (Ait.) E. Mey. ex Steud and Dodonaea angustifolia L.f. have the highest FL (85.1% and 86.7%), respectively (Table 4).

Table 3: ICF values of traditional medicinal plants used for treating livestock diseases in the study area

Disease category	No. plant species (nt)	Percent of all species	Use citations (nur)	Percent of all use citations	ICF
Blackleg	78	70.9	245	31.8	0.70
Bloat	52	47.3	172	30.2	0.70
Colic	33	30	55	60	0.4
Diarrhea	26	30.2	47	55.3	0.84
External parasite	26	30.2	51	50.9	0.5
Internal parasite	75	68.2	219	34.2	0.66
Leech	24	21.8	121	19.8	0.81
Mastitis	10	9.1	18	55.6	0.47
Pneumonia	14	12.7	23	60.8	0.14
Pink eye	7	6.4	9	77.7	0.25
Rabies	6	5.5	7	85.7	0.2
Snake bite	15	13.6	56	26.8	0.75
Trypanosomiasis	21	19.1	34	61.8	0.4
Wound	18	16.4	34	52.9	0.5

Table 4: Fidelity Level index of Medicinal Plants against Commonly Reported Livestock Diseases

Species of medicinal plants	Therapeutic category	SF	TF	FL %
Helinus mystacinus (Ait.) E. Mey. ex Steud.	Blackleg	57	67	85.1
Croton macrostachyus Del.	Bloat	64	99	64.6
Calpurnia aurea (Aiton) Benth	External parasite	10	25	40
Phytolacca dodecandra L' Herit.	Leech	5	12	41.7
Dodonaea angustifolia L.f	Diarrhea	13	15	86.7
Allophylus sp.	Internal parasite	6	11	54.5
Echinops kebericho Mesfin	Snake bite	35	79	44.3
Allium sativum L	Leech	26	42	61.9
Olinia rochetiana A.Juss	Internal parasite	18	38	47.4

SF= frequency of citation of a given species for a specific aliment, TF = the total number of citations of that species for any ailments

4. Discussion

4.1. Demographic characteristics of informants

Traditional healers in Africa are thought to be men (Okello *et al*. 2007; Bekalo *et al*. 2009; Tchetan *et al*., 2021) [37, 11, 45]. The majority of the informants were in the age groups of 31–46 years old (40.9%) and 47–62 years (30.9%). These age-related findings align with reports by Berhanu *et al*. (2020) [12] in Ambo districts of Oromia region, Yigezu *et al*. (2014) [50] in the Jimma Zone; Birhanu *et al*. (2015) [14] from Horro Guduru Wollega, West Ethiopia; Gutema *et al*. (2022) in Afar Pastoralist. The findings also agree with reports by Tamiru *et al*. (2013) [44] in Dabo Hana district, West Ethiopia, and Gebrezgabiher *et al*. (2013) [24] in Tigray Region. Old informants (51–80 years old) have more knowledge of medicinal plants due to their long-term direct contact with plant resources (Tugume *et al*., 2016) [48] in Ugand. Young age informants have less medicinal knowledge and interest due to the fact that traditional knowledge is built with years of experience in general. If nothing is done to motivate them, there is a risk that indigenous knowledge will be lost. Younger generations have been exposed to modern education and are thus uninterested in learning and practicing ethnomedicinal wisdom, which would help to perpetuate indigenous knowledge (Khan *et al*., 2021) [33]. According to studies, there is a difference in medicinal knowledge among age groups (Awas and Demissew, 2009; Chekole *et al*. 2015; Eshete and Molla, 2021) [7, 15, 19] in Ethiopia. Medicinal plant knowledge is passed down orally from generation to generation, usually in old age, to the most selected family that correspondence to current findings (Tadesse *et al*., 2018; Eshete and Molla, 2021; Asefa *et al*., 2021) [43, 6, 19]. The gender distributions of medicinal plant knowledge were found to be higher in males (99%) than in females. This might be due to the fact that men are most favored in the shift of knowledge while women, in the majority of cultures, are considered for the family's care. Gender-related findings are consistent with those reported by Woldu (2016) and Bekele *et al*. (2018) in Ethiopia's Endamohoni and Dale Sadi districts, respectively. These findings, on the other hand, contradict the findings of Khan *et al*. (2022), who found that females possessed more indigenous knowledge than males. Because of the impact of modern education, illiterate members of the community know more about medicinal plants than educated informants. The difference, however, was not statistically significant. These findings align with reports by Feyisa *et al*. (2021) [22] and Khan *et al*. (2021) [33] in Adea Berga District, Oromia Region of Ethiopia and the Kashmir Himalaya, Pakistan, respectively.

4.2. Habits, parts used and source of medicinal plants

The present finding indicated that herbs were frequently utilized by informants for the treatment of different diseases compared to trees and shrubs. Local informants used herbs, trees, and shrubs for herbal preparation at rates of 39.17%, 35%, and 25%, respectively. The Herbs are popular as a source of herbal therapies due to their higher pharmacologically active ingredients, availability everywhere, and ease of collection when compared to trees and shrubs (Kamatenesi *et al*. 2011) [29]. Analogous studies conducted elsewhere yielded similar results (Singh *et al*. 2014; Kayani *et al*. 2015; Malla *et al*. 2015; Faruque *et al*.

2018; Shoaib *et al*., 2021; Khan *et al*., 2021; Alemneh, 2021) [42, 30, 35, 20, 41, 33, 4]. The current findings, on the other hand, contradict previous reports, as shrubs were frequently used by local informants (Kefalew *et al*. 2015; Abebe and Chane, 2021; Eshete and Molla, 2021) [31, 2, 19]. Various plant parts are commonly used in the formulation of herbal remedies. Leaves and roots were most frequently used in the formulation of remedies for the treatment of animal diseases. The most frequently used plant parts for the treatment of livestock diseases are leaves. This might be associated with ease of collection and conservation importance compared to other plant parts. Another reason for using leaves is that they are the main sites of photosynthetic apparatus and are involved in a variety of physiological processes of plants, as well as producing secondary metabolites, which could be a reason for their effectiveness and efficacy against various livestock diseases. This finding is consistent with previous findings, as leaves are the most commonly used plant part in Bangladesh, Iran, and Ethiopia (Ghorbani 2005; Telefo *et al*. 2011; Abebe and Chane, 2021; Alemneh, 2021; Eshete and Molla, 2021) [25, 46, 4, 2, 19]. In comparison to leaves, Khan *et al*. (2021) [33] found that roots were the most commonly used plant parts for herbal remedies, which contradicts the current findings. Roots, on the other hand, were the second most commonly used plant part by informants due to their higher concentration of bioactive compounds compared to other plant parts, despite the fact that this was a destructive type of harvesting from a conservation standpoint (Basualdo *et al*. 1995; Abebe and Chane 2021) [10, 2]. Harvesting of leaves does not pose any serious impact on the life cycle of plants and is considered a sustainable type of harvest. The present findings are in agreement with other studies where leaves are the most widely used plant part in ethnoveterinary practices (Akash *et al*. 2014; Faruque *et al*. 2018) [3, 20].

Most of the informants frequently utilized the fresh condition of medicinal plants, as current study results showed. 78% of the informants/traditional healers utilize fresh materials compared to using dry materials of plant species. The study found that using fresh plant parts to make herbal remedies was more effective than using other parts since it might contain more bioactive ingredients. The dependence of local informants on fresh parts of plant cause threats to plant species than the dried form since fresh materials harvested directly and used with its extra deterioration with no chance of preservation. This findings was also in line with other studies elsewhere in Ethiopia (Eshete and Molla, 2021; Asefa *et al*., 2021) [19, 6], which showed that majority of herbal remedies were prepared from fresh plant parts compared to dried parts. Herbal remedies made from both dried and fresh plant parts have been reported in small amounts. The method of preparation differed depending on the plant species, plant part used, and, in some cases, the condition being treated. These include crushing, soaking, infusion, decoction, and rubbing. The main ingredients used in the preparation of herbal remedies were water, salt, and milk. The ingredients are suggested to have a synergistic effect, improve flavor, and make it easier to administer herbal medication (Eshete and Molla, 2021) [19].

4.3. Diversity of species use

Collected medicinal plants were documented with a detailed description of their local name, scientific name, habit, preparation, and mode of application with their respective indications during the study period. The current findings showed that 110 species belonging to 55 families were documented for the treatment of different types of livestock diseases. The presence of a large number of species indicates that the study area has a diverse flora used in the treatment of various ailments, as well as a rich traditional knowledge of medicinal plants in the society (Tugume *et al*. 2016) [48]. As a result, the diversity of medicinal plants meets the miscellaneous healthcare needs of communities in the study area, despite the fact that many people cannot afford modern treatment due to widespread poverty. The majority of these medicinal plants were found in the wild and were harvested for their leaves. Similarly, studies on Ethiopian found that almost all medicinal plant species are harvested from wild habits (Lulekal *et al*. 2008; Giday *et al*. 2009 and Yirga *et al*. 2010; Eshete and Molla, 2021) [34, 26, 51, 19]. However, due to an increased human and livestock population, wild habitats were severely exhausted, resulting in the extinction of numerous plant species that once thrived in the wild. The most dominant families of medicinal plants used by the informants were Euphorbiaceae, Solinaceae, Asteraceae, and Rhamnaceae. This finding agrees with reports by Tugume *et al*. (2016) [48] in Uganda. The frequent utilization of these families might be due to their higher abundance in the study area or might be linked to their high healing potential for livestock diseases. The families that had the highest number of species were Asteraceae (21 species, 19.1%), Fambaceae (12 species, 10.9%), Rutaceae and Solainaceae (5 specie, 4.5%). Many medicinal plant species were also reported to be rare since there was no habit or practice by local informants to conserve medicinal plants. This could pose a threat to those medicinal plants that are scarcely available in the study area. These require immediate attention in order to preserve rare medicinal plants for use in livestock's primary health care.

4.4. Livestock diseases treated and diagnoses

In primary health care for livestock in Ethiopia, herbal therapies are still preferred. Thirty livestock diseases were identified as being treated with local medicinal plants. Among these reported or identified livestock diseases, blackleg, internal parasites, bloat, leech infestation, colic, and external parasites were found to be the most frequently reported forms of livestock disease in the study area. Diarrhea was also discovered to be a commonly reported veterinary ailment. The vast majority of plant species are treated for more than one condition. The use of a single plant species to treat multiple livestock diseases indicates the presence of numerous metabolites in that plant species as well as its broad spectrum of bioactive molecules against various pathogens. In other cases, a combination of plants was used in the preparation of a herbal remedy against a specific ailment, demonstrating the synergistic effects of such plants. Informants diagnose livestock diseases based on observation and/or information obtained by interviewing the livestock owner about major symptoms shown by the diseased animal. Medicinal plants are prescribed after diseased animals are visually examined by traditional healers. Rubbing and pasting herbal preparations were the most commonly reported treatment methods for handling dermatological diseases. Due to a knowledge gap, different dosages were used by informants to treat the same livestock ailments. The absence of any adverse effects of traditional medicines after administration was also more frequently mentioned. But some of the preparations were reported to have some adverse effects, like vomiting and temporary

inflammations in patients. The highest number of medicinal plant uses was recorded for Croton macrostachyus Del. (against 12 ailments), Echinops kebericho Mesfin (against 11 ailments), Calpurnia aurea (Aiton) Benth (against 10 ailments), and Withania somnifera (L.) Dunal (against 9 aliments). Informants indicated that the highest percentage of species were used to treat blackleg disease (70.9%).

4.5. Informants Consensus Factor and fidelity level index of medicinal plants

The ICF determined the informant agreement for a plant species in treating a specific disease. ICF values range from 0 to 1, with values close to one indicating a high rate of informant agreement on plant species used against disease categories. ICF values close to zero indicate a low level of agreement among informants regarding the use of a specific plant species for the treatment of a specific disease. Diarrhea and leech infestation had the highest informant consensus values (0.84 and 0.81), respectively. When only one or a few plant species are indicated to be used by a large number of informants to treat a specific disease, high informant consensus factors are obtained, whereas low ICF values indicate that informants disagree about which plant to use (Heinrich *et al*. 1998) [28]. The high ICF value for diarrhea and leech infestation indicates that informants agree on the various plant species used to treat these ailments and their importance. The ICF also tests the consistency of informants' knowledge regarding a particular rehabilitation for a given disease category. ICF showed which species of plants are frequently utilized and thus a good point for further pharmacological and Phytochemical studies.

Fidelity level values of selected medicinal plants were calculated against frequently reported livestock diseases. The fidelity values of medicinal plants range from 41.7% to 86.7% in the study area *Helinus mystacinus (Ait.) E. Mey. ex Steud and Dodonaea angustifolia L.f*. species have the highest FL (85.1% and 86.7%), respectively. The highest FL value of medicinal plants indicates that they have high healing potential in the study area. Therapeutic plants that are frequently used by local informants to treat multiple diseases have lower fidelity level values, whereas medicinal plants that are used to treat one or a few ailments have a high fidelity level. The validation of the bioactivity of medicinal plants preferred by informants increases their acceptance in health care systems both nationally and internationally. FL demonstrates the percentage of informants claiming the use of a plant species for the same major ailment to the total number of informants who mention the plant for any use.

5. Conclusion and Recommendation

The current findings indicate the presence of abundant indigenous knowledge and medicinal plant species in the study area. One hundred and ten species of plants belonging to fifty-five families were documented to manage livestock health by traditional healers. Most of these medicinal plants were discovered in the wild. Traditional medicinal remedies are still preferred in primary health care for livestock in Africa, including Ethiopia. Thirty different types of veterinary ailments were found to be treated using one or more locally identified medicinal plant species by the informants. Local informants/elders had no habits or practices for cultivating wild medicinal plants, and the elderly were secretive in transferring knowledge in the study area. This could pose a threat to those medicinal plants that are scarcely available in the study area. Therefore, urgent attention should be given to conserving those medicinal plants and encouraging traditional healers to transfer their indigenous knowledge to their families and others to preserve for the next generation. And Phytochemical and pharmacological screening of plant species has the highest fidelity level needed to extract bioactive compounds and test through *in vitro* and *in vivo* assay methods.

Declarations: I confirm that I have read, understood, and agreed to the submission guidelines, policies, and submission declaration of the journal.

Ethics Approval and Consent to Participate: The Ethiopian Institute of Agriculture's research ethics committee approved the study and collection of plant specimens. Before beginning data collection, the local informants/healers were informed of the study's purpose.

Availability of Data and Material: The dataset generated during the study is available upon request from the corresponding author.

Competing Interests: The author declare that I have no competing interests" in this section.

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Authors' Contributions: I confirm that we made significant contributions to the work, read the manuscript, attest to the validity and legitimacy of the data and its interpretation, and agree to its submission.

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