Ethnoveterinary uses of medicinal plants amongst the tribal populations of District Malakand, Khyber Pakhtunkhwa, Pakistan

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Ethnobotany Research and Applications 25:42 (2023) - http://dx.doi.org/10.32859/era.25.42.1-24
Manuscript received: 09/01/2023 – Revised manuscript received: 24/03/2023 - Published: 25/03/2023

Research

Abstract

Background: The current study expresses that most of the peoples were dependent on the natural resources as compared to cultivated. Domestic animals play a vital role in the development of human civilization that why plants are utilized as a remedy for a variety of domestic animals, in addition to humans. The people of District Malakand were extremely correlated with the therapeutic potential of medicinal plants as ethnoveterinary medicine.

Methods: The present study was conducted from January 2015 to December 2017 for observing the area and also to collect the medicinal plants. The assessment was observed deeply the knowledge concerned with the traditional uses of medicinal plant to cure the animal diseases. Animal diseases are a major constraint for the livestock owners; therefore, some strategies and measures should be adopted in near future. During the study stratified sampling were carried using the questioner and interviewed the people and followed by group discussion was employed to achieve the goals.

Results: The represented study has 76 plant species belonged to 45 families. Amongst them one species was Pteridophyte belonged to family Pteridaceae, and one was Gymnosperm belonged to Pinaceae, while the rest of 74 species of 43 families were Angiosperms. The herbs were dominant with 40 species (52.6 %), followed by trees with 22 species (29.0 %), and shrubs with 14 species (18.4 %). The largest families were Fabaceae, Lamiaceae, Poaceae and Solanaceae with 5 species each, while the second largest family was Rosaceae with 4 species. The third largest families were Apocynaceae, Amaryllidaceae, Brassicaceae, and Malvaceae with 3 species each. A total

of thirty-three ailments were treated with different plants species. The most common ailments treated of the animals were constipation, intestinal worms, paralysis, broken bone, diuretic, diarrhea, indigestion, tympany, itching, and jaundice.

Conclusion: The presented study revealed that production of animals played an important role in the inhabitants of Malakand district. Their people have abundant traditional knowledge of ethnoveterinary plant remedies and practical experience of animal care and production. The traditional knowledge is near to extinction in near future, due to the extensively usage of modern veterinary medicine.

Keywords: Fidelity level, District Malakand, Medicinal plants, Pakistan, Traditional knowledge.

Background

Ethnoveterinary medicine is a system that is based on folk beliefs, conventional knowledge skills, methods and practices used for remedial diseases that maintains proper health of animals. It provides the chief source for the treatment of various disorders in livestock all over the world even today (Mir *et al.* 2021, 2022). Man has used plant recipes for the curing of different diseases in their domesticated animals since the advent of human civilization (Khan *et al.* 2021; Singh *et al.* 2011; Rehman *et al.* 2023; Ullah *et al.* 2022; Abdin *et al.* 2022).

Ethnoveterinary knowledge has been transferred orally from generation to generation. The documentation of this knowledge is very important because modern civilization will completely finish traditional veterinary knowledge (Khan *et al.* 2012; Irfan *et al.* 2018e; Ahmad *et al.* 2021; Jan *et al.* 2022). Throughout the world many traditions of veterinary medicine are found as Ayurveda in India, Chinese acupuncture and Tibetan veterinary drugs whose traditional records are present (Lans *et al.* 2006; Manoj *et al.* 2012; Ahmad *et al.* 2016; Al-Fatimi *et al.* 2019; Asif *et al.* 2021).

The field of ethnoveterinary is recently introduced in Pakistan, as majority of the population is linked with agriculture. The livestock importance can be guessed from the fact that Pakistan is the fifth largest milk producing country in world (Rashid et al. 2022; Wali et al. 2019, 2021). In other countries of the world a lot of work has been done on plants used in ethnoveterinary, but in Pakistan very little work has been done (Irfan *et al.* 2018f; Jan *et al.* 2017, 2020a, b; Ullah *et al.* 2021).

Iqbal *et al.* (2005) reported a long history of ethnoveterinary knowledge from China, India and Pakistan. Jabbar *et al.* (2006) reported that Pakistani farmers have low access to modern veterinary medicines due to which they mostly depend upon ethnoveterinary medicines. According to Iqbal *et al.* (2005) ethnoveterinary knowledge is very useful for Indo-Pak Subcontinent.

Any plant or parts of plants like roots, stem, leaf, bark, fruit and seed which contains active chemicals constituents in their tissues which produces a specific physiological response in the cure of various diseases in human and animals are called medicinal plants (Baig *et al.* 2013; Iftikhar *et al.* 2019; Irfan *et al.* 2018a; Musa *et al.* 2022; Sher *et al.* 2022; Jan *et al.* 2021a, b). The developing countries depend wholly or partly on conventional herbal medicines for the care and control of animal and human diseases (Musa *et al.* 2008; Irfan *et al.* 2018d; Ullah *et al.* 2018). According to world health organization, the dependency of people on traditional medication is due to absence of suitable allopathic treatment. In fact, much of the community is remote, the more of its population is dependent on traditional indigenous knowledge (Phillipson, 2001; Asgary *et al.* 2014; Secher *et al.* 2018; Irfan *et al.* 2022; Jan *et al.* 2022). New species with highly medicinal importance have been added to the flora of Pakistan that can be used for the further extraction of phytochemicals and pharmacological activities (Ali *et al.* 2017).

Materials and Methods

Study area

Malakand district is situated between 34-22" to 34-41" North latitude and 71-37" to 72-14" East longitude in Khyber Pakhtunkhwa, Pakistan (Fig. 1). It is a doorway to Swat, Dir, Chitral and Bajaur, and is bounded by a range of mountains. These mountains separate it from Swat at North-East, other ranges separates it from Bajaur and Mohmand districts. It is bounded on North by Lower Dir, on South-East by district of Mardan and South-West by Charsada and Mohmand districts. Its climate is moderately cooled in winter, and pleasant in summer. June, July and August are the hottest months**,** while the coldest months are December, January and February **(**Barkatullah and Ibrar, 2011; Alamgeer *et al.* 2013).

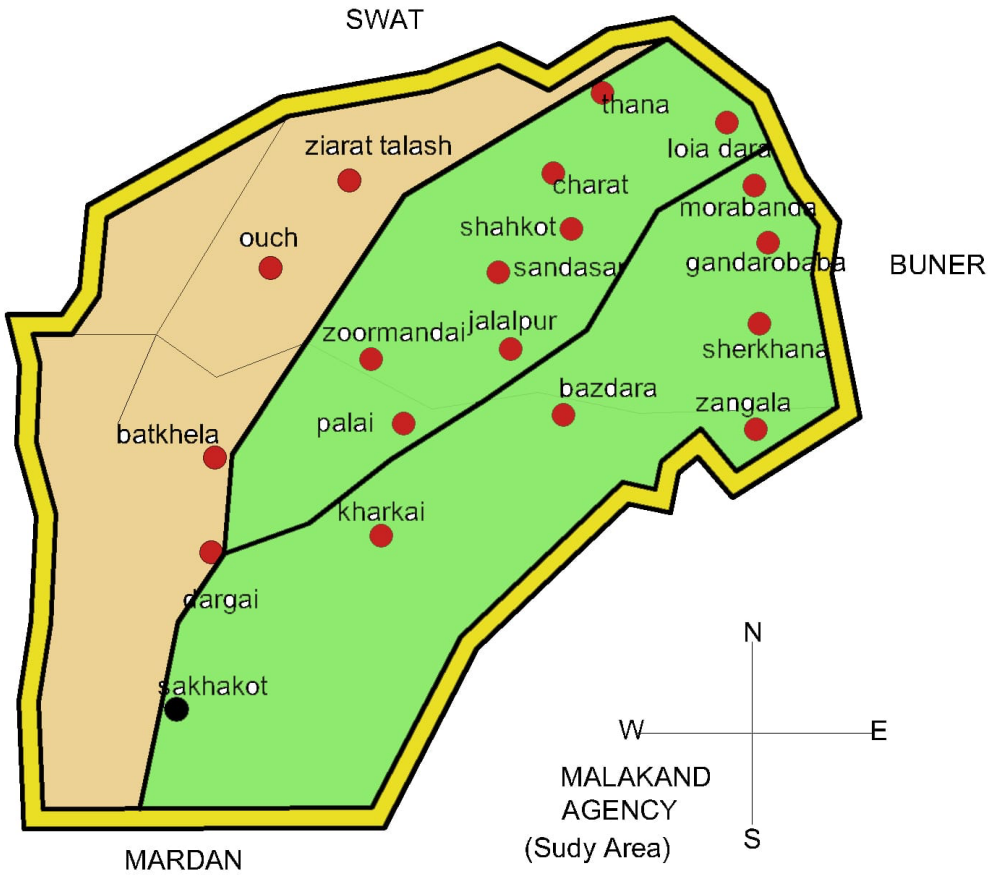

Figure 1. Map of the study sites of district Malakand, Khyber Pakhtunkhwa, Pakistan.

Data collection, identification and preservation of plants species

The ethnoveterinary knowledge of the therapeutic taxa from different localities of the studied area with the help of residents was documented. Initially available relevant literature was studied; field visits for data collection were conducted. The valuable native knowledge of therapeutic taxa was obtained through random interviews and questionnaires from residents of the studied sites. Elder peoples and hakims were given preference by asking questions about different plants parts application for the medication of particular disorders. The medicinal plants were collected from various localities, tagged, pressed, dried, preserved, and mounted on standard herbarium sheets with proper care, all specimens were identified with the help of Flora of Pakistan, and finally deposited to the herbarium at Hazara University, Mansehra, Pakistan (HUP).

Data analysis

Use Value (UV)

To know about medicinal importance of individual plants used values (UV) were applied to give a quantitative form of its relative importance to the informants neutrally (Phillips *et al.* 1994). This quantitative study evaluates the relative importance of each medicinal species based on relative use among informants. Use value was determined by using the following equation:

$$UV = \sum Ui/Ni$$

Ui = the number of use reports cited by each informant for a given plant species.
Ni = the total number of informants interviewed for a given plant species.

Informant Consensus Factor (ICF)

Informant consensus factor was used to determine the consensus and numbers of informants reported the plants for various ailments. The ICF value was calculated by using the following equation according to (Heinrich *et al.* 1998).

$$ICF= \quad \frac{(Nur-Nt)}{Nur-1}$$

"Nur "is the total number use report for each category of disease and "Nt" is the total number of species used in the report.

Relative Frequency of Citation (RFC)

Relative Frequency of Citation was used to determine the local importance of each species. It was calculated according to the given equation (Vitalini *et al.* 2013).

$$RFC=\frac{FC}{N}(0 < RFC < 1)$$

"FC" is representing the number of informants used a particular species and "N" is the total number of informants for a particular species.

Relative Popularity Level (RPL)

Relative popularity level is the estimated ratio between the total numbers of informants reported for exact disease, and the total number of disorders treated by a specific plant species. It was determined on the basis of popularity and unpopularity of plants taxa according to (Ali-Shtayeh *et al.* 2008).

Results

Ethnoveterinary information collected from district Malakand

The presented study was carried out in district Malakand has information regarding the local uses of medicinal plants. The represented study has 76 plant species belonged to 45 families. Amongst them one species was Pteridophyte belonged to family Pteridaceae, and one species was Gymnosperm belong to Pinaceae, while the rest of 74 species of 43 families were belonged to Angiosperms. The most dominant families were Fabaceae, Lamiaceae, Poaceae and Solanaceae with 5 species each, while the second largest family was Rosaceae with 4 species. The third largest families were Apocynaceae, Amaryllidaceae, Brassicaceae and Malvaceae with 3 species each, while Asteraceae, Euphorbiaceae, Polygonaceae and Rhamnaceae have 2 species each, while the rest of all families have one species each (Table 1).

Habit of Medicinal Plants

Analysis of the habit of medicinal plants the herbs were dominant with 40 species (52.6 %), followed by trees with 22 species (29.0 %), and shrubs with 14 species (18.4 %) (Table 1).

Nature of medicinal plants

Most of the people were dependent on the natural resources as compared to cultivated plants. Local people were dependent on both wild and cultivated plants species i.e., 55 species were wild i.e., *Ajuga bracteosa, Berberis actinacantha, Datura innoxia, Malva neglecta, Rumex dentatus* and *Zanthoxylum armatum* and 21 species were cultivated species i.e., *Platanus orientalis*, *Melia azedarach*, *Prunus persica* and *Saccharum officinarum* (Table 2).

Plant Parts Used and Method of collection

Different plant parts were used to prepare effective recipes for the curing of different diseases. The regularly used plant parts were leaves (33.3 %), Root (19.7 %), stem (18.4 %) fruit (18 %) followed by seeds (10.5 %) (Table 2). Theses medicinal plants were collected by different methods like digging (29 %), picking (27.6 %) and plucking (27.4 %) (Table 2) such extensive collection of roots and dig out the whole plant threatens the survival and stability of valuable medicinal plants (Table 4).

Availability status of plants species

Due to deforestation and overgrazing the availability of medicinal plants decreased during the past 30 years. According to aged villagers, medicinal plants were abundant in the area about 30 years ago, but due to increased marketing pressure on medicinal plants, non-sustainable harvesting methods like digging of whole plant, lack of job in the area, and increased population of the area. As a result, most economic plants species were disappeared with an alarming rate in the area. It is observed that (56.6 %) plants species were decreased (19.8 %) were persistent while (23.7 %) plant species were increased (Figures 2,3).

Table 1. Botanical and local name, family, habit, part used, status, disease for which they are used and mode of application.

Family	Botanical name	Local name	Habit	Part used	Animals treated	Disease cured	Mode of preparation	Used Value UV	RFC values	RPL values
Fabaceae	*Acacia modesta* Wall.	Polosa.	T	R	Cow, goat	Fever	Fresh roots are grind, boiled in water and filtered through a fine cloth. Give this filtrate to the animals	0.975	0.23	1.56
Adiantaceae	*Adiantum capillus-venaris* L.	Aspabote	H	W	Cow, buffalo, goat, sheep	Jaundice	Whole plant and *Butea monospermic* flowers are boiled in water and cool down. It is filtered through a fine cloth. The decoction is given to animals two times a day after meal for 10 to 15 days.	0.4	0.64	1.43
Lamiaceae	*Ajuga bracteosa* Wall ex. Benth.	Bootee	H	W	Cow, buffalo, goat	Fever	Dried whole plant is powdered and adds one teaspoon in one glass of water given to the animals after meal one time a day for two days.	0.976	0.29	1.21
Alliaceae	*Allium cepa* L.	Piaz	H	B	Cow, buffalo, goat	Remove leech	Onion bulb is crushed and mixed in water. It is given to the animals one time a day at night. A single dose is sufficient	0.688	0.16	1.07
Alliaceae	*Allium sativum* L.	Ooga	H	B	Cow, buffalo	Indigestion	Bulb is ground and mixed with fruit of *Xanthoxylum armatum*, salt and flour. It is given to the animals one time a day.	0.714	0.37	1.75
Liliaceae	*Aloe vera* L.	Mosabara	H	L	Horse	Purgative	The powered with teaspoon in one glass of water given to horse. Overdose may cause vomiting. In pregnant horses it may not be used because it effects on uterus. This may cause abortion in horses.	0.444	0.21	1.50
Berberidaceae	*Berberis lyceum* Royle.	Ziar large(Kware)	S	R	Cow, buffalo, goat, sheep	Weakness, body cooling, broken bone, fever	Fresh or dry root is boiled in water use to animals' tonic. dried root is ground and with water for a while used for fever.	0.976	0.54	1.44

Nyctaginaceae	*Boerhavia diffusa* L.	Insat	H	R	Cow, goat	Indigestion	The plant root is cut into small pieces and grind. Mix it in flour and give a single dose.	0.688	0.53	0.34
Bombaceae	*Bombax ceiba* L.	Badar, Sumbal	T	Bk	Cow, buffalo, goat	Fever	Fresh bark is ground and mixed with flour. A single dose is given to the animal for one day.	0.538	0.41	1.67
Brassicaceae	*Brassica campestris* L.	Sharsham	H	Se	Cow, buffalo, goat, sheep	Cool body, Weakness	The seed oil and mixed with Lassee (obtained from curd) is given to animal.	0.784	0.69	1.28
Brassicaceae	*Brassica nigra* L.	Thor sharsham	H	Sh	Cow, buffalo, goat, sheep	Placenta retention	Fresh whole plant is given to animal two times a day for two days.	0.75	0.39	1.32
Fabaceae	*Butea monosperma* (Lam.) P. Kuntra.	Palaigul	T	F	Cow, buffalo, goat, sheep	Body cooling, fever	Grind or fresh flowers boiled in water then given to the animals.	0.927	0.35	1.12
Asclepiadaceae	*Calotropis procera* (Willd.) R. Br.	Spalmai	S	Fr	Cow, buffalo, goat, sheep	Tympany	The fresh or dried white fibers in fruits are collected. These fibers are mixed in half glass of mustard oil. It is given to the animals for one time a day.	0.222	0.25	1.82
Moraceae	*Cannabis sativa* L.	Bhang	H	Sh	Ox	Weakness	The fresh leaves and branches of the plant are directly given to the animal. A single dose is given in a day	0.455	0.45	1.87
Solanaceae	*Capsicum anum* L.	Marchake	H	Fr	Cow, buffalo, goat, sheep	Appetizer	The fruits are ground and mixed with Lassee (curd) and Khawrai. This mixture put for four days.	0.444	0.19	1.98
Fabaceae	*Cassia fistula* L.	Landes	T	Fr	Cow, buffalo, goat, sheep	Diarrhea, Pain	The seeds pulp is mixed in water and given to the diseased animal once in a day.	0.385	0.25	1.57
Chenopodiaceae	*Chenopodium album* L.	Sarme, Ghwarsarme	H	R	Cow, buffalo, goat	Diuretic	The roots are ground and mixed in flour. A single dose for a single day is used.	0.455	0.22	1.38
Convolvulaceae	*Convolvulus arvensis* L.	Prewathke	H	L	Cow, buffalo, goat	Milk deficiency	Fresh plants are directly given to the animals for about one week.	0.818	0.15	2.1
Boraginaceae	*Cordia myxal* L.	Nashora	T	Bk	Goat, sheep	Broken bone	The fresh bark of the plant is put around the broken bone in poultice form.	0.588	0.39	0.98
Rosaceae	*Cotoneaster nummularia* (Fischer) .C.A .Meyer	Mamanra	S	Sh	Cow, buffalo, goat	Fever	The fresh stem or branches are directly given to the animals.	0.829	0.45	1.53
Cucurbitaceae	*Cucurbita maxima* L.	Petakado	H	Fr	Cow, buffalo, goat	Body cooling	The fruits of the plant are cut into pieces and boiled in three glasses of water.	0.611	0.41	1.2
Thymeleaceae	*Daphne oleoides* Schreb.	Leghone	S	Bk	Cow	Remove skin insects	The bark put around the neck of the animals. The unwanted infectious small creatures	0.75	0.64	0.78

							(bugs) are automatically removed from the skin of animal.			
Datiscaceae	*Datisca canabina* L.	Kalbeer	H	R	Cow, buffalo, goat, sheep	Diarrhea, jaundice	Roots are grind, boiled in "lassee" and put the mixture for two or three days.	0.538	0.45	1.3
Solanaceae	*Datura innoxia* Mill.	Batorai, Randa	H	L	Cow, buffalo, goat, sheep	Indigestion, paralysis	fresh leaves are ground and mixed with flour. It is used one time a day for two days.	0.708	0.48	1.33
Urticaceae	*Debregesia salicifolia* (D.Don) Rendle.	Alijai	H	R	Cow, buffalo, goat	Removing warms	Roots cut into pieces, grind, boil in two glasses of water, mixture is given to the animals	0.55	0.56	1.45
Ebenaceae	*Diospyrus lotus* L.	Tor amlook	T	Fr	Cow, buffalo, goat, sheep, camel	Diarrhea	Fruits are ground and mixed with flour. It is given to the animals one time a day.	0.684	0.58	1.47
Sapindaceae	*Dodonea viscosa* (L) Jacq.	Ghwaraske	S	L	Cow, buffalo, goat, sheep	Pain, wound	Fresh leaves are applied directly on wound or where some pain is one time a day.	0.976	0.35	1.5
Zygophyllaceae	*Fagonia cretica* L.	Azghake	S	W	Cow, buffalo	Body cooling	fresh or dried plant ground and boiled in two glasses of water then given to the animal.	0.975	0.41	1.8
Moraceae	*Ficus carica* Forssk.	Eenzar	T	Bk	Cow, buffalo, goat	Placenta retention	The bark of *Ficus carica* and *Grewia optiva* is cut into small pieces and boiled in four glasses of water.	0.75	0.36	1.19
Apiaceae	*Foeniculum vulgare* Mill.	Kaga	H	Se	Cow, buffalo, goat, sheep, camel	Indigestion	Dried seeds are mixed in flour and given to animals two or three times daily.	0.786	0.31	1.2
Malvaceae	*Grewia optiva* J. R. Drumm. ex Burret.	Pastawone	T	L	Cow, goat	Milk deficiency	The fresh leaves are given directly into the animals for milk production.	0.741	0.49	1.67
Poaceae	*Hordeum vulgare*	Warbashe	H	L, Se	Goat, sheep, donkey	Weakness	The fresh or dried plant is directly given to the animals.	0.68	0.44	0.45
Fabaceae	*Indigofera heterantha* Wall ex Brand.	Ghwareja	S	L	Cow, buffalo, goat	Abdominal pain, jaundice	fresh leaves and stem are grind, mixed in flour and given to the animal.	0.417	0.54	1.16
Acanthaceae	*Justicia adhatoda* L.	Bekan, or Bekanr	S	L, Sh, F	Cow, buffalo	Indigestion, pain, fever, tympany	Fresh stem or branch is chewed, *Justicia adhatoda* leaves and *Fagonia cretica* grinded, boil in water and mixed with flour.	0.75	0.32	2.1
Euphorbiaceae	*Mallotus phillipiniensis* (Lam) Muell.	Kambela	T	Fr	Cow, buffalo, goat, sheep	Purify body & blood, purgative	The fruits have reddish powder. The fruits are collected and mixed in water. The color of the fruit will dissolve in water.	0.563	0.67	1.38

Malvaceae	*Malva neglecta* Wall.	Panerak	H	R	Cow, goat	Placenta retention, milk deficiency``	Roots are ground and boiled in water. Add Gur (raw sugar). A single dose is given in a day.	0.556	0.86	1.1
Meliaceae	*Melia azedarach* L.	Shandai	T	Fr	Cow, buffalo, goat, sheep	Plague	Ripened fruit boiled in two glass of water mixture is used two or three times.	0.611	0.23	0.67
Lamiaceae	*Mentha longifolia* (L) Huds.	Enale, or Venale	H	L	Goat	Weakness	Dried shoots are boiled in water and cool down.	0.95	0.73	0.83
Musaceae	*Musa* x *paradisica* L.	Kela	H	L	Buffalo	Red water	Fresh leaves are directly given to animal for four days.	0.3	0.66	1.96
Amaryllidaceae	*Narcissus tazetta* L.	Gon-e-n gus (Gul e nargus) (Daffodils)	H	R	Cow, buffalo, goat, sheep	Blocked nipples	Grind the root and mix in flour and given to the animals.	0.455	0.21	0.45
Apocynaceae	*Nerium indicum* Mill.	Gandeere	S	L	Camel	Appetizer, sore	Fresh leaves are boiled in water and mixture cool down.	0.842	0.36	0.81
Cactaceae	*Opuntia dilleni* Haw.	Zuqam	S	Fr	Cow, buffalo, goat, sheep	Wound in eyes	Fresh fruits are given to animal once in a day for two days.	0.706	0.59	1.17
Pinaceae	*Pinus roxburghi* Sergeant.	Nakhtar	T	G	Cow, buffalo, goat	Intestinal worms	Resin is mixed in flour, given a single dose in a day.	0.611	0.29	1.38
Anacardiaceae	*Pistacia integrimma* Stew ex. Brandis.	Shnai	T	Fr	Cow, buffalo, goat, sheep	Weakness, red water	Fruits are ground and mixed in flour. It is given to the animal one time a day for one day.	0.444	0.16	0.56
Platanaceae	*Platanus orientalis* L.	Chinar	T	Bk	Cow, buffalo, goat	Broken bone	Bark pieces are boiled in water. After cooling it is given to the animals.	0.667	0.46	0.84
Lamiaceae	*Plectranthus rugosus* Wall. ex Bth.	Sperke, Lada	H	L	Cow, buffalo, goat	Fever, wound	Leaves are powdered and mixed in flour. A single dose used in a day.	0.6	0.58	1.51
Poaceae	*Poa annua* L.	Wakha	H	W	Cow, buffalo, goat, sheep, donkey	Weakness & milk deficiency	Fresh grass mixed with *Hordeum vulgare* grains. This mixture is directly given to the animals.	0.773	0.44	0.78
Rosaceae	*Prunus armeniaca* L.	Khoobanai	T	L	Goat, sheep	Weakness	Fresh leaves are given directly to the animals.	0.444	0.62	0.45
Rosaceae	*Prunus persica* (L.) Batsch.	Shaltaloo	T	L	Cow, buffalo, goat	Intestinal worms	Leaves boiled in water and Filter the mixture and then given to animals.	0.375	0.45	1.5
Punicaceae	*Punic agranatum* L.	Nagore, Narsawe	T	Fr	Cow, buffalo, goat, sheep	Indigestion, diarrhea	Fruit is ground and mixed in water. It is given daily for two days.	0.667	0.71	1.76

Fagaceae	*Quercus incana* Roxb.	Banjkarora	T	Fr	Cow, buffalo, goat, sheep	Intestinal worms	Fruits are ground and boiled in two glass of water. It is given one time a day for two days.	0.533	0.45	1.09
Euphorbiaceae	*Ricinus communis* L.	Aranda	T	Se	Cow, buffalo	Itching, purgative	Seeds oils mixed in flour given to the animals for purgative, also for itching.	0.5	0.65	1.10
Rosaceae	*Rubus fruticosus* L.	Karora	T	L	Cow, buffalo, goat, sheep	Fever	Leaves boiled in water. A single dose is given to the animals.	0.75	0.34	1.67
Polygonaceae	*Rumex dentatus* L.	Shalkhe	H	R, L	Cow, buffalo, goat	Placenta retention, wound	Fresh leaves directly given to the animals only one time. Leaf extracts applied on wound.	0.84	0.17	1.23
Polygonaceae	*Rumex hastatus* D. Don.	Tarooke	H	W	Cow, buffalo, goat, sheep	Constipation	Fresh plant is directly given to the animal once in a day.	0.769	0.65	1.56
Poaceae	*Saccharum officinarum* L.	Gane	H	St	Cow, buffalo, goat	Pain, cough, delivery, milk deficiency, weakness, tympany, warm body	Gur (raw sugar) prepared juice dissolved given to the animals for body pain, for cough the juice mixed with *Thymus linearis* and boiled, for tympany the *Thymus linearis* (sperkai) and Gur is boiled. For weakness raw sugar used.	0.667	0.54	0.36
Lamiaceae	*Salvia moorcroftiana* Wall ex Benth.	Khwardag	H	R	Cow, goat	Indigestion, constipation	Roots, black tea and raw sugar are mixed in four glass water and boiled. It is given to animals.	0.789	0.59	1.95
Pedaliaceae	*Sesamum indicum* L.	Konzalle	H	Se	Cow, buffalo, goat	Weakness	Roasted seeds are mixed in flour. A single dose is used for three days.	0.706	0.77	1.47
Brassicaceae	*Sisymbrium irio* L.	Jamama	H	Se	Cow, buffalo, goat, sheep	Weakness	Seeds are mixed in three glasses of "Lassee". A single dose is given to the animals.	0.833	0.45	2.7
Solanaceae	*Solanum esculentum* L.	Tamatr	H	Fr	Cow, buffalo, goat	Fever	tomato and chili (*Capsicum annum*) grinded, boil in water and after cooling mix with two glass Lassee in it.	0.762	0.36	1.87
Solanaceae	*Solanum surratense* Burm f.	Maraghone	H	L	Cow, buffalo, goat, sheep	Pain of bones, appetizer, sore	Paste of leaves and stem used around the bone, milky juice of fruit applied on sore, fruits grinded and mixed in flour given to the animals as an appetizer.	0.75	0.33	1.45
Asteraceae	*Sonchus arvensis* L.	Shawdapai	H	L	Cow, buffalo	Milk deficiency	Fresh leaves directly given to the animal two times a day.	0.75	0.67	1.7
Asteraceae	*Tagetes erecta* L.	Lal ghakhe	H	Sh	Cow, buffalo, goat, sheep	Cough, asthma	Leaves stem and branches are ground and mixed in water. It is used one time a day for one day.	0.739	0.25	1.22

Tamaricaceae	*Tamarix aphyla* (L.) Karst.	Ghaz	T	L, Bk	Cow, buffalo, goat, sheep	Broken bone	Paste prepared of fresh leaves, put on a cloth and tied around the broken bone.	0.828	0.36	1.34
Fabaceae	*Trigonella foenumgraecum* L.	Malkhwaze	H	L, Sh	Cow, buffalo, goat	Weakness, milk deficiency, swollen and hard udder	Whole plant small pieces add "Soowa" and boil in water given to the animal one time a day.	0.759	0.41	1.41
Poaceae	*Triticum aestivum* L.	Ghanum	H	Se	Cow, buffalo, goat, sheep	sickness, weakness,	Roasted grains directly, its color changed to black and mix it with wheat flour given to animal daily.	0.706	0.16	1.9
Asclepiadaceae	*Tylophora hirsuta* (Wall.) Wight	Kolmatara	S	St, R	Cow, buffalo	Body cooling, jaundice	Stem and root are ground and boiled in four glasses of water given to animals daily.	0.727	0.46	1.67
Scrophulariaceae	*Verbascum thapsus* L.	Khardag	H	R	Cow, buffalo, goat, sheep	Diarrhea, abdominal pain	Fresh roots are mixed with flour a single dose is used for three days.	0.533	0.45	1.49
Violaceae	*Viola odorata* L.	Banafshagul	H	F, L	Cow, buffalo, goat	Body cooling	Flowers are ground and mixed in flour is given to the animals.	0.714	0.63	1.59
Verbenaceae	*Vitex negundo* L.	Warmandai	T	R	Cow, buffalo, goat, sheep	Body cooling	Fresh stem pieces are ground and mixed with flour and are given two times a day for two days.	0.75	0.41	1.48
Vitaceae	*Vitis vinifera* L.	Angoor	S	St	Cow, buffalo, goat, sheep	Red water	Roots *Vitex negundo* and *Zizyphus nummularia* into pieces and boiled in water given to animals.	0.556	0.52	2.5
Solanaceae	*Withania somnifera* (L) Dunal.	Kotelal	H	R	Cow, buffalo, goat	Diarrhea, blocked nipples	grind roots are then mixed in flour given to the animal. A single dose of it is sufficient.	0.789	0.32	1.37
Rutaceae	*Zanthoxylum armatum* DC.	Dambara	S	Fr	Cow, buffalo, goat, sheep	fever, cold, indigestion	Dried seeds mixed in flour given to animal. Precaution is from cold weather and cold grass	0.545	0.39	2.1
Poaceae	*Zea mays* L.	Jawar	H	Se	Cow, buffalo, goat, sheep, camel	Diarrhea, weakness	Maize flour and burned salt are mixed given to animals. Maize flour is mixed with water also can used.	0.667	0.56	1.99
Rhamnaceae	*Zizyphus mauritiana* Lamk.	Bera	T	L	Goat, sheep	Weakness	Dried leaves are directly given to the animals one time a day for two to three days.	0.375	0.31	1.27
Rhamnaceae	*Zizyphus nummularia* (Burn. f) Wight and Arn.	Karkana	S	R	Cow, goat	Body cooling	Fresh roots are boiled in four glasses of water. It is given to animal one time a day for two days.	0.625	0.58	1.62

Legend: Habit: T; Tree, **H**; Herb, **S**; Shrub, **Part used: R**; Root, **W**; Whole plant, **B**; Bulb, **L**; Leaf, **Se**; Seed, **Sh**; Shoot, **Bk**; Bark, **F**; Flower, **Fr**; Fruit, **G**; Gum, **St;** Stem,

Table 2. Botanical and local name, family, habit, part used, status, disease for which they are used and mode of application

Family	Botanical name	In which form it is used	Carrier used	Availability Status	From how long the medicinal properties have been known (years)	Nature	Collection method
Fabaceae	*Acacia modesta* Wall.	Fresh	Wt	Dec	75	W	Dig
Adiantaceae	*Adiantum capillus-veneris* L.	Fresh	Wt	Dec	60	W	Dig
Lamiaceae	*Ajuga bracteosa* Wall ex. Benth.	Fresh	Al	Dec	80	W	Dig
Alliaceae	*Allium cepa* L.	Fresh	Al	Inc	70	Cul	Dig
Alliaceae	*Allium sativum* L.	Fresh	Flo	Inc	90	Cul	Dig
Liliaceae	*Aloe vera* L.	Dried	Wt	Inc	60	Cul	Plu
Berberidaceae	*Berberis lyceum* Royle.	Fresh or Dried	Wt	Dec	78	W	Dig
Nyctaginaceae	*Boerhavia diffusa* L.	Fresh or Dried	Flo	Dec	84	W	Dig
Bombaceae	*Bombax ceiba* L.	Fresh	Flo	Inc	85	Cul	Plu
Brassicaceae	*Brassica campestris* L.	Fresh or Dried	Las	Inc	78	Cul	Pic
Brassicaceae	*Brassica nigra* L.	Fresh	Al	No ch	50	Cul	Plu
Fabaceae	*Butea monosperma* (Lam.) P. Kuntra.	Fresh or Dried	Wt	Dec	70	W	Plu
Asclepiadaceae	*Calotropis procera* (Willd.) R.Br.	Fresh or Dried	Mu oil	No ch	55	W	Pic
Cannabaceae	*Cannabis sativa* L.	Fresh	Al	No ch	70	W	Plu
Solanaceae	*Capsicum annuum* L.	Fresh or Dried	Las	Inc	68	Cul	Pic
Fabaceae	*Cassia fistula* L.	Dried	Wt	No ch	74	W	Pic
Amaranthaceae	*Chenopodium album* L.	Fresh	Flo	No ch	80	W	Dig
Convolvulaceae	*Convolvulus arvensis* L.	Fresh	Al	No ch	77	W	Plu
Boraginaceae	*Cordia myxa* L.	Fresh	Al	No ch	78	W	Plu
Rosaceae	*Cotoneaster nummularia* (Fischer. f) .C.A. Meyer	Fresh	Al	Dec	70	W	Plu
Cucurbitaceae	*Cucurbita maxima* L.	Fresh	Wt	Inc	66	Cul	Pic
Thymeleaceae	*Daphne oleoides* Schreb.	Fresh	Al	Dec	65	W	Plu
Datiscaceae	*Datisca canabina* L.	Fresh	Las	No ch	70	W	Dig
Solanaceae	*Datura innoxia* Mill.	Fresh	Flo	No ch	75	W	Plu
Urticaceae	*Debregesia salicifolia* (D. Don) Rendle.	Fresh	Wt	Dec	65	W	Dig

Ebenaceae	*Diospyrus lotus* L.	Fresh	Flo	Dec	76	W	Pic
Sapindaceae	*Dodonea viscosa* (L) Jacq.	Fresh	Alo	Dec	67	W	Plu
Zygophylaceae	*Fagonia cretica* L.	Fresh	Wt	Dec	70	W	Dig
Moraceae	*Ficus carica* Forssk.	Fresh	Wt	Dec	80	W	Plu
Apiaceae	*Foeniculum vulgare* Mill.	Dried	Flo	Inc	85	Cul	Pic
Malvaceae	*Grewia optiva* J.R. Drumm. ex Burret.	Fresh	Al	Dec	60	W	Plu
Poaceae	*Hordeum vulgare* L.	Fresh or dried	Al	Dec	65	Cul	Plu & Pic
Fabaceae	*Indigofera heterantha* Wall ex Brand.	Fresh	Flo	Dec	70	W	Plu
Acanthaceae	*Justicia adhatoda* L.	Fresh	Flo	Dec	68	W	Plu
Euphorbiaceae	*Mallotus phillipiniensis* (Lam) Muell.	Fresh	Wt	Dec	60	W	Pic
Malvaceae	*Malva neglecta* Wall.	Fresh	Wt	Dec	75	W	Dig
Meliaceae	*Melia azedarach* L.	(Rippend fruit) fresh	Wt	Dec	60	W	Pic
Lamiaceae	*Mentha longifolia* (L) Huds.	Dried	Wt	Dec	75	W	Plu
Musaceae	*Musa* x *paradisica* L.	Fresh	Al	Inc	65	Cul	Plu
Amaryllidaceae	*Narcissus tazetta* L.	Fresh	Flo	Dec	80	W	Dig
Apocynaceae	*Nerium indicum* Mill.	Fresh	Wt	Dec	70	W	Plu
Cactaceae	*Opuntia dilleni* Haw.	Fresh	Alo	Inc	40	W	Pic
Pinaceae	*Pinus roxburghi* Sergeant.	Fresh	Flo	Dec	75	W	Plu
Anacardiaceae	*Pistacia integerimma* Stew ex. Brandis.	Fresh	Flo	Dec	80	W	Pic
Platanaceae	*Platanus orientalis* L.	Fresh	Wt	Dec	75	Cul	Plu
Lamiaceae	*Plectranthus rugosus* Wall. ex Benth.	Fresh	Flo	Dec	80	W	Plu
Poaceae	*Poa annua* L.	Fresh	Al	Dec	75	W	Dig
Rosaceae	*Prunus armeniaca*	Dried	Al	No ch	60	Cul	Plu
Rosaceae	*Prunus persica* (L) Batsch.	Fresh	Wt	Inc	70	Cul	Plu
Punicaceae	*Punic agranatum* L.	Fresh	Wt	Dec	75	W	Pic
Fagaceae	*Quercus incana* Roxb.	Dried	Wt	Dec	70	W	Pic
Euphorbiaceae	*Ricinus communis* L.	Dried	Flo	No ch	70	W	Pic
Rosaceae	*Rubus fruticosus* L.	Fresh	Wt	Dec	70	W	Plu
Amaranthaceae	*Rumex dentatus* L.	Fresh	Al	No ch	75	W	Dig & Plu
Polygonaceae	*Rumex hastatus* D.Don.	Fresh	Al	Dec	60	W	Dig
Poaceae	*Saccharum officinarum* L.	Dried	Wt	Inc	80	W	Plu
Lamiaceae	*Salvia moorcroftiana* Wall ex Benth.	Fresh	Wt	Dec	65	W	Dig
Pedaliaceae	*Sesamum indicum* L.	Dried	Flo	Dec	60	Cul	Pic

Brassicaceae	*Sisymbrium irio* L.	Dried	Las	Inc	70	Cul	Pic
Solanaceae	*Solanum esculentum* L.	Fresh	Wt	Inc	65	Cul	Pic
Solanaceae	*Solanum surretense* Burm f.	Fresh	Al	Dec	60	W	Plu
Asteraceae	*Sonchus arvensis* L.	Fresh	Al	No ch	60	W	Plu
Asteraceae	*Tagetes erecta* L.	Fresh	Wt	Dec	75	W	Plu
Tamaricaceae	*Tamarix aphyla* (L.) Karst.	Fresh	Al	Dec	70	W	Plu
Fabaceae	*Trigonella foenumgraecum* L.	Fresh	Wt	Inc	60	Cul	Plu
Poaceae	*Triticum aestivum* L.	Dried	Al	Inc	70	Cul	Pic
Asclepiadaceae	*Tylophora hirsuta* (Wall.) Wight	Fresh	Wt	No ch	65	Cul	Plu & Dig
Verbenaceae	*Verbascum thapsus* L.	Fresh	Flo	No ch	60	W	Dig
Violaceae	*Viola odoraata* L.	Fresh	Flo	Dec	60	W	Plu
Verbenaceae	*Vitex negundo* L.	Fresh	Wt	Dec	75	W	Dig
Vitaceae	*Vitis vinifera* L.	Fresh	Flo	Inc	60	Cul	Plu
Solanaceae	*Withania somnifera* (L) Dunal.	Fresh	Flo	Dec	62	W	Dig
Rutaceae	*Zanthoxylum armatum* DC.	Dried	Flo	Dec	35	W	Pic
Poaceae	*Zea mays* L.	Dried	Al	Inc	70	W	Pic
Rhamnaceae	*Zizyphus mauritiana* Lamk.	Fresh	Al	Dec	60	W	Plu
Rhamnaceae	*Zizyphus numularia* (Burn. f) Wight and Arn.	Fresh	Wt	Dec	70	W	Dig

Keys: Availability Status: Inc; Increased, **Dec**; Decreased, **No Ch**; No change, **Used form: W**; Wild, **Cul**; Cultivated. **Carrier used: Wt**; Water, **Flo**; Flour, **Al**; Alone, **Las**; Lassee, **MuOil**; Mustard Oil. **Collected method: Dig**; Digging, **Plu**; Plucking, **Pic**;Picking.

Table 3. Livestock disease and number of medicinal plant species used.

Livestock disease	Nt	Nur	ICF
Abdominal pain	2	15	0.92
Appetizer	4	12	0.72
Asthma	3	55	0.96
Blocked udder	4	34	0.90
Body cooling	8	17	0.56
Broken bone	4	26	0.88
Common cold and flu	2	63	0.98
Constipation	2	47	0.97
Cough	3	45	0.95
Delivery problems	2	77	0.98
Diarrhea	7	21	0.7
Diuretic	3	34	0.93
Eye wound	4	23	0.86
Fever	11	54	0.81
Indigestion	8	34	0.78
Intestinal worms	3	12	0.81
Itching	2	46	0.7
Jaundice	2	12	0.90
Milk deficiency	6	34	0.84
Pain	7	23	0.72
Paralysis	3	8	0.71
Placenta retention	4	35	0.85
Plague	6	13	0.58
Purgative	3	32	0.93
Purify blood	2	27	0.96
Remove leech	3	15	0.85
Skin insects	4	9	0.62
Sore	2	15	0.92
Swollen and hard udder	6	42	0.87
To heat body	2	12	0.90
Tympany	2	33	0.96
Weakness	15	41	0.65
Wound	4	16	0.8

Key: Nt; number of taxa, **Nur;** Number of reports for specific diseases.

Table 4. Showing parts used and percentage.

Part used	Number of plants	Percentage
Leaves	24	33.3 %
Root	15	19.7 %
Stem, branches	14	18.4 %
Fruit	13	18 %
Seeds	8	10.5 %
Bark	6	7.9 %
Whole plant	5	6.8 %
Flower	3	4.0 %
Bulb	2	2.6 %
Gum	1	1.4 %

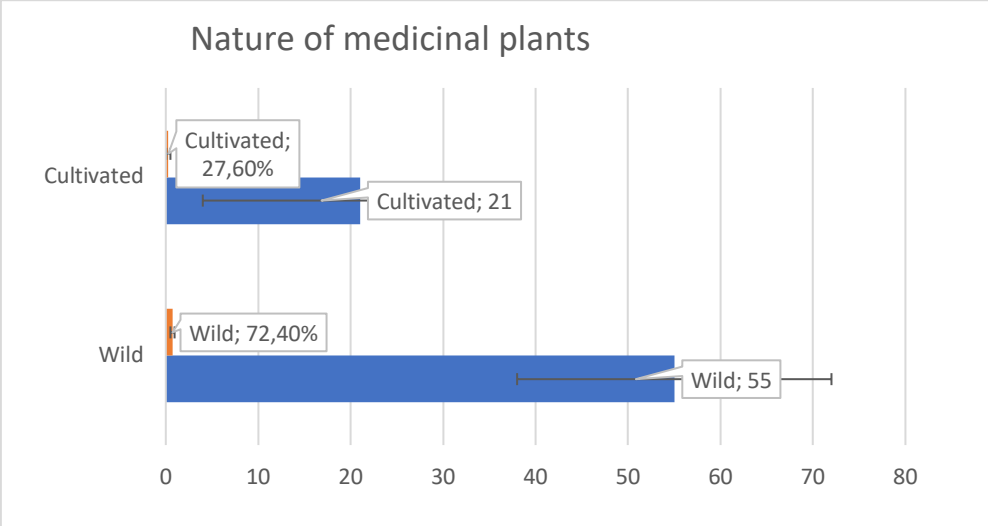

Figure 2. Nature of collected data in the study area.

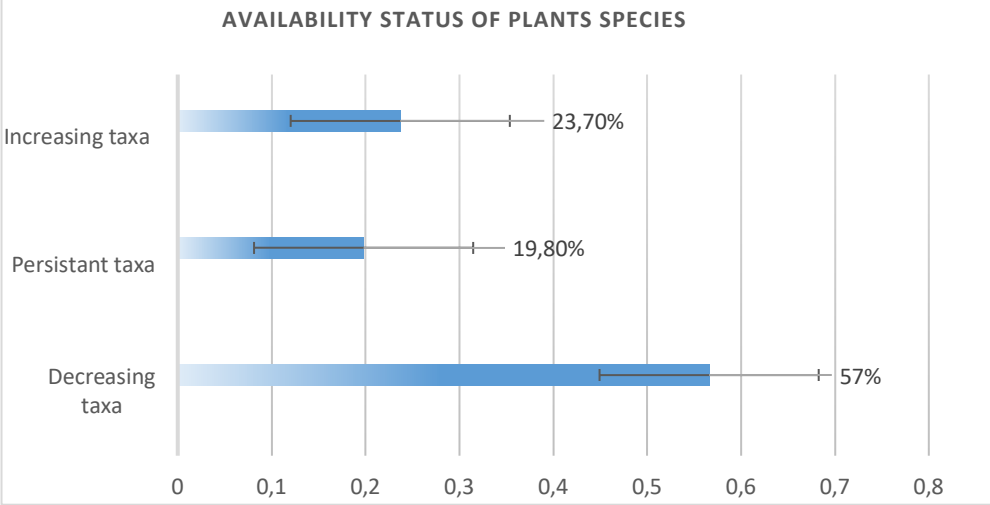

Figure 3. Availability status of plant species in study area.

Cured diseases

Most of the inhabitants of the area were conservative and correlated with agriculture. They were keeping different animals such as cow, goat, sheep, donkey and buffalo for various purposes like milk production, carrying luggage and plough the field owing of less expenditure. These animals were the basic source of earning and essential for agriculture, they were treating them as the member of family and too sensitive about them. Due to the dependency on these animals, they were also dependent on medicinal plants to cure the various diseases.

In current study a total of 33 ailments were recorded, the most common ailments of the animals were intestinal worms, broken bone, diuretic, diarrhea, indigestion and jaundice (Table 1). As study area is devoid of modern facilities so people use traditional recipes for the treatment of their livestock. The plants species utilized such as *Ajuga bracteosa* was used to treat fever, *Calotropis procera* was used to treat tympany, *Cannabis sativa* was used as tonic, while some were used in mixture with other plants like *Butea monosperma* was used along with *Fagonia cretica* and *Tylophora hirsuta* to treat body cooling and fever, *Ficus carica* was used with *Grewia optiva* was used to treat placenta retention (Table 1).

Mode of recipes

Different recipes were used effectively against different ailments. About (30.3%) plants species were given directly to the animals as fodder, while (36.9%) recipes were used as carrier with water, in recipes flour was 29 % used, with curd in recipes was used 5.3 % and (1.3%) recipes was given with mustard oil (Table 1). The area was very rich with

respect to ethnoveterinary knowledge, and the local peoples have very old traditional knowledge of the uses of plants which were transferred from generation to generation.

Quantitative Analysis

Use value

The use value was calculated for each plant species, it was generally used to check relative importance of single plant species. Highest use value was reported for *Ajuga bracteosa* (0.976)*, Berberis actinacantha* (0.976), *Dodonaea viscosa* (0.976), *Fagonia cretica* (0.975), *Acacia modesta* (0.975), *Butea monosperma* (0.927), *Convolvulus arvensis* (0.818), *Cotoneaster acuminatus* (0.829), *Nerium indicum* (0.842), *Rumex dentatus* (0.84), *Sisymbrium irio* (0.833), and *Tamarix aphylla* (0.828), while the lowest use value was reported by *Calotropis procera* (0.222), *Ziziphus nummularia* (0.375) and *Prunus persica* (0.375) (Table 1).

RFC Value

Relative frequency citation (RFC) indicates the local vitality of each species in the study. Amongst them the top ten were *Malva neglecta* (0.86), *Sesamum indicum* (0.77), *Mentha longifolia* (0.73), *Punica granatum* (0.71), *Brassica campestris* (0.69), *Mallotus actinoneurus* and *Sonchus arvensis* results the same frequency with (0.69) each, while the *Musa acuminata* (0.66), *Ricinus communis* and *Rumex hastatus* with (0.65) each, *Adiantum capillus-veneris* and the *Daphne oleoides* also resulted same frequency (0.63), while the lowest frequency was resulted for *Convolvulus arvensis* (0.15), *Allium cepa*, *Pistacia integerrima,* and *Triticum aestivum* with (0.16) each, *Rumex dentatus* (0.17), *Capsicum annuum* (0.19), *Narcissus tazetta* and *Aloe vera* with (0.21) each (Table 1).

RPL Value

The highest relative popularity level (RPL) was reported for *Zea mays* (1.99), *Capsicum annuum* (1.8), *Musa acuminata* (1.96), *Salvia moorcroftiana* (1.95), *Solanum esculentum* (1.87), *Allium sativum* (1.75), *Bombax ceiba* and *Grewia optiva* (1.67) each, *Zizyphus nummularia* (1.62), *Cassia fistula* (1.57), and *Acacia modesta* (1.56), while the lowest value were reported for *Boerhavia diffusa* (0.34), *Saccharum officinarum* (0.36), *Hordeum vulgare, Narcissus tazetta* and for *Prunus armeniaca* (0.45) each, *Pistacia integrimma* (0.56), and *Melia azedarach* (0.67) reported (Table 1).

ICF Value

Analysis based on ICF value resulted that value from 0.7 to 0.98, the common cold, flu, and delivery problems resulted highest value with (0.98) each, while the second highest value was reported for constipation with (0.97) value, the third highest value was recorded for asthma, while the lowest value was resulted for diarrhea with (0.7) value (Table 3).

Discussion

In our findings, the dominant families the Fabaceae, Lamiaceae, Poaceae, and Solanaceae with 5 species each had supported by the finding of Jan *et al.* (2022) from adjacent to the area, which revel the sight of similarities of results through proven the dominancy of these families with our assessment. The habit-wise analysis resulted in the herbs being dominant with 40 species (52.6 %) which shows the adaptation of herbs in the resident area owing to the short life cycle. The previous maximum assessment showed the dominancy of the herbs such as previously Birjees *et al.* 2022. The regularly used plant parts were leaves (33.3 %), Root (19.7 %), stem (18.4 %) fruit (18 %) followed by seeds (10.5 %) which suggested and proved that these parts of the plants had active ingredients due to effective work. the same result was also previously presented by various scientists like (Agyare *et al.* 2009; Rahmatullah *et al.* 2010). In our documented results such as digging (29 %), picking (27.6 %), and plucking (27.4 %) resulted dominantly. Owing to the limited number of plants proper conservation and sustainable use of these medicinal plants various methods for the collection of the specific part had used for the collection like (Wondimu *et al.* 2007; Bahmani *et al.* 2014). For the effective work against a disease various sort of recipes and carriers had used by the people of the area About (30.3%) of plants species were given directly to the animals as fodder, while (36.9%) of recipes were used as carriers with water, recipes flour was 29 % used, with curd in recipes was used 5.3 % and (1.3%) recipes were given with mustard oil. according to Sofowora *et al.* 2013 over 90% of traditional therapeutic plants have proper recipes and remedies for effective work. In findings 33 ailments were recorded, the most common ailments of the animals were intestinal worms, broken bone, diuretic, diarrhea, indigestion and jaundice because these disoreder easily treated in the resident's area (Arshad *et al.* 2012).

The assessment had various statical parameters, in our results which showed the resident area medicinal plants importance (Table 1). Analyzing traditional data of medicine through various parameters of statistics provides sight

into the new findings which lead to the discoveries. Theses parameters provide accurate data and pieces of information about medicinal plants (Kindscher *et al.* 2013).

Livestock keeping is one of the vital economic sources of agriculture and is the integral part of tribal communities; animals are a source of calories in the form of meat, milk and their products for livelihood and still are a good source of earning of the people of the area. According to Iqbal *et al.* (2005) livestock played an important role in the national economy of Pakistan. Almost 68% of the population lives in rural areas and is directly or indirectly linked with agriculture for their livelihood and is the largest contributor to overall agriculture. Livestock is an important sector of agriculture in Pakistan that accounts for 49.1% of agricultural value. The role of livestock in rural economy is realized from the fact that 30-35millions rural population is engaged in livestock production. It includes buffalos, sheep, goats, camels, and horses, small ruminants also played an important role in the national economy of Pakistan.

The livestock and dairy development department of the government partially provides health care to these animals. Their owners, therefore, have to rely on ethnoveterinary practices being inherited by their predecessor's generation to generation. The animals usually have diseases such as fever, diarrhea, jaundice, indigestion, constipation, milk deficiency and tympany.

Malakand district was unexplored with respect to ethnoveterinary knowledge, it is an attempt to document the indigenous knowledge of local peoples. The present study was about the use of ethnoveterinary herbal remedies used by the local people of Malakand district. The people of the study area have their own treatment system for most of the diseases of their livestock. A total 76 species belonged to 45 families have been reported. The largest families were Fabaceae, Lamiaceae, Poaceae and Solanaceae with 5 species each, while the second largest family was Rosaceae with 4 species. Some medicinal plants were used for a single disease such as *Acacia modesta* was used for fever, *Aloe vera* for purgative, *Cordia myxa* for broken bone, *Fagonia cretica* for body cooling, while some are used for many diseases such as *Berberis actinacantha* was used for weakness, body cooling and in broken bone, *Dodonea viscosa* was used in pain, diarrhea and for wound healing, *Justicia adhatoda* was used for indigestion, pain and fever.

In the carried assessment some of the medicinal plants were used singly for example, whole plant of *Ajuga bracteosa* was used in fever, fruit of *Calotropis procera* was used in tympany and leaf of *Cannabis sativa* was used in weakness, concerned with the form of use some of the medicinal plants were used in mixture form for example, whole plant of *Adiantum capillus-veneris* was used with *Butea monosperma* for jaundice, *Allium sativum* was used with *Zanthoxylum armatum* and salt for indigestion. Similarly, (Tabuti *et al.* 2003; Jabbar *et al.* 2006) had reported ethnoveterinary study from different parts of Pakistan. Dilshad *et al.* (2008) had reported 66 plant species used in ethnoveterinary in Sargodha district of Pakistan. Farooq *et al.* (2008) reported 18 plant species represented 14 families to cure parasitic diseases of livestock from Cholistan desert of Pakistan. Similar ethnoveterinary study has been reported by Tamboura *et al.* (2000) according to his study 95% of traditional recipes were used for cure of livestock derived from plants. The study of Alawa *et al.* (2002) discloses that ethnoveterinary practices are common in livestock bearers in North Nigeria.

Sindhu *et al.* (2010) carried out ethnoveterinary study from district Mansehra, Pakistan and reported 35 plant species belonged to 25 families. Eighteen medicinal plant species has been reported by Ole-Midron (2003) from Kenya. Murthy *et al.* (2008) documented 21 medicinal plants species used in ethnoveterinary medicine from Andhra Pradish, India. All over the world researchers are involved to document the traditional ethnoveterinary knowledge. Such as, Maroyi (2012) had reported 23 plant species of 16 families used for livestock diseases in Zimbabwe. Rural population in Zimbabwe has considerable traditional ethnoveterinary knowledge. Chalechale *et al.* (2013) had documented 20 plant species used for livestock treatment from Kurdistan, Iran. In Nigeria ethnoveterinary plant recipes are used commonly by livestock bearers in village and herdsmen (Alawa *et al.* 2002).

Majority of the people of the study area were dependent on agriculture and livestock production. The local people utilized locally available herbal recipes due to many reasons such as poverty due to which they cannot afford modern veterinary medicines and there is a long distance between their residence and the area where some modern veterinary facilities are available. Due to these reasons the traditional herbal medicine is the first option of the people of district Malakand.

The current study resulted that farmers have a preference to collect medicinal plants directly from the field and could easily use them. In various parts of the world ethnoveterinary knowledge has been documented but in Pakistan very little work has been done on ethnoveterinary. Due to which different plants having ethnoveterinary importance were documented from rural hilly areas of district Malakand. Danish *et al.* (2012) had documented district Swabi herbal remedies used in ethnoveterinary practices. They explored twenty medicinal plants species. Twenty-three medicinal plants used in ethnoveterinary were reported from Allai valley Battagram (Haq *et al.* 2012). Shah *et al.* (2012) carried out ethnoveterinary study from district Abbottabd, Pakistan. They reported 34 medicinal plants species of 34 families. Chaudhary *et al.* (2006) investigated 32 medicinal plants species of 21 families used as ethnoveterinary medicines from Samahni valley, Bhimber Azad Jammu and Kashmir.

Each village of the district Malakand has many expert persons in ethnoveterinary medicine. The survey showed that most of the peoples have some information about the use of herbal medicines for the treatment of many ailments of their livestock (Irfan *et al.* 2019).

The local inhabitants collected medicinal plants species by different methods such as plucking (36 species), digging (22 species) and picking (21 species). Analysis of the growth forms of medicinal plants revealed that herbs constituted largest number with 40 species (52.6%) followed by trees 22 species (29.0%) and shrubs 14 species (18%). The villagers were used herbs, as most of the trees and shrubs have been cut down for fuel wood purposes.

The local people used different parts of plants for various therapeutic uses such as the leaves of 24 plants (33.3%) was used as purgative, milk deficiency, indigestion, paralysis etc. Fruits of 13 plants (18%) was used in diarrhea, pain, body cooling and 5 species as whole plants (6.8%) are used in weakness, milk deficiency and constipation.

The local people depend on their natural resources. In the study area 55 medicinal plants are collected from natural resources while 21 medicinal plants are cultivated. This showed that how the local people depend on their natural environment. Similarly, Rajakumar and Shivanna (2012) reported 35 medicinal plants collected from wild and 17 cultivated species used as ethnoveterinary.

The population of medicinal plants has been decreased in last 30 years. It is decreased due to excessive and unwise utilization such as over grazing, climate change, and increase in population, poor method of collection like dig out the whole plant, market pressure and deforestation. Lack of scientific knowledge, ignorance, poverty and joblessness add more pressure to these factors. The local people cut down the forests for the cultivation of orange fruits because it is the high source of income for local people (Irfan *et al.* 2018c).

Khan (2009) reported the ethnoveterinary information about 35 different plant species from Cholistan desert, Pakistan. They showed groups of various plant species used for same disease. For example, they point five different species used as carminative and stomachic. Various parts of plants were used such as stem, leaf, root, flower, bark, seed, bulb, bud, resin, juice, latex etc; which depends on plant type and disease, as discussed by (Giday *et al.* 2003; Viegi *et al.* 2003). Farmers choose quantity and method for their use according to intensity of infection and animal size. Amount is usually measured by bottle or hand by farmers. Generally fresh materials were used for medicinal preparation. The most commonly used route of drug administration was oral followed by dermal. Elder persons of study area have accurate ethnoveterinary knowledge as compared to young generation (Irfan *et al.* 2017; Irfan *et al.* 2018b). This tendency is also found in Southern Ethiopia studied by Balemie and Kebebew (2006). Pieroni (2007) had also found similar phenomenon in Pakistani migrants in Bradford, UK.

Khan *et al.* (2012) had collected ethnoveterinary data of Poonch valley Azad Jammu and Kashmir. They have collected data about nineteen different medicinal plant species. Fourteen animal diseases were found cured by ethnoveterinary recipes. Mostly shrubs and herbs are used. Materials are mostly utilized in fresh form. We have also found that many plant species are used in fresh form.

Mondal and Biswas (2012) had done field survey of Bankura district, West Bengal, India and collected ethnoveterinary information. They collected data of 35 plants belonging to 21 families. They proposed that this type of study is extremely necessary.

Mahmood *et al.* (2013) reported preliminary study on therapeutic plants. They have collected information from aged people through interview. They found forty plant species used in ethnoveterinary. According to their many

plants are used in different ways. In our report of Malakand area we have also reported many examples of plants used in different ways.

The use values are generally used to check relative importance of single plant species. Use value is high for the plant with many uses report (approached to 1) and lowest for those plant with few uses report (approach to 0). Highest use value in the current study was reported for *Ajuga bracteosa* (0.976), *Berberis actinacantha* (0.976), *Dodonea viscosa* (0.976), *Fagonia cretica* (0.975), *Acacia modesta* (0.975), *Butea monosperma* (0.927), *Convolvulus arvensis* (0.818), *Cotoneaster acuminatus* (0.829), *Nerium indicum* (0.842), *Rumex dentatus* (0.84), *Sisymbrium irio* (0.833), and *Tamarix aphylla* (0.828). While lowest UV was reported by *Calotropis procera* (0.222), *Zizyphus nummularia* (0.375) and *Prunus persica* (0.375). Medicinal plants with low use values should not be ignored. Plants having high use value should be further screen for their ethnopharmacological studies to see any valued chemical compound found in a plant species (Mahmood *et al.* 2012; Shen *et al.* 2010).

Conclusion

The production of animals played an important role in the inhabitants of Malakand district. Their people have abundant traditional knowledge of ethnoveterinary plant remedies and practical experience of animal care and production. The traditional knowledge is near to extinction in near future, due to the extensively usage of modern veterinary medicines. Animal diseases are a major constraint for the livestock owners, therefore, some strategies and measures should be adopted in near future, such as sharing of knowledge of ethnoveterinary with the people of the area. The ethnoveterinary practice is a great gift of God for the poor people of Pakistan, and is very beneficial for the farmers, their recipes are easy to administer by them. It is helpful to increase the livestock production globally that will reduce the poverty alleviation. However further comprehensive studies regarding phytochemistry and pharmacology of these medicinal plants is necessary to determine their active biochemical ingredients that can leads to novel drug discovery that will also validate the ethnomedicinal knowledge.

Declarations

Ethics statement: Prior to the survey, we obtained oral informed consent from each participant.
Consent for publications: Not applicable.
Funding: Authors have not received any funding during this research.
Conflicts of Interest: The authors declare that there are no conflicts of interest in this article.
Data Availability statement
The figures and tables supporting the results of this study are included in the article, and the original data sets are available from the first author upon request.
Author's contribution: KK wrote the original draft of the manuscript, GJ supervised this work, MI and FGJ helped in statistical analysis, MH did the formal analysis, FU and RWB thoroughly revised the article. All the authors approved the final manuscript after revision.

Acknowledgments

We are thankful to the local community members of the study area for sharing their valuable information.

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