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## Ethnobotanical Study of Medicinal Plants in Raya Kobo District, North Wollo, Ethiopia

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### ABSTRACT

A study titled has been conducted among the people of Raya Kobo district in Northern Ethiopia to study medicinal plants among 2018 to 2019. 124 respondents from rural and urban groups were selected for thno-botanical data collection via using interview. Semi-structured interview, field observations, guided field walk, group and quantitative analytical tools were used to compile ethnobotanical plant species. Preference ranking, paired comparison, direct matrix ranking, informant consensus factor (ICF) and fidelity level (FL) were employed for data analysis. A total of 69 plant species were documented that are used to treat 19 human and 9 livestock ailments. 56 (82%) species were reported to be used to treat human ailments and 13 (18%) for livestock ailments. Herbs were the most widely used plants, accounting for 26 (37.68) species. Common diseases in the study area were fungus for which 22 (21%) species and wound 19 (18%) were reported. The most frequently used plant parts were leaves 34 (61%), followed by root 8 (14%), fruits 7 (13%) and whole part 5(9%) fruits for human where as for livestock leaves 6 (46%) followed by fruit 3(23%) on livestock. direct use of the leaf sap, which accounted for 17 preparations (30%). The majority 59(85.6%) of remedies were prepared from freshly collected plant parts. The common route of administration was dermal 55(55%) followed by oral 22(22%). Highest ICF values were documented in Raya Kobo District for liver disease; and highest FL values of human medicinal plants were recorded for *Calpurena aurea* (100%) against itch. Most of the medicinal plants were not widely traded for medicinal purposes, but mostly for other non-medicinal uses. The local communities of the study area need to involve in conservation and management of plants in general and medicinal plants in particular.

**Keywords:** Raya Kobo, Medicinal plants, Traditional knowledge, Ethnobotanical study

## **1. INTRODUCTION**

Traditional medicine defined as the over all of the knowledge and practices whether able to be explained or no (WHO, 1978). Ethnobotany is defined as the study of how people of a particular custom and religion make use of medicinal plants. From the beginning, local community has enhanced their own local clearly defined knowledge on plant utilization, protection and monitor. The benefit of traditional medicine as a source of principal healthcare was for the first time officially recognized by the World Health Organization (1978).

The healing of disease capacity of plant products can be studied for the treatment of diseases over five thousand years ago (Mahesh and Satish, 2008). According to Tesfaye Awas and Sebsebe Demissew (2009), traditional medicine is practiced throughout the world and determined by locally effectual normal resources and traditional knowledge. The study of ethnobotany plays an essential role because of the straight contact that can be established with the veracity of information on the use of plants both wild and cultivated and for the purposes of agricultural implements, fodder, medicine, food, fiber and profits throughout the world (Zemedu Asfaw, 2013).

Raya Kobo district is located in north eastern Ethiopia; Traditional medicinal plants are the main parts of local medical service system. The valuable medicinal plants are destructed due to clearance of forest, population intimidation, fire, agricultural expansion, overgrazing, dryness, trading charcoal and firewood. Particularly, clearance of forest is greatly reported by researcher (Binyam Getachew, 2002). Absence of evidences and inadequate representation of ethno medicinal plant knowledge are a few of main harmful matter of traditional medicine in Ethiopia (Haile Yeneger and Delenasaw Yewhalaw, 2007).

The serviceable literature has no information about the use of traditional medicinal plants in the study area. For this reason, documentation of cultural inheritance as a whole and ethno botanical information of medicinal plants of the country is one of the ways of preserving indigenous knowledge of the people on medicinal plants before it is lost and unable to get it back. For that reason, the present study has the aims to add and fill this information and knowledge gap in the study area concerning Ethnobotanical Study of Medicinal Plants by people of Raya Kobo Woreda, North Wollo, and Ethiopia.

## **2. MATERIALS AND METHODS**

### **2. 1. Description of the Study Area**

Raya Kobo is one of the woreda in the Amhara National Regions of Ethiopia. The Administration center of Raya Kobo is Kobo Town found at 571 km North of Addis Ababa, the capital city of Ethiopia. Geographically, it is located between 12°09'N 39°38'E/ 12.150°N 39.633°. The land district's area is estimated at 2,001.57 square kilometers, and Kobo is bordered on the South by the Logiya River which separates it from Habru and Guba Lafto, in the west by Gidan, on the North by Tigray Region, and on the East by the Afar Region. Towns in Kobo include Gobiye, Kobo and Robit (Kobo Robit). The district is further divided into 48 the smallest administrative unit.

2. 2. Map Ethiopia, stars showing the study sites

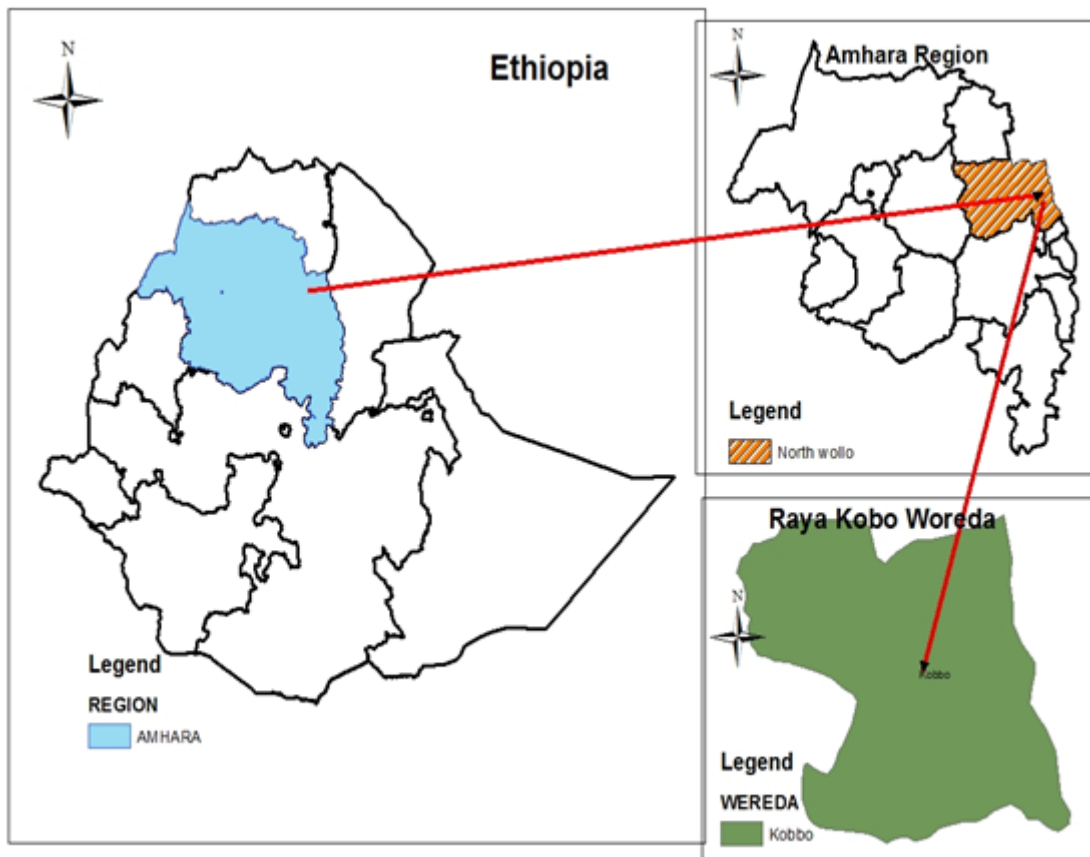


Figure 1. Map Ethiopia, blue-black color showing the study sites.

2. 3. Climate

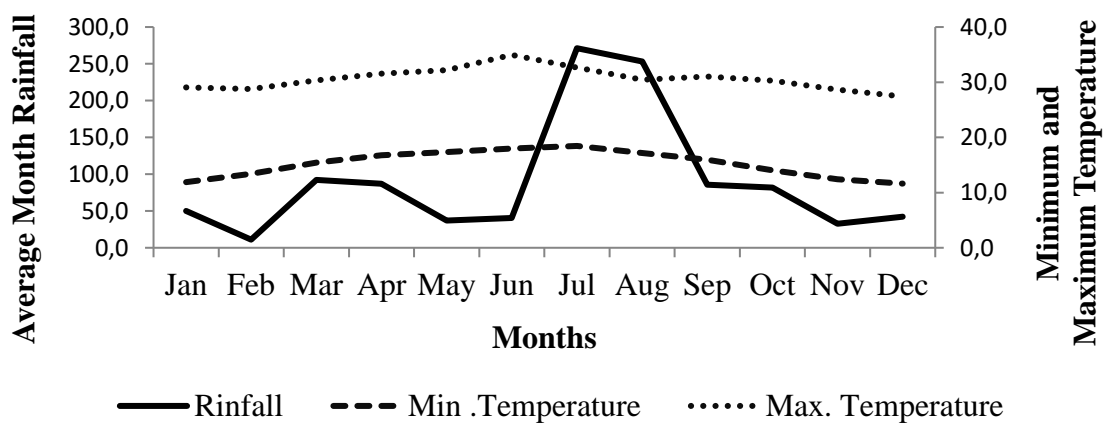


Figure 2. Mean monthly long-term (2009- 2017) Rain fall, minimum and maximum temperature data in the study area.

Climate data of the study area revealed that the highest mean annual temperature over ten years (between 2009 and 2017) was June >35 °C and the lowest was February 10 °C recorded. The highest mean annual rainfall of the study area during the last ten years (between 2008 and 2017) was July >250 mm and the lowest was 0 to 50 mm was recorded during December.

#### **2. 4. Method of data collection and analysis**

Preliminary survey using semi-structured interviews, questionnaires, focus groups, field observation, guided field walk, supplemented by key informant interview and market survey was also conducted in the study area between October 2018 and February 2019 to determine the knowledge of TM use in Raya Kobo people. A total of 7 localities or kebeles were selected and five from rural kebeles and two from urban kebele. The availability of seven traditional Practitioners identified with the participations of Kebele administrators. The following kebeles were selected Zobel, addiskign, Tekulesh, Addisalem, Aba ergo and Kobo town (Kebele 03 & 04).

From seven sampled kebeles, informants from aged eighteen and above were selected to gather the evidences on medicinal knowledge of the community. In this study, numbers of household from each kebele were randomly selected for the survey, by assign random numbers to the households in total of 5719 population of the seven kebeles. The kebeles were Zobel, addiskign, Tekulesh, Addisalem, Abaergo and Kobo town (Kebele 03 & 04). These kebeles have been total households of 850, 980, 845, 650, 550, 1000 and 840 respectively. Sample size for each kebele was calculated using proportion of the number of households of the two groups. The herbalists were selected based on purposively method while general respondents were selected through random sampling method. Therefore, the sample size would be determined by using the formula given:

$$n = \frac{N}{1+N(e^2)}$$

Therefore, based on the formula, a total of 124 samples of households or respondents (117 general informants and 7 key informants) were selected purposively from the total number of households in the seven kebeles.

#### **2. 5. Ethno-botanical Data Collection**

Ethno-botanical data were collected in seven different kebeles 5 rural and 2 urban kebeles between October 2018 to February 2019; following standard methods (Martin, 1995). The plant specimens were dried, pressed and brought in the mini-herbarium of Wollo University for further identification and labeling using taxonomic keys and description given in the relevant volumes of the Flora of Ethiopia and Eritrea and deposited at the mini- Herbarium of Wollo University. Finally, the accuracy of identifications was re-enforced by Wollo university senior plant taxonomist and the voucher specimens with labels were stored at the mini - herbarium of Wollo University.

#### **2. 6. Ethical consideration**

Before conducting the survey, all data collections were done with special care on the base of the cultural view of the local communities in the study area. Informants were also informed that the objectives of the research were for academic reasons. Since, ethno medicinal indigenous

knowledge was only obtained from indigenous people and traditional specialists within the community so any value that would be obtained as a result of the research would benefit the community.

## **2. 7. Data Analysis**

Descriptive statistics such as frequency and percentage were employed to analyze the data collected on socio-economic, ethno-botanical characteristics of the sample households, medicinal value, methods of preparation, routes of administration, disease treated, parts used and habit was analyzed through descriptive statistics. During data analysis, MS Excel spreadsheet was utilized.

## **2. 8. Ethno-botanical Data Analysis techniques**

### **2. 8. 1. Preference ranking**

Preference ranking was the ranking or ordering of a set of objects such as medicinal plants to determine their order of cultural importance across a community. The most important in the set was given the highest number, decreasing in number as the members of the set decrease in importance. In this study, a total of eight preference ranking activities were carried out. Preference ranking was performed to rank medicinal plants in treating different human and livestock ailments as regarded by informants.

### **2. 8. 2. Paired comparison**

In pair wise ranking, relatively few items were included; because the time needed to carry out the task increases exponentially as additional items included and the total number of pairs required increases as shown by the value of  $n(n-1)/2$  where 'n' stands for number of items to be compared (Martin, 1995). Scores of each species were summed up and ranked based on the preference of key informants for the medicinal plant species used against livestock.

### **2. 8. 3. Direct matrix ranking**

Based on information, five multipurpose plant species and five use diversities of these plants were listed for five selected informants from both different groups each to assess their relative importance in their respective localities. The scores of each species are summed up and ranked.

### **2. 8. 4. Informant consensus**

Medicinal plants with higher informant consensus needed to be seriously considered for further ethno-pharmacological studies, since they were species widely applied by many people and they have been utilized for a long time (Macia *et al.*, 2005).

## **2. 9. Informant consensus factor (ICF)**

The medicinal plants that were effective in treating groups of ailments have a higher informant consensus factor value. ICF was calculated by taking the number of use citations in each category (nur) minus the number of species used (nt), divided by the number of use citations in each category minus one (Heinrich *et al.*, 1998). The reported ailments were categorized and then the ICF values were calculated.  $ICF = \frac{nur-nt}{nur-1}$

## 2. 10. Fidelity level (FL)

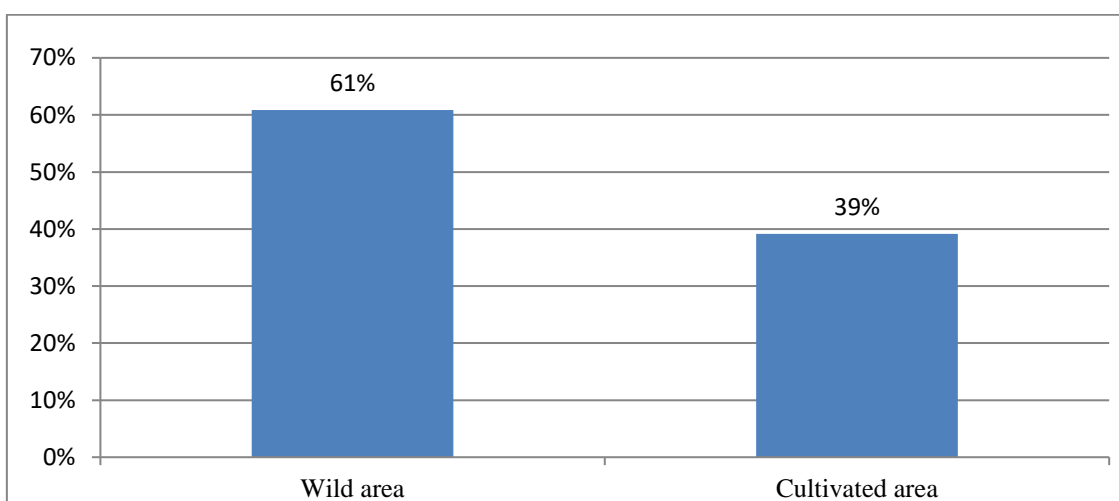
FL was calculated as the ratio between the number of informants who suggested the use of a species for the same major purpose ( $I_p$ ) and the total number of informants who mentioned the plant for any use ( $I_u$ ).  $FL = I_p/I_u$ ,  $FL\% = (I_p/I_u) * 100$ .

## 3. RESULTS

### Ethno-medicinal plant species recorded in the study

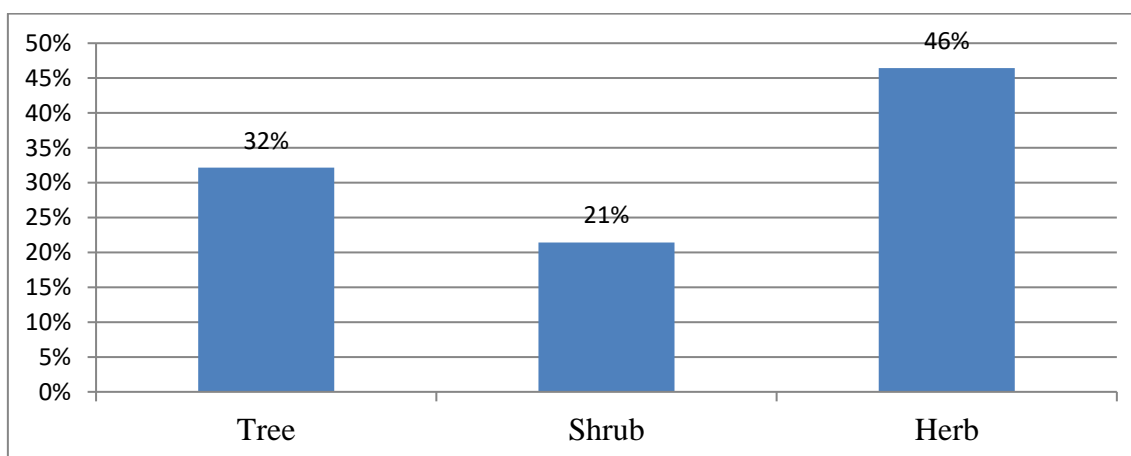
#### Diversity of medicinal plants

The finding showed that 69 plant species were recorded in the study area.



**Figure 3.** Diversity of medicinal plant

#### The growth habits of medicinal plant species



**Figure 4.** Habit of medicinal plant species

The Habitat of medicinal plant species

**Table 1.** Hbitat of medicinal plant species used to treat human disease.

<b>Habitat</b>	<b>Raya kobo</b>	
	Frequency	Percent
Farm land	12	21%
Open area	4	7%
Forest area	11	20%
Home garden	9	16%
Bush land / grass land	2	4%
Rocky places	1	2%
Wooded land	2	4%
Reverine forest	1	2%
Coldest and wettest area	1	2%
Common weed in distributed	1	2%
Over grazed	2	4%
Naturalized in waste place	1	2%
High land oil crops	1	2%
Wet place	1	2%
Weed in fields	1	2%
Acacia wood land	4	7%
Driest land	2	4%
Total	56	100%

Main human ailments

**Table 2.** Frequency of human ailments.

Ailments/ illness	Raya kobo	
	Frequency	Percent
Wart	10	9%
Wound	19	18%
Abdominal pain	4	4%
Fungus	22	21%
Febrile illness	13	12%
Tenia vesicolor	2	2%
Snake bite	3	3%
Tonsil	5	5%
Ear ailments	5	5%
Bleeding in female	2	2%
For bad smelling	6	6%
Itch	2	2%
Kidney	2	2%
Facial skin	4	4%
Breast ailment	2	2%
Any poisonous	1	1%
Arm pain	2	2%
Nose blood	1	1%
Abnormal of menstruation	2	2%
Total	107	100%



## Medicinal plants used by local people

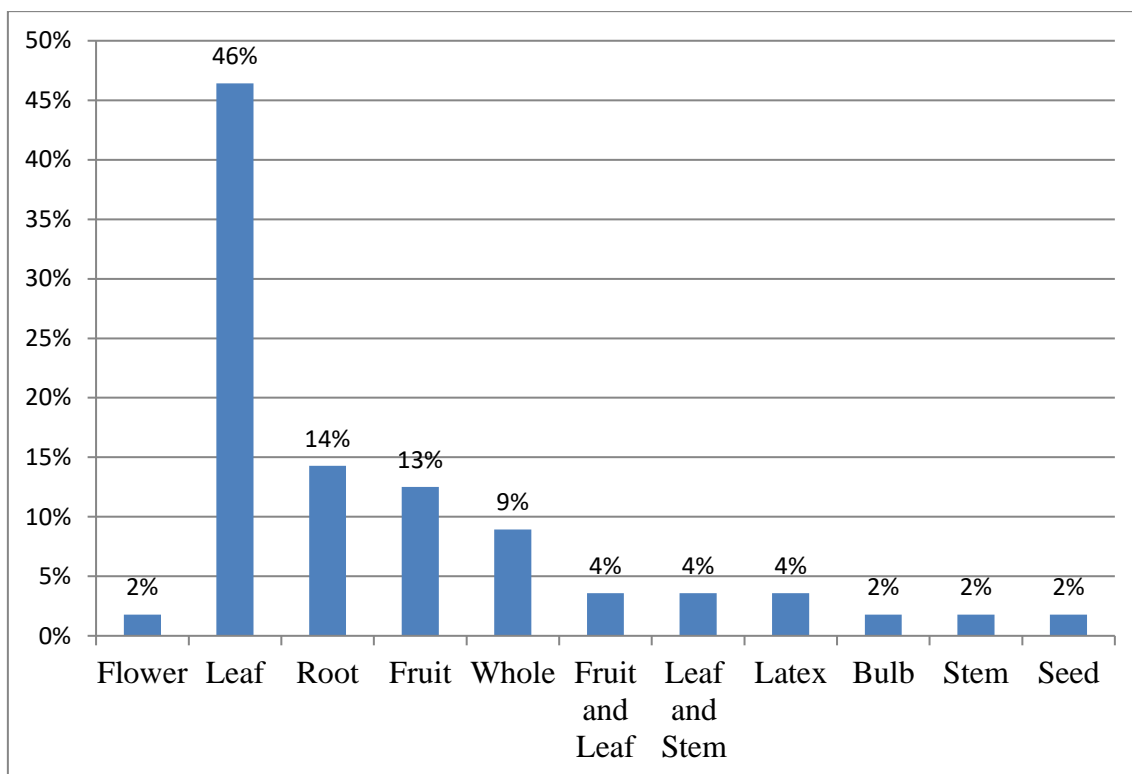
**Table 3.** Frequency of medicinal plants used to treat human ailments

Plant species COMMON	Family	Common	Frequency	Percent (%)
<i>Rhamnus prinoides</i> L'Herit.	Rhamnaceae	Gesho	4	4%
<i>Olea europaea</i> subsp. <i>cuspidata</i> L.	Oleaceae	Weyera	3	3%
<i>Ricinus communis</i> L.	Euphorbiaceae	Gulo	3	3%
<i>Ocimum lamiifolium</i> Hochst. ex. Benth	Lamiaceae	Dama kassie	3	3%
<i>Ruta chalepensis</i> L.	Rutaceae	Tena adam	4	4%
<i>Schinus molle</i> L.	Anacardiaceae	Kondo berberie	1	1%
<i>Justicia schimperiana</i> (Hochst. ex Nees)	Anacardiaceae	Simiza	2	2%
<i>Euphorbia candelabrum</i> Kotschy.	Euphorbiaceae	Yemidema kulkual	2	2%
<i>Ziziphus spina-christi</i> L.	Rhamnaceae	Kurkura	3	3%
<i>Zehneria scabra</i> (Linn.f.)	Cucurbitaceae	Areg resa	3	3%
<i>Xanthium strumarium</i> L.	Asteraceae	Megale ketel	2	2%
<i>Ximenia Americana</i> L.	Olacaceae	Enkoy	2	2%
<i>Withania somnifera</i> L.	Solanaceae	Gezawa	3	3%
<i>Kalanchoe densiflora</i> Rolfe.	Crassulaceae	Endehwahula	1	1%
<i>Abutilon angulatum</i> (Guill. & Perr.)	Malvaceae	Nechlo	1	1%
<i>Chenopodium ambrosioides</i> L.	Malvaceae	Amedmado	1	1%
<i>Pterolobium stellatum</i> (Forssk.)	Fabaceae	Kentafa	2	2%
<i>Balanites aegyptiaca</i> (L.) Del.	Balanitaceae	Bedena	4	4%
<i>Barleria eranthemoides</i> R.Br.ex	Acanthaceae	Yeset Aff	1	1%
<i>Citrus aurantiifolia</i> Christm.	Rutaceae	Lomi	4	4%

<i>Mangifera indica</i> L.	Anacardiaceae	Mango	2	2%
<i>Persea Americana</i> Mill.	Lauraceae	Abucado	2	2%
<i>Eucalyptus globulus</i> Labill	Myrtaceae	Nechi beharizaf	6	6%
<i>Lycopersicon esculentum</i> Mill.	Solanaceae	Timatim	1	1%
<i>Gossypium herbaceum</i> L.	Musaceae	Tit	2	2%
<i>Aloe adigratana</i> Reynolds.	Aloaceae	Eret	2	2%
<i>Allium cepa</i> L.	Alliaceae	Keyi shenkurt	2	2%
<i>Daucus carota</i> L.	Apiaceae	Carrot	1	1%
<i>Asparagus africanus</i> Lam.	Asparagaceae	Kestnecha	1	1%
<i>Calotropis procera</i> Ait.	Asclepiadaceae	Tobiya	3	3%
<i>Bidens macroptera</i> Mesfin	Asteraceae	Adey Ababa	1	1%
<i>Silene macrosolen</i> A. Rich.	Caryophyllaceae	Wogert	1	1%
<i>Cymbopogon martini</i> Roxb.	Poaceae	Teji sar	1	1%
<i>Euclea divinorum</i> Hiern	Ebenaceae	Dedeho	2	2%
<i>Cucumis africanus</i> L.f.	Cucurbitaceae	Yemeder emboye/ rough	3	3%
<i>Lonchocarpus laxiflorus</i> Guill. & Perr.	Fabaceae	Meterez/ Amera	1	1%
<i>Cucumis dipsaceus</i> Ehrnb. ex spach.	Cucurbitaceae	Yemeder emboye (Hairy)	3	3%
<i>Mentha spicata</i> L.	Lamiaceae	Nana	2	2%
<i>Datura stramonium</i> L.	Solanaceae	Banjie	4	4%
<i>Moringa stenopetala</i> (Bak. f.) Cuf.	Moringaceae	Sheferaw	7	7%
<i>Nicotiana tabacum</i> L.	Solanaceae	Tobaaco	3	3%
<i>Agave sisalana</i> Perro ex Eng.	Agavaceae	Chiret	2	2%
<i>Croton macrostachyus</i> Del.	Euphorbiaceae	Bisana/ mekanisa	3	3%

<i>Acacia etbaica</i> Schweinf.	Fabaceae	Doret	2	2%
<i>Linum usitatissimum</i> L.	Linaceae	Telba	2	2%
Total			100	100%

Plant parts used



**Figure 5.** Plant parts used to treat human ailments

Modes of remedy preparations

**Table 4.** Modes of preparation of human medicinal plants.

Mode of preparation	Frequency	Percent
Direct use of the leaf sap	17	30%
Roasting the leaf sap	2	4%
Mixing with coffee	1	2%

Mixing with water	3	5%
Boiling and mixing with <i>Eucalyptus</i> use topically	7	13%
Stroking the leaf and use it	7	13%
Directing use its latex	2	4%
Dried leaves mixing with butter	1	2%
Heating the leaf	3	5%
Via mixing boiled water with weshwesh tea	1	2%
Directly, masticate the root part	1	2%
Direct using the fruit part	2	4%
Cracking the leaf part	1	2%
Via mixing salt and butter and then painting the wound	2	4%
Breakdown / abrasion the fruit part	6	11%
Total	56	100%

Condition of preparation of remedy

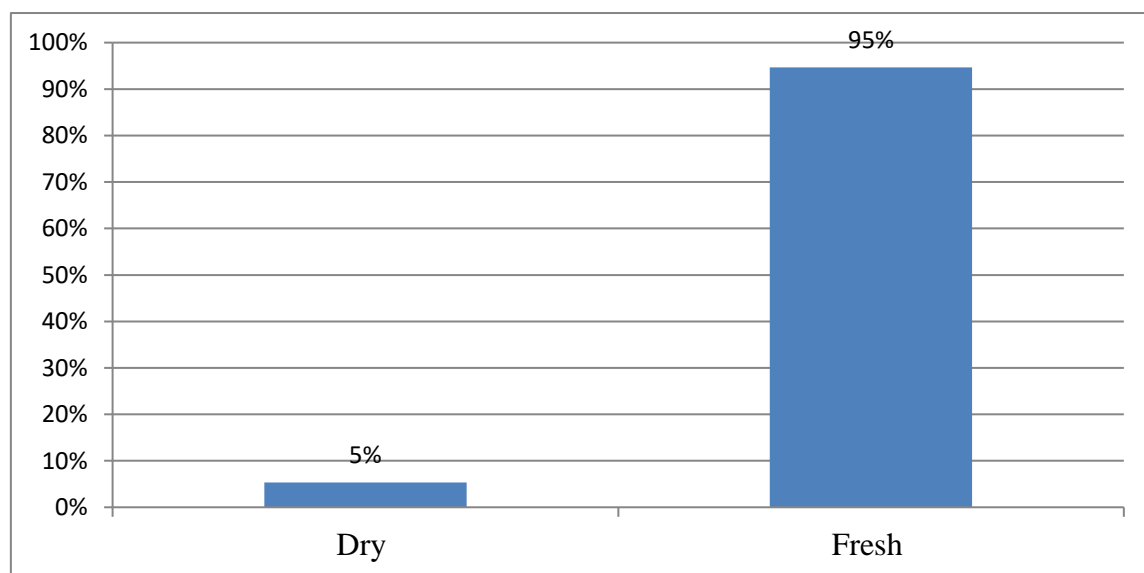


Figure 6. Condition of preparation of remedy

Route of administrations of human medicinal plants

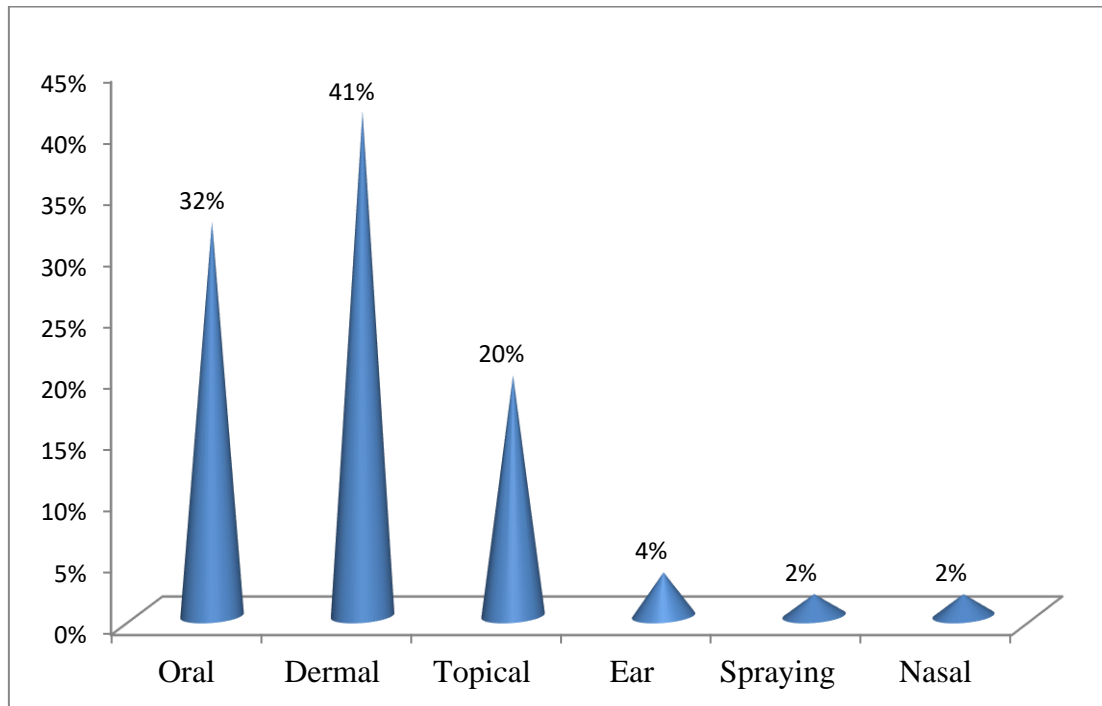


Figure 7. Route administration of medicinal plants

The habit forms of medicinal plant species in live stocks

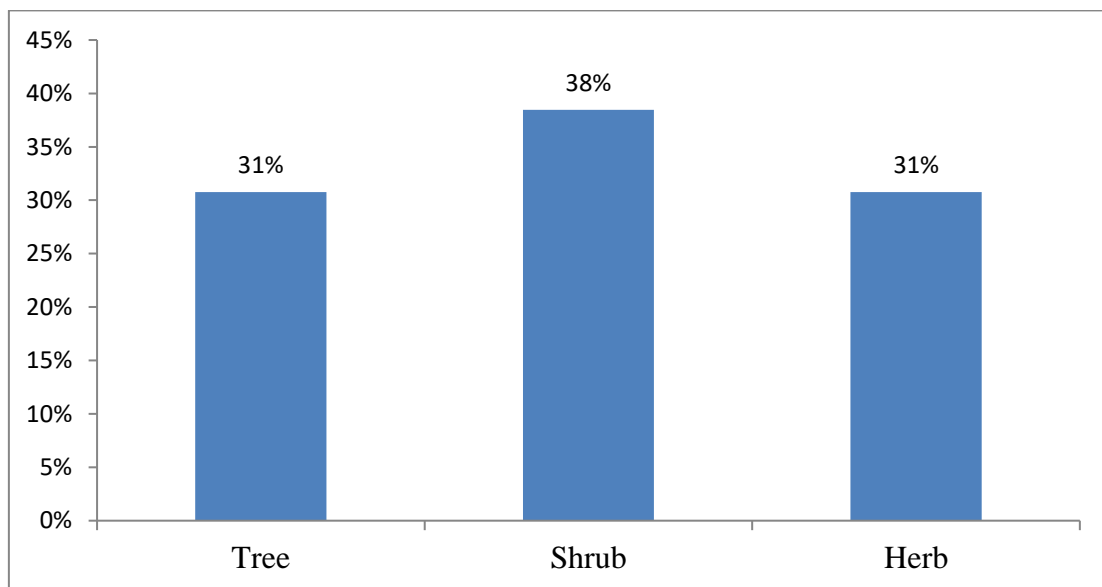


Figure 8. Habit forms of medicinal plant species used to treat livestock ailments

The Habitat of medicinal plant species

**Table 5.** Habitat of medicinal plant species used to treat livestock diseases.

<b>Habitat</b>	<b>Frequency</b>	<b>Percent</b>
Degraded vegetation	1	8%
Farm land	5	38%
Open area	2	15%
Montane forest ever green bush land	1	8%
Spreads under ground	1	8%
Bush land / grass land	1	8%
Home garden	2	15%
Total	13	100%

Main Livestock ailments

**Table 6.** Frequency of main livestock ailments.

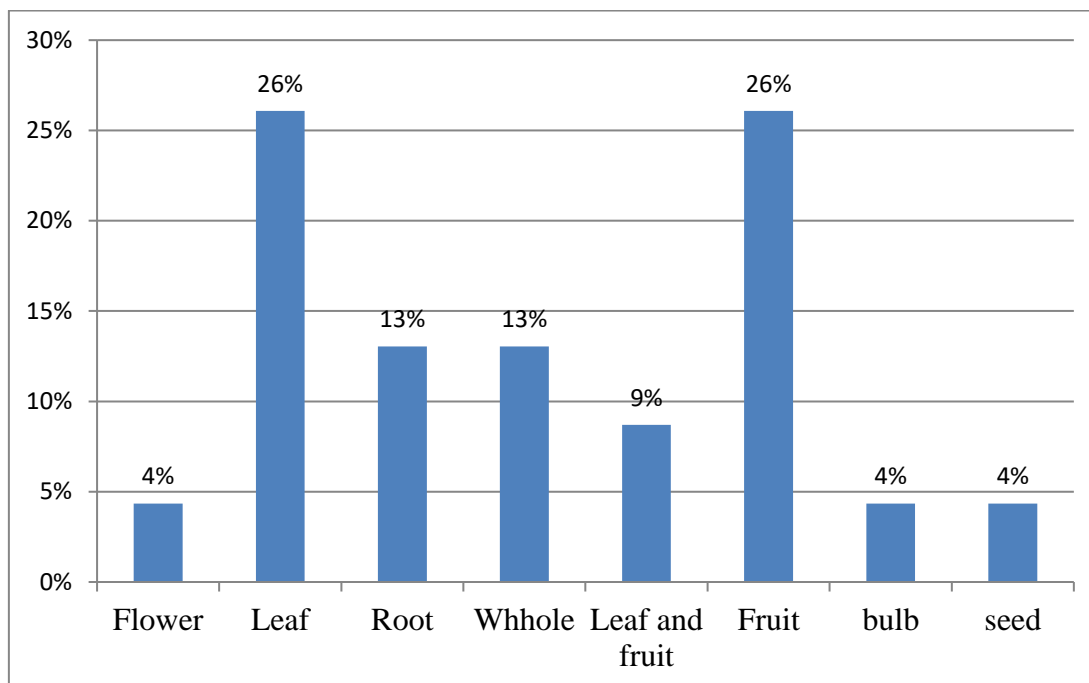
<b>Ailment</b>	<b>Frequency</b>	<b>Percent</b>
Eye ailment	3	14%
Itch	2	10%
Wound	4	19%
Alekt	2	10%
Ecto – parasite	2	10%
Cough for hen	2	10%
For aggressive camel	2	10%
For hen ailments	4	19%
Total	21	100%

Medicinal plants used by local people

**Table 7.** Frequency of medicinal plants used to treat livestock ailments.

<b>Plant species</b>	<b>Family</b>	<b>Common</b>	<b>Frequency</b>	<b>Percent (%)</b>
<i>Coffea arabica</i> L.	Rubiaceae	Buna	3	9%
<i>Carica papaya</i> L.	Caricaceae	Papaya	2	6%
<i>Psidium guajava</i> L.	Myrtaceae	Zeyeton	3	9%
<i>Phytolacca dodecandra</i> L'Her.	Phytolaccaceae	Endod	3	9%
<i>Cissus quadrangularis</i> L.	Vitaceae	Kimitita, Yeseytan Mukecha	1	3%
<i>Zingiber officinale</i> Roscoe.	Zingiberaceae	Zingebel	1	3%
<i>Trigonella foenum-graecum</i> L.	Fabaceae	Abesh	2	6%
<i>Allium sativum</i> L.	Alliaceae	Nechi shenkurt	3	9%
<i>Capsicum frutescens</i> L.	Solanaceae	Beriberi	3	9%
<i>Melia azedarach</i> L.	Meliaceae	Neem	2	6%
<i>Myrtus communis</i> L.	Myrtaceae	Ades	2	6%
<i>Calpurnia aurea</i> Benth.	Fabaceae	Degta	3	9%
<i>Leucas abyssinica</i> Benth.	Lamiaceae	Afentagen	4	21%
Total			32	100%

Plant parts used



**Figure 9.** Plant parts used for livestock remedy preparation

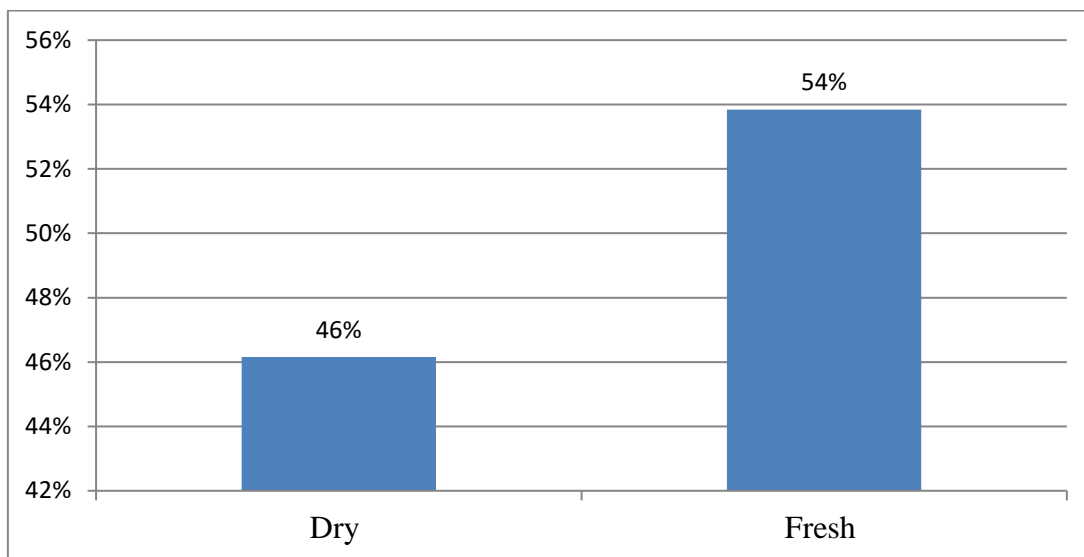
Modes of remedy preparation

**Table 8.** Modes of preparation of medicinal plants.

Mode of preparation	Frequency	Percent
Drinking via using the waste product of coffee	1	8%
Preparing and giving its seeds and leaves	2	15%
Breaking down and abrasion of the fruits part	4	31%
Direct use of the leaf sap	4	31%
Giving the combination of ginger sap with water	1	8%
Giving the pieces of fenugreek	1	8%
Total	13	100%

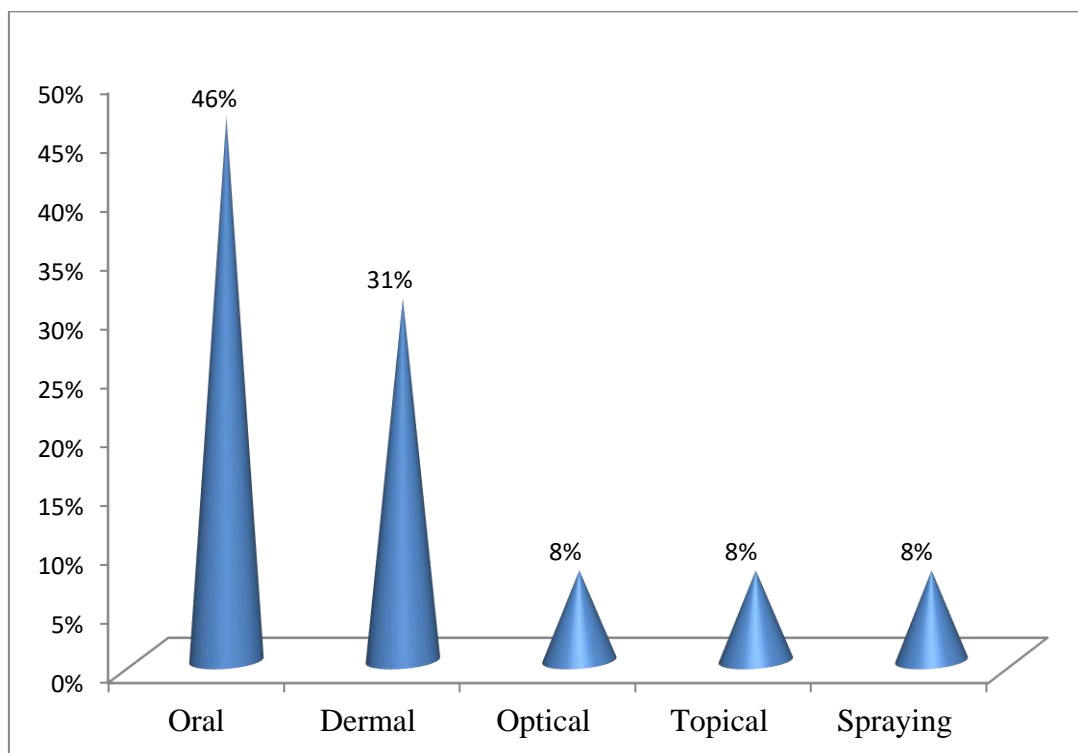


Condition of preparation of medicinal plants.



**Figure 10.** Condition of preparation of medicinal plants.

Route of administrations.



**Figure 11.** Rout of administration of livestock medicinal plants

### Most important medicinal plant species

#### Informant consensus

In this study, the informant consensus of medicinal plant usage resulted in ICF ranging from 1 to 0.13 per disease category for human and livestock health ailments.  $ICF = \frac{nur-nt}{nur-1}$

**Table 9.** Informants consensus factor (ICF) for more prevalent health ailments in the study area.

Categories of diseases	Plant species	Species in Percent	No of use citation	Percent of use citation	ICF
Organ problem(eye, ear)	5	9.1	7	3.3	0.33
Tonsillitis	2	3.64	3	5	0.5
Swelling, wound	8	14.55	10	2.2	0.22
Yemechi-besheta	14	25.45	16	1.3	0.13
Snake bitted	3	5.45	4	3.3	0.33
Liver diseases	1	1.81	3	10	1
Bad smelling	5	9.1	7	3.3	0.33
Fungus	3	5.45	5	5	0.5
Wart	5	9.1	8	4.3	0.43
Abdominal pain	3	5.45	5	5	0.5
Cough	2	3.64	4	6.7	0.67
Stomach	2	3.64	3	5	0.5
Itch	2	3.64	3	5	0.5

Relative healing potential of medicinal plants for human and livestock ailments

**Table 10.** Fidelity level value indexes of traditional medicinal plants to treat disease.

Medicinal plant	Treated ailment	IP	IU	FL value (%)
<i>Calotropis procera</i>	Wart	5	5	100%

<i>Calpurena aurnea</i>	Itch	6	6	100%
<i>Cucumis africanus</i>	Swelling	4	4	100%
<i>Cucumis dipsaceus</i>	Liver disease	5	5	100%
<i>Datura stramonium</i>	Fungus	3	4	75%
<i>Kalanchoe densiflora</i>	Wound, swelling	2	2	100%
<i>Lepidium sativum</i>	Itch, yemechi- besheta	4	6	66.67%
<i>Moringa stenopetala</i>	Yemechi-besheta, diabetics	9	10	90%
<i>Ruta chalepensis</i>	Bitted by snake	6	8	75%
<i>Xanthium strumarium</i>	Barelie	2	3	66.67%
<i>Ocimum lamifolium</i>	Yemechi besheta	6	7	85.71%

Preferences for human and livestock medicinal plants

**Table 11.** Preference ranking of eight medicinal plants for any medicinal value.

Species name	Ranking value for each respondent (A-G)							Total	Rank
	A	B	C	D	E	F	G		
<i>Justicia schimperiana</i>	3	1	2	1	2	1	2	12	8
<i>Ocimum lamiifolium</i>	4	6	5	6	5	5	5	36	4
<i>Zehneria scabra</i>	2	2	1	2	1	2	3	13	7
<i>Eucalyptus globules</i>	5	5	3	3	4	3	4	27	5
<i>Phytolacca dodecandra</i>	6	4	8	8	8	8	6	48	2
<i>Rhamnus prinodes</i>	1	3	4	4	3	4	1	20	6
<i>Coffea Arabica</i>	7	7	6	5	6	6	8	45	3
<i>Withania somnifera</i>	8	8	7	8	7	7	7	52	1

Paired comparison

**Table 12.** Paired evaluation of five medicinal plant species used to treat Fibril illness.

Plant species	Respondents (A-G)								Total	Rank
	A	B	C	D	E	F	G	H		
<i>Eucalyptus globulus</i>	3	2	2	5	4	5	3	3	27	2 <sup>nd</sup>
<i>Zehneria scabra</i>	4	5	3	4	5	3	4	4	32	1 <sup>st</sup>
<i>Withania somnifera</i>	5	3	4	1	3	4	2	3	25	3 <sup>rd</sup>
<i>Justicia schimperiana</i>	2	1	5	2	2	2	1	2	17	5 <sup>th</sup>
<i>Moringa stenopetala</i>	1	4	1	3	1	1	5	2	18	4 <sup>th</sup>

Ranks of multi-purpose medicinal plants

**Table 13.** Direct matrix ranking of eight plant species based on five use criteria.

Species	Use criteria					T	R
	C	MD	BU	FU	TO		
<i>Eucalyptus globulus</i>	3	4	5	4	4	20	6 <sup>th</sup>
<i>Croton macrostachyus</i>	2	2	2	8	1	15	7 <sup>th</sup>
<i>Calpurina aurea</i>	2	2	2	5	3	14	8 <sup>th</sup>
<i>Balanites aegyptiaca</i>	5	4	6	6	5	26	3 <sup>rd</sup>
<i>Acacia etbaica</i>	4	7	7	7	5	30	2 <sup>nd</sup>
<i>Ximenia americana</i>	7	3	3	3	7	22	5 <sup>rd</sup>
<i>Olea europaea subsp. Cuspidata</i>	6	6	4	3	6	23	4 <sup>th</sup>
<i>Ziziphus spina-christi</i>	8	8	8	5	8	37	1 <sup>st</sup>
Total	38	36	37	41	39		
Rank	3 <sup>rd</sup>	5 <sup>th</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>		

## Marketability of medicinal plants

Marketability surveys were made in three daily and three weekly markets found four kebeles were randomly selected for market survey, local markets in rural kebele (Robit gebeya, Tekulesh gebeya in Tekulesh, Zobel gebeya in Zobel, Kidame gebeya in Addiskign) and markets in urban kebeles (Arebit gebeya, Segno gebeya). Wogert (*Silene macrosolen*), Ades (*Myrtus communis*), Abesh (*Trigonella foenum-graecum*), Feto (*Lepidium sativum*), Zingebel (*Zingiber officinale*), *Allium sativum*, Teji-sar (*Cymbopogon martini*) Telba (*Linum usitatissimum*) were found common in the market place sold basically for spice except Wogert (*Silene macrosolen*) and Ades (*Myrtus communis*) are medicine. So, the market survey results revealed that most herbalists prepared and sold traditional medicinal plants at their homes rather than the market.

## 4. DISCUSSION

### The diversity of medicinal plants in the study area

Sums of 69 plant species were documented from the study area. From the given of plant family, Solanaceae have accounted for the highest number of medicinal plants followed by Fabaceae and Lamiaceae (Table 3). According to several scholars or other studies conducted elsewhere in the country revealed that the highest contribution of these families to the Ethiopian medicinal flora. The local people of the study area found more medicines for their ailments first and then try to search for their livestock ailments. Similar finding were reported by (Ensermu Kelbessa *et al.*, 2015) also reported more number of medicinal plant use for human ailments than for livestock.

Medicinal plant species were collected and identified in this study area. Similarly, the traditional medicinal plant species were collected from Amaro District (Ermias Lulekal *et al.*, 2007); Tilahun Teklehaymanot *et al.*, 2009). Raya kobo communities utilize more medicinal plant compared to the Gedeo society in Wonago Woreda, South Nations Nationalities People of Regions, Ethiopia who use 72 species (Tilahun Teklehaymanot *et al.*, 2009), the Bench ethnic group who use 35 Bench medicinal plants (Mirutse Giday *et al.*, 2009). This could indicate greater dependence of the study community on traditional medicinal plants for their primary healthcare needs.

### The habit forms of medicinal plants used

Currently in the study area, among the collected medicinal plants that the main medicinal plants for human were herbs covering 26 (37.7%) species, followed by trees 21 (30.44%) (Figure 4). The result revealed that habit forms of shrub medicinal plants for livestock followed by tree that were utilized in the study area (Figure 8).

The common use of herbaceous medicinal plants was also reported in studies carried out elsewhere in Ethiopia (Ensermu Kelbessa *et al.*, 2000; Sebsebe Demissew and Tesfaye Awas, 2009; Sebsebe Demissew *et al.*, 2013; Subhasis, 2019; Tochukwu, 2021; Shubhjeet, 2021; Ashoke, 2019).

These results also agree with usual pattern of dominance of herbaceous species as seen in greatest medicinal plant species items in other countries for example in a study in Mabira Central Forest Reserve, Uganda, (Maud *et al.*, 2016), herbs made up the highest proportion of medicinal plants species followed by trees.

### **Habitats of medicinal plants**

The 90 (61.22%) of medicinal plant species were found in natural habitats are the main sources of medicinal plants as described in other studies (Haile Yineger, 2008<sup>a</sup> *et al.*, 2008<sup>b</sup>; Tilahun Teklehaymanot *et al.*, 2009; Zemedu Asfaw *et al.*, 2009; Abebe Beyene and Damme *et al.*, 2013). Therefore, wild habitats are the major pool of medicinal plant resources for the local communities. Similar with the current study of the total medicinal plant species 12 (21%) species were obtained from it. Most of the Raya kobo medicinal plants were harvested from the wild (Figure 3). The finding revealed that medicinal plants that were reported to be used for livestock health problems from farm land (Table 5) which is in agreement with results of many studies conducted elsewhere in the country (for example, Zemedu Asfaw *et al.*, 2004; Sebsebe Demissew *et al.*, 2009; Giday Yirga, 2010).

### **Plant parts used**

The most utilized plant parts for traditional drug preparation were leaves accounted for 34 (61%), followed by root 8 (14%), fruits 7 (13%) and whole 5(9%) (Figure 5) in livestock, the result revealed that the most frequently utilized plant was leaf (26%) and fruit plant (26%) parts in the study area (Figure 9). Many studies conducted anywhere in Ethiopia also revealed the dominance of leaves in the preparation of remedies (Haile Yineger *et al.*, 2007; Balcha Abera *et al.*, 2013) and in other part of the world (Ahmad *et al.*, 2014; Mehmet *et al.*, 2015; Maud *et al.*, 2016), agrees with the result leaves were the most habitual utilized parts in preparing herbal remedies.

Remedy preparation that involves roots, seeds, fruit, latex, stems or whole plant have change that present an enduring hazard to the maintenance of continuous action of a single plant compared to leaves (Figure 5). Other reports revealed that fruits and roots to be the most used parts (Haile Yineger *et al.*, 2008; Tilahun Teklehaymanot *et al.*, 2009 and Ensermu Kelbessa *et al.*, 2015).

### **Modes of preparation of medicinal plants**

In this study, the preparation has been used both a single and multiple species. Thus, wide use of single plant species for the preparation of local medicines in the study area is agreed with findings in (Zemedu Asfaw and Ensermu Kelbessa, 2004). The main way of using remedy preparation was directing use of the leaf sap (Table 4).

### **Condition of preparation of traditional medicine plants**

The result revealed that 60 (87%) herbal medicine preparation were utilized in fresh form and 9 (13%) in dried forms of preparation (Figure 6 & 10). Harvested fresh plant parts were the dominant ones used in remedy preparation in the study area. Other studies conducted elsewhere also indicated the wider utilize of fresh materials (Zerihun Woldu *et al.*, 2003; Damme *et al.*, 2013). This finding is also consistent with the finding of Ermias Lulekal *et al.*, 2007) who showed that the most of the remedy preparations were in fresh form.

### **Route of administration and dosage of the traditional medicinal plants**

In the study area, dermal rout administration was the major rout with 27 (40%) of the preparation, followed by oral 25 (36%) and the rests of rout administration is also represents by

14 percent (including in Figure 7 & 11). These results are consistent with findings of various ethno-botanical researches elsewhere in Ethiopia and other countries such as that of (Zerihun Woldu *et al.*, 2003; Tilahun Teklehaymanot *et al.*, 2009; Adugna Tolera *et al.*, 2013 and Maud *et al.*, 2016). In the study area, the knowledge of indigenous herbalists in Raya kobo districts, the utilization of measurement of dosage to give attention to different diseases was never strong. Herbalists utilize various measurements for dosage and these measurements were never factual to identify the exact amount. The finding is consistent with findings in (Zemedede Asfaw *et al.*, 2016).

### Most important medicinal plant species

The consequences of this study revealed that some medicinal plants were present and the highest informant consensus went to *Zehneria scabra* and *Withania somnifera* which were cited by many informants in the study area (Table 1). Relative healing potential of medicinal plants for human and livestock ailments results showed that *Calotropis procera*, *Calpurena aurnea*, *Cucumis africanus*, *Cucumis dipsaceus*, and *Cucumis dipsaceus* the first species and *Lepidium sativum*, the least. This was an indication of their good healing potential in the study area (Table 2). Preference ranking of eight selected medicinal plant species on the basis of treating several ailments showed *Withania somnifera* as the most preferred one followed by *Phytolacca dodecandra* and *Justicia schimperiana* as the least preferred one (Table 12).

Paired comparison method in medicinal plants revealed that *Zehneria scabra* was ranked first, *Eucalyptus globulus* was ranked second and *Justicia schimperiana* was the least one (Table 13). The result of direct matrix ranking revealed that *Ziziphus spina Christi*, *Acacia etbaica*, *Balanites aegyptiaca*, *Olea europaea* subsp. *cuspidata*, *Ximenia americana*, *Eucalyptus globules*, *Croton macrostachyus* and *Calpurina aurea* were ranked 1<sup>st</sup> to 8<sup>th</sup> respectively (Table 14).

## 5. CONCLUSIONS AND RECOMMENDATIONS

In Raya kobo district, 69 medicinal plant species were documented from the study environment. The most numbers of the medicinal plant species were gathered from the wild area. 56 medicinal plant species were utilized against human ailments and 13 medicinal plant species against livestock diseases. Fungus, wound, febrile illness and wart were the most often reported human health ailments, followed by bad smelling, Tonsil, Ear ailments, Facial skin and abdominal pain ailments where as wound and hen ailments were common in livestock.

The greatest habitual occupied plant parts were leaves. The main modes of remedy preparation were direct the leaf of the sap followed by boiling and mixing with eucalyptus and Stroking the leaf with water. The most traditional medicinal plants were prepared in fresh form. Dermal and oral routes make possible great speed functional reaction for the prepared drugs with causes of disease and enhance able to cure disease power.

Finally, medicinal plant species were reported that mainly threatened by deforestation due to the purpose of agricultural expansion and for different necessary equipments. Plenty happens are also occurred in conservation of medicinal plants. In spite of the fact, the community of the study area have not undertaking the benefit of protecting plants from harmful under both ex-situ and in-situ conservation methods. Therefore, Awareness creation among the society should done and enforced at all levels to enable the diversity of plants and the traditional

knowledge of the community; any stakeholders should be protected and conserved within the given medicinal plant species; the next authors or researchers should comprehend the remaining gaps.

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