International Journal of Phytomedicine 9 (2017) 223-240
http://www.arjournals.org/index.php/ijpm/index

Original Research Article

ISSN: 0975-0185

Documentation of ethno veterinary practices in the CKNP region, gilgit-baltistan

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Abstract

Majority of the livestock holders in different areas of Central Karakoram National Park (CKNP) region in Gilgit-Baltistan lack the modern veterinary healthcare facilities. The local community mostly depends upon the traditional floral therapeutic veterinary practices for the cure of various livestock diseases. The lack of the ethno veterinary surveys in the CKNP region results in loss in the scientific documentation of the traditional information and practices about the livestock healthcare.

The present study deals with the documentation of the livestock diseases and the ethno veterinary herbal and non-herbal therapeutic practices by the livestock holders in CKNP region.

The study was conducted from March 2012 to March 2013 in the valleys of CKNP region. The ethno veterinary data was collected through thesemi-structured questionnaires and the techniques of interviews and field visits. And the productive interaction provided an enabling background for the successful Rapid Rural Appraisal and Participatory Rural Appraisal research.

Total 156 local community members were interviewed in Thallay, Khaplu, Hushe and Shigar valleys. The survey showed the prevalence of the most common diseases e.g. FMD, intestinal problems etc. Among the 51 medicinal plants, the Asteraceae family exhibited the highest number of genera with the therapeutic species. The parts of the plants that were most frequently used for the therapeutic purposes were the leaves (55%), seed (15%) etc.

The present study contributed to the documentation of the medicinal plants used in the ethno veterinary practices in valleys in CKNP region, Gilgit-Baltistan.

Keywords: Ethno veterinary Practices –Livestock Diseases– CKNP – Gilgit-Baltistan.

Introduction

The ethno veterinary medicine is a scientific term used for the holistic and interdisciplinary studies of the folk beliefs, traditional information, methods, skills and practices of the people about the livestock healthcare and livestock production found among the local community [1,2]. In addition it also includes the information about the feeding, breeding and management strategies with spiritual elements and experience of humans [3]. People all over the world possess indigenous knowledge about the therapeutic practices that are used for the better healthcare of their animals and to keep them productive in terms of milk, meat etc. [4]. The traditional herbalists possess sufficient indigenous knowledge about the medicinal plants which is orally transferred to the new generation [5,6] and such practices found among the farmers and pastoralists are very important in the developing countries [7-11]. The unavailability of the veterinary services and increased cost of the synthetic drugs contributed to the use of phytotherapeutics [12].

The documentation of indigenous knowledge and scientific studies on the ethno veterinary medicinal plants have been carried out in different countries like Brazil [12], Croatia [13], South Africa [14], Italy [15], Bangladesh [16], Kenya [17], Nepal [18], Macedonia [19], India [20-24], Ethiopia [25-28], Botswana [29,30], Nigeria [31-33] etc.

In Pakistan certain ethno veterinary studies have been carried out recently for the treatment of livestock ailments in different parts of the country like Tharparkar, Sindh [34], District Dir (Lower), Khyber Pakhtunkhwa [35], Ormara, Gawadar [36], Poonch valley Azad Kashmir [37], Greater Cholistan desert [38,39] etc. While the ethno botanical and ethno veterinary studies in the northern areas of Pakistan, Gilgit-Baltistan were carried out in Gilgit district [40],

DOI:10.5138/09750185.1898

Haramosh and Bugrote valleys [41], Abbot bad district [42], Gahkuch Ghizer [43], Nalter valley [44], Hunza-Nagar [45], Deosai Plateau, Western Himalayas [46], Skardu [47] etc.

Central Karakoram National Park (CKNP) is situated in Gilgit-Baltistan, the formerly called Northern areas of Pakistan. CKNP ranges from 2 km with hot climate to 6 km with cold climate in elevation [48-50). Different languages are spoken in different areas of Gilgit-Baltistan including Balti (mostly in Baltistan region), Shina, Brushski etc [51]. Mean temperatures range from -10 C in winter to +35 C in summer in the rangeland of Gilgit-Baltistan [52]. The present study deals with the documentation of livestock diseases and the ethno veterinary practices by the livestock holders in the CKNP region.

To our knowledge, this would be the first report about the ethanoveterinary practices from the study area. The recent literature shows some ethnobotanical survey but the present report contains the first information on the herbal treatment of livestock diseases. Most of the therapeutic plants are scientifically un-investigated, so this report will provide the first information for the researchers in the fields of natural product chemistry, pharmacology etc.

Methods

Study Area

The study was conducted from March 2012 to March 2013 in Thallay (1006 km^2), Khaplu (District Ghanche), Hushe (1660 km^2) and Shigar (895 km^2) valleys in Baltistan region (Figure 1). The valleys under investigation fall within the buffer zone of Central Karakorum National Park (CKNP), established in 1993 by the Gilgit-Baltistan government under the Gilgit-Baltistan Wildlife Preservation Act (1975) to protect the flora and fauna of the area in its natural state. CKNP is the largest protected area and the largest national park in Pakistan, covering an area of about 10,000 km^2. CKNP is the largest source of freshwater for Pakistan and comprises some of the World's largest mountain glaciers e.g. Siachen (75 km), Baltoro (57 km) and Hispur-Biafo (122 km) which are internationally well-known for hiking and trekking prospects. There are sixty peaks of over 7,000 m, and ten of the World's highest and most famous mountains, including K-2 (8611 m), Gasharbrum-I (8068 m), Broad Peak (8047 m), Gasherbrum-II (8035 m) and Masherbrum (7821 m) are situated within the park's boundaries [53, 54].

Data Collection Method

The ethno veterinary data were collected during various field visits conducted between March 2012 and March 2013. The survey team comprised of a local veterinarian, a natural resource management (NRM) specialist, a local community member, a phytochemist and a field-guide. While the herbalists, traditional healers and livestock holders including men and women were the major sources of information. The ethno veterinary data were collected from 156 respondents that were randomly selected. The method that was used in order to collect the indigenous knowledge mainly based on semi-structured questionnaires. The collection of the indigenous knowledge through interviews and semi-structured questionnaires only started after explaining the aim and objectives of the ethno veterinary study and getting a verbal consent also known as prior informed consent. All researchers followed the ethical guidelines of the International Society of Ethno biology(http://ethnobiology.net/code-of-ethics/).Each of the 156 informants was asked to fill the questionnaire with the help of the interviewer. The questionnaires were devised to document the indigenous information regarding ethno veterinary practices in the CKNP region. The questionnaires consisted of certain questions requiring identity (name, age, gender, level of education, occupation, name of the village etc) of the person, demographic data of the village, main livelihood income of the farmers in the village, livestock population in the village, livestock mortality rate, type of disease/s that the livestock suffered from, type and sources of the treatment of livestock diseases, traditional treatment of each disease, local names (Balti) and sources of the ethno veterinary medicinal plants, parts of the plants used, methods of remedy preparation, dosage prescription, non-herbal remedies preparation etc. The questions were translated to the local language 'Balti'. Furthermore the techniques of interviews and field visits were used to collect ethno veterinary data [36, 55, 56]. The respondents were interviewed individually in the local Balti language. Each time the questionnaire was administered to the interviewee and the local veterinarian accompanied the interviewer for an interactive and productive discussion. Such productive interaction provided an enabling background for the successful Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) research [17, 57, 58].

Plant collection and identification

During the flowering season the plant specimens identified by the traditional herbalists and livestock holders were collected with the assistance of the field enumerators and local community members. Each plant specimen included the vegetative parts, flowers, leaves, fruits or seeds that were appropriate for taxonomic identification. The plant species were identified by Dr. Sher Wali Khan, a known taxonomist, Department of Biological Sciences, Karakoram International University. And the specimens were submitted to the department and voucher numbers were allotted for each specimen.

Data analysis and interpretation

Certain tables and charts were used to summarize the collected information about the livestock diseases and the ethno veterinary

herbal practices. The data analysis and tabulation was carried out by calculating the informant consensus factor (ICF), a quantitative ethno botanical method, to identify the most important use categories for the therapeutic flora studied and to estimate the variability of the indigenous documented knowledge by the respondents. The ICF values [59- 61] for the most common livestock disease categories and the therapeutic flora were calculated according to the formula:

$$ICF = n_{ur} - n_t / n_{ur} - 1$$

Where n_{ur} is the number of usage-reports or number of citations in each use-category and n_t is the number of taxa used or number of species cited.

Results

Livestock species and diseases

The local cattle e.g. goat (rabaq), sheep (loo), bull (khlang) and the crossbreed cattle e.g. zo/zomo, yak/yakmo were the study animals. Furthermore the survey included the treatment practices for donkey (bongbu) and horses (hrta) etc. The survey showed the prevalence of the most common diseases e.g. FMD, intestinal problems, retention of placenta, blood related diseases etc. The local names of the livestock diseases are described in table 1.

Herbal treatment practices

A total of 156 interviews were conducted that resulted in the documentation of 51 plant species that were distributed in 41 genera and 21 families. The interviewees included 50 persons from 18 villages in Thallay valley, 52 persons from 31 villages in Khaplu valley and 25 persons from 6 villages in Hushe valley. Furthermore 29 persons were belonging to 19 villages in Shigar valley. Most of the respondents were of the age of 45 or above. The vernacular names, scientific names, parts used and the valleys where the plants were reported and all the plant species are arranged alphabetically in the table 2.

Most of the reported plant species belonged to the families Asteraceae (9 species, 5 genera), Rosaceae and Lamiaceae (3 genera and 5 species each) and Apiaceae (4 genera, 4 species). Furthermore the families; Brassicaceae, Fabaceae, Poaceae and Ranunculaceae were represented by 3 genera and 3 species each. And the families; Amaryllidaceae, Berberidaceae and Polygonaceae were represented by two species each. The rest of the families; Betulaceae, Capparaceae, Caprifoliacea, Convolvulaceae, Elaeagnaceae, Gentianaceae, Iridaceae, Labiatae, Saxifragaceae and Zygophyllaceae were represented by only one species each (Figure 1,2).

Table 1. Local (*Balti*) names of Livestock diseases

Name of the disease	Local name (*Balti*)
FMD	Khachoo Nad
Diarrhea	Fshalbi Nad
Constipation	Shilangkhatpi Nad
Bloat or Tympany	Hltowa ghbospi Nad
Mange (Ectoparasite)	Snoshik
Retention of placenta	Shamakhatpa
Eye disease	Micknad
Fracture	Rusnad
Wounds	Khraqbiongma
Abdominal/stomach pain/ Colic	Hltonad
Abdominal worms (Endoparasites)	Hltohaboo
Pneumonia/cough	Khoqnad
Blood related disease (Hemorrhagic Septicemia)	Khraqnad

Table 2. Plants used for the treatment of livestock diseases

S. No.	Scientific Name (voucher number)	Family	Vernacular Name *(Balti)*	Plant Part used	Use [valleys]	Method of use
1	*Aconitum napellus* L. (SK-42)	Ranunculaceae	*Booma*	Flowers, Leaves	Wounds[T]	The flowers and leaves are fed to the animals.
2	*Allardia tomentosa* Decne. (SK-07)	Asteraceae	*Tarkham*	Leaves, Flowers	Intestinal problems[S]	The leaves and flowers are grinded and fed to the animals.
3	*Allium cepa* L. (SK-01)	Amaryllidaceae	*Xong*	Bulb	Wound, bloat/tympany[TS]	The whole bulb is fed to the animals for bloat. And the

						bulb is boiled and placed on the wounds for the removal of the particles.
4	*Allium sativum* L. (SK-02)	Amaryllidaceae	*Zgoqpa*	Bulb	Bloat[K]	The whole clove is fed to the animals.
5	*Artemisia brevifolia* (SK-08)	Asteraceae	*Karfo Bursay*	Leaves	Bloat/tympany[T], Wounds[H], ectoparasite[S]	The animals are fed with the leaves.
6	*Artemisia maritima* L. (SK-09)	Asteraceae	*Bursay*	Leaves	Indigestion and constipation [H]	Leaves are fed to the animals.
7	*Artemisia santolinifolia* (SK-10)	Asteraceae	*Kho bursay*	Leaves, Stem	Ectoparasite, abdominal worms/endoparasites[TK], wounds[TKS]	The paste of leaves and stem is applied on the wounds. It is a drug of choice for skin diseases including all ectoparasites.
8	*Artemisia sieversiana* (SK-11)	Asteraceae	*Hampa*	Leaves	Pneumonia[S]	The leaves are fed to the animals.
9	*Astragalus zanskarensis* Benth. ex Bunge (SK-26)	Fabaceae	*Shukpa*	Stem, Leaves	Eye diseases[TK], wounds[H]	The ash of the burnt stem and leaves is applied on the affected parts of eyes. And leaves are grinded and the paste is applied on wounds.
10	*Avena sativa* L. (SK-37)	Poaceae	*Nas Choo*	Seed	Pneumonia/cough, liver related disease[T]	The seeds are dipped in water for the whole night and the next morning the water is given to the animals.
11	*Berberis pseudumbellata* R. Parker (SK-16)	Berberidaceae	*Shokurum*	Root, Leaves	Anthrax[H], fracture, wounds[TK]	The grinded (powder) roots are fed to the animals and furthermore the roots are boiled and the water is given to the animals. The leaves are dipped in water and the wounds are washed with the water. It is considered as disinfectant and antiseptic.
12	*Berberis vulgaris* L. (SK-17)	Berberidaceae	*Shuturum*	Leaves	Intestinal pain	The leaves are fed to the animals.
13	*Bergenia ciliata* Sternb. (SK-50)	Saxifragaceae	*Shafus*	Leaves	Wounds[K]	The grinded powder of the leaves is applied on wounds.
14	*Betula utilis* D. Don. (SK-18)	Betulaceae	*Staqpa*	Stem	Bleeding[H]	The plant stem is extracted and the juice is applied on the affected areas.
15	*Bistorta affinis* (SK-41)	Polygonaceae	*Buma*	Leaves	Diarrhea [S]	The animals are fed with the grinded leaves.
16	*Brassica juncea* (L.) Coss. (SK-19)	Brassicaceae	*Sarsung mar*	Seed	Mange[S]	The seeds are squeezed and the extracted oil is applied on the skin.
17	*Capparis spinosa* L. (SK-22)	Capparaceae	*Champarrang*	Seed	Joint pain [K]	The seed oil is extracted and applied on the joints.
18	*Coriandrum sativum* L.	Apiaceae	*Ausu*	Seed	Stomach pain [K]	The seeds are grinded and

	(SK-03)					powdered then the animals are let to lick.
19	*Crocus sativus* L. (SK-30)	Iridaceae	*Zafran*	Flowers	Wounds[H]	The paste of the flowers is applied on wounds.
20	*Cuscuta reflexa* Roxb. (SK-24)	Convolvulaceae	*Ghabol thak*	Stem & Flowers	Retention of placenta[KSH], diarrhea, constipation[H]	The stem and flowers are fed to the animals.
21	*Daucus carota* L. (SK-04)	Apiaceae	*Gholafuvi lona*	Leaves	Retention of placenta[TKS]	The leaves are fed to the animals.
22	*Delphinium brunonianum* Royle (SK-43)	Ranunculaceae	*Makhoting*	Leaves, Flower	Ectoparasite[TKS], abdominal pain[K], mange[H]	The paste of leaves and flowers is applied on the skin for the removal of ectoparasites and it is also fed to the animals to relieve the abdominal pain.
23	*Dracocephalum nuristanicum* Rech. f. & Edelb. (SK-32)	Lamiaceae	*Shamdun*	Leaves, Flowers	Bloat, wounds, pneumonia[K], constipation[KH], FMD, indigestion, foot rot, diarrhea[H]	The mixture of leaves and flowers is considered as a drug of choice for all abdominal problems.
24	*Foeniculum vulgare* Mill. (SK-05)	Apiaceae	*Badiyan*	Seed	Diarrhea [TKH], bloat/tympany [TK], abdominal/stomach pain/colic [TH]	The seeds are boiled and extracted. The water (filtrate) is given to the animals.
25	*Gentiana olivieri* Griseb. (SK-29)	Gentianaceae	*Tikta*	Leaves, Flowers	Hepatic problems, bloat[S]	The leaves and flowers are grinded and fed to the animals.
26	*Haracleum pinnatum* (SK-06)	Apiaceae	*Hltireet*	Leaves	Abdominal worms/endoparasites[T]	The leaves are fed to the animals.
27	*Hippophae rhamnoides* L. (SK-25)	Elaeagnaceae	*Soq / Rema*	Leaves	Cough, arthritis[K]	The leaves are fed to the animals for the cure of cough.
28	*Hordeum vulgare* L. (SK-38)	Poaceae	*Cha Fay*	Seed	Diarrhea[T]	The seeds are grinded and fed to the animals with warm water.
29	*Leontopodium leontopodinum* (SK-12)	Asteraceae	*Naqposhoto*	Seed	Diarrhea, constipation, bloat/tympany[TKS]	It is a drug of choice for all abdominal issues.
30	*Lepidium latifolium* L. (SK-20)	Brassicaceae	*Sonma*	Leaves	Intestinal problems[T]	The grinded leaves are fed to the animals.
31	*Lonicera asperifolia* (SK-23)	Caprifoliacea	*Krraba*	Leaves	Indigestion[H]	The leaves are fed to the animals.
32	*Malus domestica* Borkh. (SK-45)	Rosaceae	*Skamkooshu*	Fruit	Diarrhea[K]	The dried apples are grinded and fed to the animals.
33	*Mentha arvensis* L. (SK-33)	Lamiaceae	*Peeno*	Leaves	Abdominal/stomach pain/colic[T], constipation[K]	The leaves are fed to the animals.
34	*Mentha haplocalyx* Briq. (SK-34)	Lamiaceae	*Shoma*	Leaves	Pneumonia, wounds, constipation[H], retention of placenta[T]	The leaves are applied on wounds and fed to the animals for constipation.
35	*Mentha royleana* Benth. (SK-35)	Lamiaceae	*Fowling*	Leaves	Wounds[K], constipation[H]	The leaves are applied on wounds and fed orally to the animals for the cure of

						constipation.
36	*Pennisetum glaucum* L. (SK-39)	Poaceae	*Cha soq*	Stem	FMD (cha saq)[TK], retention of placenta (cha zan)[K]	The stem is fed to the animals.
37	*Perovskia abrotanoides* Kar. (SK-36)	Lamiaceae	*Pharring bursay*	Leaves	Intestinal worms[T]	The animals are fed with the leaves.
38	*Potentilla bifurca* L. (SK-46)	Rosaceae	*Tarqan*	Leaves, Flower	Bloat/tympany[TKH], abdominal/stomach pain/colic[KH], constipation, diarrhea[H]	It is a drug of choice for all abdominal problems and it is considered the best analgesic.
39	*Prunus amygdalus* Batsch. (SK-47)	Rosaceae	*Stargi mar*	Seed	Bloat[K]	The oil is extracted from the seeds and it is used for the treatment of bloat.
40	*Prunus armeniaca* (SK-48)	Rosaceae	*Chooli mar*	Seed	Mange/ectoparasite and FMD[TKS], diarrhea[K], constipation[S]	Seed oil is extracted and fed to the animals.
41	*Prunus persica*(SK-49)	Rosaceae	*Takushu Choo*	Fruit	Wounds[TK], retention of placenta[S]	The juice of the fresh fruit is applied on wounds and warm juice is also given to the animals for the retention of placenta.
42	*Raphanus sativus* L. (SK-21)	Brassicaceae	*Gholafuvi sonma*	Leaves	FMD[K], retention of placenta[KH]	The leaves are fed to the animals.
43	*Rheum spiciforme* Royle (SK-40)	Polygonacea	*Khakhol*	Leaves	Blood related disease/hemorrhagic[T] FMD[S]	The leaves are fed to the animals.
44	*Seriphidium brevifolium* (SK-13)	Asteraceae	*Buirsay*	Leaves	Intestinal worms[T]	The animals are fed with the leaves.
45	*Sophora mollis* (SK-27)	Fabaceae	*Khakhool*	Leaves	Bleeding[K]	The leaves are applied on the wounds of the animals.
46	*Stachys tibetica* (SK-31)	Labiatae	*Khampa*	Leaves	Abdominal/stomach pain/colic[TK], ectoparasite[KS]	The leaves are fed to the animals and the grinded powder is applied on the skin for the removal of the parasites.
47	*Tanacetum falconeri* Hook. f. (SK-14)	Asteraceae	*Haltiry / Htialo / Pholing*	Leaves	Wounds[K], constipation[H]	The leaves are fed to the animals and the powdered leaves are applied on the wounds.
48	*Tanacetum gracile* (SK-15)	Asteraceae	*Cerpho bursay*	Leaves	Indigestion and intestinal worms[T]	The animals are fed with the leaves.
49	*Thalictrum foetidum* L. (SK-44)	Ranunculaceae	*Momeran*	Leaves	Abdominal pain[K]	The leaves are grinded and fed to the animals.
50	*Tribulus terrestris* (SK-51)	Zygophyllaceae	*Kokoluq*	Whole plant	Urinary problems[TK]	The whole plant material is boiled and the water (filtrate) is given to the animals.
51	*Trigonella foenum-graecum* L. (SK-28)	Fabaceae	*Shamelic*	Leaves	Diarrhea[K]	The leaves are fed to the animals.

[T] Thallay Valley, [H] Hushe valley, [K] Khaplu valley, [S] Shigar valley

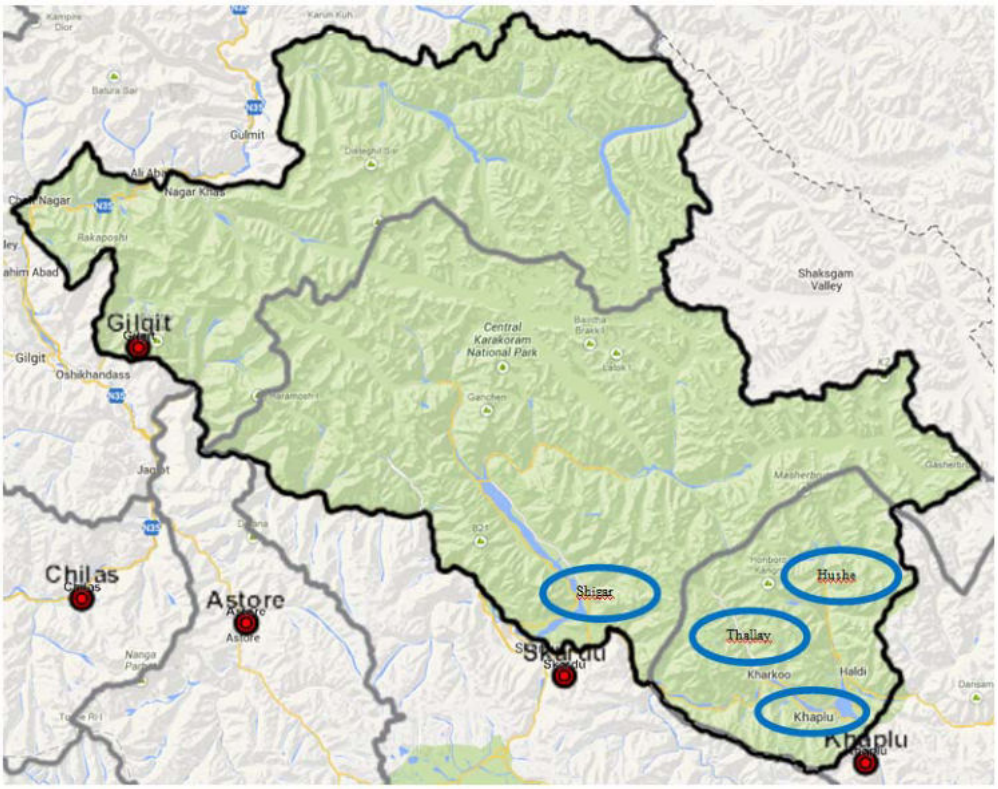

Figure 1. Map of CKNP showing the valleys (Thallay, Khaplu, Hushe & Shigar)

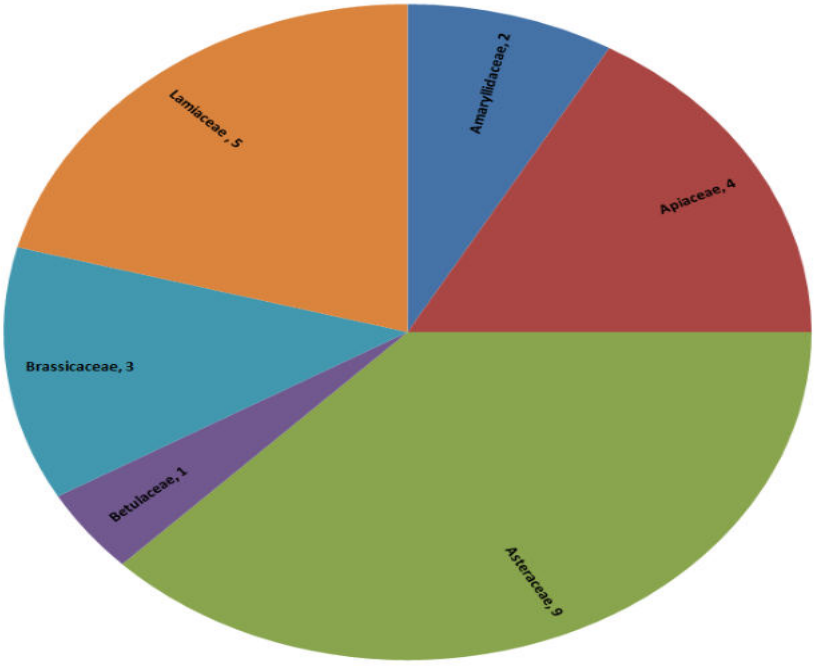

Figure 2. Number of species in plant families

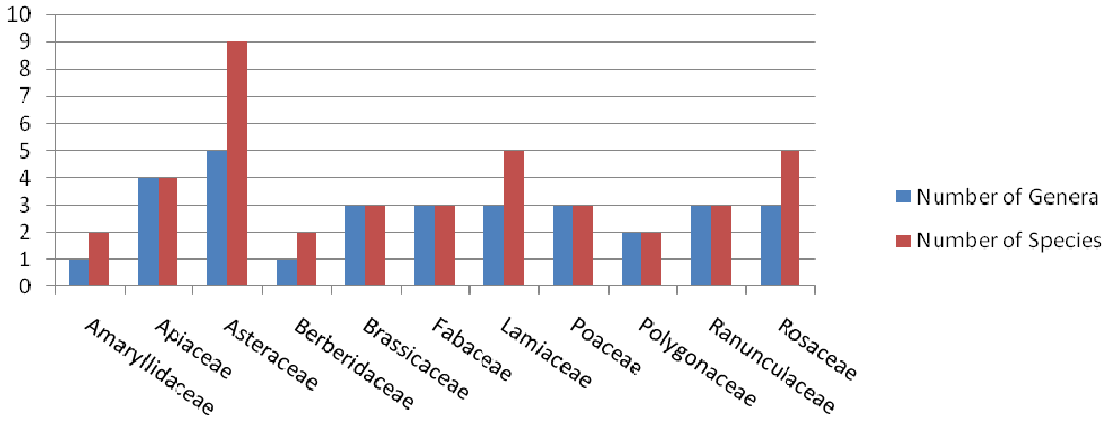

Figure 3. Number of genera & species in plant family

The farmers and especially the livestock holders in the study area not only depend upon the local flora to get fodder for their livestock but they also use various medicinal floral remedies to treat the livestock diseases. In the present study, the parts of the medicinal plants reported for therapeutic purposes were leaves (55%), seed (15%) and flowers (14%). Thus the medicinal flora was conserved. In addition only 2% roots were documented to be used for the treatment of livestock diseases (Figure 4).

The herbal remedies were mostly used for the treatment of intestinal problems (45%) followed by wounds (15%) and bloat (12%). Only 5% of the plants were used for the treatment of pneumonia (Figure 5).

Informant Consensus Factor (ICF)

To identify the most important use-categories of livestock diseases, the ICF values were calculated. To calculate the ICF values, the cited plant species were grouped into nine categories of therapeutic uses based on the diseases reported by the informants/interviewees including abdominal problems, bloat/tympany, blood related problems, FMD, gastro-intestinal problems, mange (ectoparasite), pneumonia/cough, retention of placenta and wounds. The ICF values are described in Table 3. The highest ICF values, 0.96, 0.94 and 0.93 were obtained for FMD (5 plant species and 108 frequency of report), retention of placenta (6 plant species and 98 frequency of report) and mange (6 plant species and 77 frequency of report) respectively, which indicated the best agreement amongst the informants on the use of therapeutic flora reported for the treatment purposes. Moreover the lowest ICF values were obtained for wounds (13 plant species and 51 frequency of report), abdominal problems (9 plant species and 37 frequency of report) and pneumonia/cough (6 plant species and 25 frequency of report).

Description of each valley

The description and details including population, education status, main livelihood income and livestock population during 2013 for Thallay valley (Table 4), Khaplu valley (Table 5), Shigar valley (Table 6) and Hushe valley (Table 7) are given. The villages of Thallay valley included Baltoro Gamba, Baltoro Goma, Broqpa, Chundu, Dalter, Gamba trangzong, Garbong, Gongma trangzong, Haider abab Daghoni, Harangus, Kharku, Khasamic, Lahar, Malayar, Parangus, Taso, Yarkhor, Yulskil. The villages of Khaplu valley included Askari Gon, Bathong, Braqchan, Chalabati Gon, Chaqchan, Charbuchung, Dinis, Garbong, Gharais, Gharalti, Ghawari, Ghunar chorbat, Gonma satqji, Goqpi, Hatchhi, Hippi, Karaming, Khangsar, Khsergrong, Kunais, Kuwakhong, Kuwas, Lungkha, Marzi gon, Muldumar, Sergiab, Siksa, Stronpi, Surmo, Thaskong and Youchung. And Agaipa, Alchori, Aliabad Churka, Alibad Shigar, Chamaqpa, Chandupa, Chinpa, Daskor, Ghzwapa, Hashupi, Hurchos, Khalti, Matulu, Skora, Suguldo, Thougmo, Ticho, Wakhor and Yonu were the villages of Shigar valley that were studied for the ethno veterinary practices. Moreover the villages of Hushe valley namely Balay Gon, Hushe Main, Kanday, Khana, Machulo and Marzi Gond were visited for the ethno veterinary study.

The data about the livestock population including goat, sheep, local breed cattle/bull, cross breed cattle, Zo/Zomo and Yak/Yakmo during 2013 in all the above-mentioned villages of the concerned valley are summarized in Figure 6. Zo (male) and Zomo (female) are the offspring of the cross (Yak x cow) and Yakmo (female) is produced as a result of the cross (Yak x Briqmo) of the sixth generation of the cow[62]. The livestock population in 18 villages in Thallay valley include goat (15596), sheep (16072), local cattle/bull (1376), cross breed cattle (653), Zo/Zomo (1006) and Yak/Yakmo (631). And in 31 villages in Khaplu valley, the livestock population is14469 (goat), 10197 (sheep), 1725 (local cattle/bull), 2658 (cross breed cattle), 2137 (Zo/Zomo) and 344 (Yak/Yakmo). Similarly the number of goat, sheep, local cattle/bull, cross breed cattle, Zo/Zomo and Yak/Yakmo in Shigar valley (19 villages) is9813,

9874, 5400, 702, 949 and 222and in Hushe valley (6 villages) is 6961, 4069, 1787, 1189, 1179 and 382respectively (Figure 6).

Non-herbal treatment practices

Apart from the floral remedies, the local livestock holders treat their diseased animals with some non-herbal practices. The livestock holders in Thallay and Khaplu use mixture of wheat flour, most usually, and salt which is put on the rough surface and the animals suffering from FMD are allowed to lick it. While in Shigar valley, the mixture of coal and salt or only coal is applied on the affected part of feet of the animals. The animals which suffer from diarrhea are treated by feeding them the mixture of salt and ghee (local oil). For the treatment of constipation, the mixture of black salt, eating soda and sugar with equal quantity are fed to the animals. Furthermore for the treatment of nodules, the animal's dung is burnt and its ash or its mixture with oil and sulphur is applied on the affected area. Similarly apricot oil is applied for the treatment of mange. Fresh butter or sufficient amount of sugar is fed to the animals for the retention of placenta. The animals suffering from bloat are treated by sharp cut on the ear. However the details are written in the Table 8.

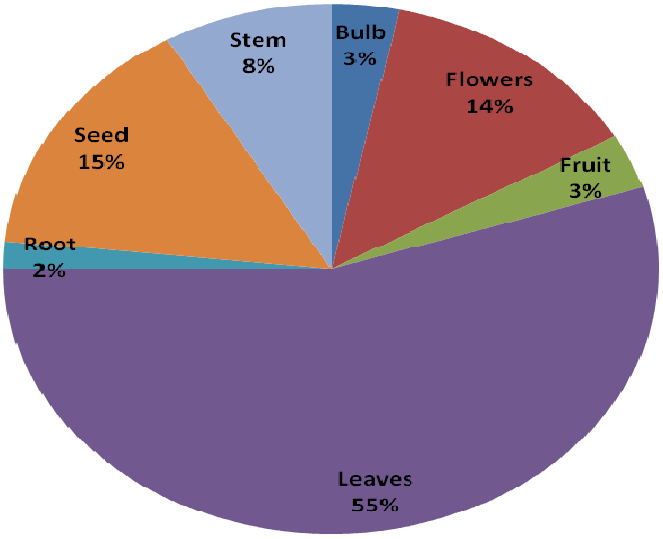

Figure 4. Parts of the plants in ethno veterinary use

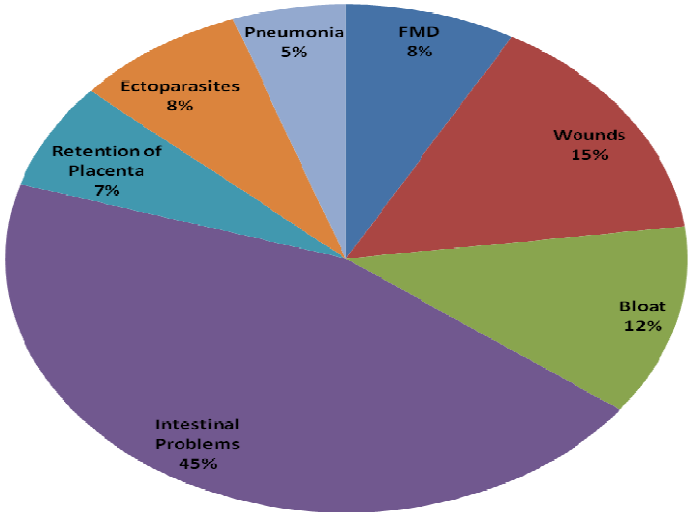

Figure 5. Number of plants (percentage) used for the treatment of ailments.

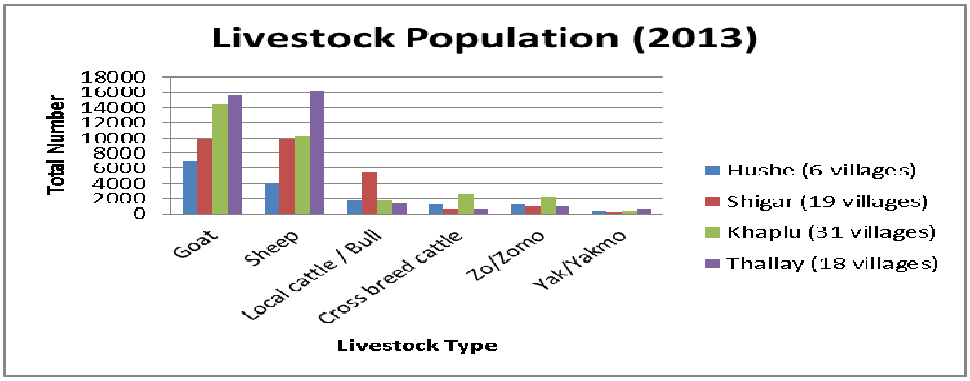

Figure 6. Livestock population (2013) in Thallay, Khaplu, Shigar and Hushe valley

Table 3. Common livestock diseases, number of therapeutic plant species and ICF values

Type of Livestock disease	Frequency of report	Number of plant species used	ICF
Abdominal problems	37	9	0.77
Bloat or Tympany	69	9	0.88
Blood related problems	11	3	0.80
FMD	108	5	0.96
Gastro-intestinal problems	129	25	0.81
Mange (Ectoparasite)	77	6	0.93
Pneumonia/cough	25	6	0.79
Retention of placenta	98	6	0.94
Wounds	51	13	0.76

Table 4. Description and details of Thallay valley

S. No.	Name of the village	Total population	Education status		Main Livelihood income			Livestock population (2013)					
			Bachelor M:F	Higher M:F	Job	Bsn.	Agri.	Goat	Sheep	Local Cattle/ Bull	Cross breed Cattle	Zo/ Zomo	Yak/ Yakmo
1	Baltoro Gamba	649	13:01	02:00	-	-		630	380	39	15	48	23
2	Baltoro Goma	1980	25:10	06:00	-	-		509	800	86	35	13	04
3	Broqpa	1135	39:06	04:01	-	-		950	809	85	09	56	35
4	Chundu	1867	05:04	20:03				750	1609	96	86	103	52
5	Dalter	1162	08:02	03:01		-		866	700	86	11	47	35
8	Gamba trangzong	400	12:03	08:02	-	-		320	350	30	25	32	28
7	Garbong	500	08:02	05:02		-		400	380	25	17	28	20
6	Gongma trangzong	700	10:03	08:03	-	-		650	430	15	15	30	25
9	Haider abab Daghoni	600	14:04	10:02	-	-		370	380	40	35	20	16
10	Harangus	835	06:02	03:00		-		350	370	150	10	40	37
11	Kharku	707	11:02	08:00	-	-		253	402	202	33	85	18
12	Khasamic	805	04:00	02:00		-		2930	3090	55	10	37	56
13	Lahar	2676	15:04	09:03	-			1730	1830	75	157	186	65
14	Malayar	598	17:02	06:00		-		243	346	137	16	86	13
15	Parangus	476	12:01	04:00	-	-		750	530	55	09	35	23
16	Taso	325	03:00	03:00				139	209	11	09	25	16
17	Yarkhor	1275	19:03	05:00	-			2556	2757	109	86	75	95
18	Yulskil	870	12:03	06:02	-	-		1200	700	80	75	60	70

[Bsn.]Business; [Agr.]Agriculture (livestock)

Table 5. Description and details of Khaplu valley

S. No.	Name of the village	Total population (approx.)	Education status		Main livelihood income			Livestock population (2013)					
			Bachelor M:F	Higher M:F	Job	Bsn.	Agri.	Goat	Sheep	Local Cattle/ Bull	Cross breed Cattle	Zo/ Zomo	Yak/ Yakmo
1	Askari Gon	415	07:09	00:00	-			29	38	09	43	02	00
2	Bathong	400	10:02	06:02	-	-		321	265	20	70	15	09
3	Braqchan	840	18:02	12:03	-			57	89	20	80	231	00
4	Chalabati Gon	420	27:29	02:03		-		30	00	00	33	00	00
5	Chaqchan	4029	29:20	07:02		-		304	246	76	207	77	02
6	Charbuchung	1200	12:03	08:04	-	-		179	100	70	35	48	13
7	Dinis	1200	12:04	07:04	-			113	67	15	70	102	45
8	Garbong	1200	18:10	16:04	-			545	123	30	70	45	00
9	Gharais	1400	18:22	15:12	-	-		101	00	28	18	00	00
10	Gharalti	700	10:03	08:04	-	-		300	320	50	60	50	06
11	Ghawari	380	17:08	08:02	-	-		411	305	26	51	12	01
12	Ghunar chorbat	5711	12:07	05:03		-		2506	2048	08	250	200	18
13	Gonma satqji	700	08:03	07:02	-	-		180	170	37	65	20	10
14	Goqpi	100	06:02	04:01	-	-	-	50	55	10	18	07	00
15	Hatchhi	820	50:70	02:05		-		270	280	90	110	120	12
16	Hippi	300	10:03	21:00		-		250	200	04	80	13	01
17	Karaming	800	20:02	1510		-		800	700	20	130	00	00
18	Khangsar	900	20:06	18:06	-			300	250	80	100	25	10
19	Khsergrong	1200	18:08	14:03	-			200	150	40	100	50	10
20	Kunais	2018	18:08	13:04	-	-		637	315	129	108	24	01
21	Kuwakhong	100	02:00	00:00	-			50	60	24	25	217	01
22	Kuwas	1500	10:04	08:04	-	-		450	350	120	30	70	20
23	Lungkha	130	16:11	13:12	-	-		370	280	80	40	50	10
24	Marzi gon	676	08:00	03:00	-			680	475	86	65	205	13
25	Muldumar	2500	10:04	05:02		-		700	250	08	80	08	00
26	Sergiab	3387	45:29	06:03	-	-		2436	1301	85	150	75	02
27	Siksa	2500	30:10	20:06	-	-		700	600	250	180	230	80
28	Stronpi	1400	18:10	16:04	-	-		150	180	30	80	35	10
29	Surmo	2000	25:03	18:01	-	-		700	500	200	150	200	70
30	Thaskong	1200	10:04	08:03	-	-		250	180	70	100	06	00
31	Youchung	700	15:00	06:00		-		400	300	10	60	00	00

Bsn.Business; Agr.Agriculture (livestock)

Table 6. Description and details of Shigar valley

S. No.	Name of the village	Total population (approx.)	Education status		Main livelihood income			Livestock population (2013)					
			Bachelor M:F	Higher M:F	Job	Bsn.	Agri.	Goat	Sheep	Local Cattle/ Bull	Cross breed Cattle	Zo/ Zomo	Yak/ Yakmo
1	Agaipa	900	35:08	20:05				320	150	210	35	55	25
2	Alchori	6000	14:05	04:01				1500	2000	960	150	80	07
3	AliabadChurka	700	05:00	02:00	-	-		500	800	350	15	100	02
4	AlibadShigar	700	05:00	02:00	-	-		500	800	350	15	100	02
5	Chamaqpa	435	10:05	06:00		-		135	150	95	05	35	15
6	Chandupa	736	07:06	04:00		-		195	250	107	06	80	05
7	Chinpa	590	15:08	10:07	-	-		148	109	197	09	32	26
8	Daskor	500	05:03	02:02	-	-		200	250	40	03	60	20
9	Ghzwapa	500	20:05	10:00				800	500	150	50	20	80
10	Hashupi	230	01:00	00:00		-		60	50	35	05	09	00
11	Hurchos	2000	20:07	12:00	-	-		800	1100	400	60	50	04
12	Khalti	450	10:02	04:00		-		600	800	150	03	45	02
13	Matulu	650	03:00	02:00	-	-		50	200	160	00	120	00
14	Skora	960	05:00	03:00	-	-		600	400	80	30	30	02
15	Suguldo	550	15:06	07:00	-	-		1500	1600	1500	300	30	03
16	Thougmo	417	04:01	03:00		-		105	165	98	03	30	09
17	Ticho	1000	15:05	10:02		-		200	170	83	05	45	15
18	Wakhor	213	02:00	02:00		-		200	80	35	08	08	02
19	Yonu	800	08:00	06:00	-	-		1400	300	400	00	20	03

[Bsn.]Business; [Agr.]Agriculture (livestock)

Table 7. Description and details of Hushe valley

S. No.	Name of the village	Total population (approx.)	Education status		Main livelihood income			Livestock population (2013)					
			Bachelor M:F	Higher M:F	Job	Business	Agri	Goat	Sheep	Local Cattle/ Bull	Cross breed Cattle	Zo/ Zomo	Yak/ Yakmo
1	BalayGon	664	00:00	00:00	-	-		1100	700	88	116	28	01
2	HusheMain	1320	08:02	01:00				700	650	210	16	380	60
3	Kanday	1700	25:00	06:00				1280	800	200	60	390	290
4	Khana	608	20:01	04:00	-	-		681	369	119	187	301	01
5	Machulo	3000	15:08	07:04	-	-		3000	1500	1000	300	80	30
6	MarziGond	800	10:04	02:00	-	-		200	50	170	510	00	00

[Bsn.]Business; [Agr.]Agriculture (livestock)

Table 8. Description of non-herbal practices

Type of Disease	Non-herbal practices	Method of use
FMD	Flour + salt[TK], Oil[H], Coal + salt[S]	The mixture of (wheat) flour and salt is put on the rough surface as such and the animals are allowed to lick. OR any kind of oil is applied. Coal is put on the affected part of feet.
Diarrhea	Salt + Ghee[TKS]	The mixture of salt and ghee is put on the rough surface and the animals are allowed to lick.
Constipation	Black salt[H] + soda + sugar[TK]	All items are mixed in equal quantity and the animals are allowed to lick.
Nodules	Ash of animal's dung[TKS] Sulphur + Ash + Oil	The ash of animal dung is applied on the nodules. Sulphur, ash of animal's dung and oil is mixed and applied on the nodules.
Mange	Oil [TKS]	Any kind of oil e.g. apricot oil is applied.
Retention of Placenta	Butter[T] Sugar[S]	Fresh butter is given to the animals or good sugar is given to the animals.
Fracture	Wood+tap+egg[TKHS]	The egg-white is applied on the plain wood and it is then fastened to the fracture with bandage.
Bloat	Cut [S]	A sharp cut is made on the ear of the animals.

[T] Thallay Valley, [H] Hushe valley, [K] Khaplu valley, [S] Shigar valley

Phytochemical review of some species: A number of chemical constituents have been reported very recently in literature for certain plant species. Alkaloids or the presence of alkaloids are reported from *Aconitum nepellus* [63],*Heracleum pinnatum* [64], *Tribulus terrestris* [65]etc. And terpene moieties are reported from *Artemisia santolinifolia* [66], *Artemisia sieversiana* [67], *Mentha haplocalyx* [68] etc. Glycosides are reported from *Hippophae rhamnoides* [69], *Stachys tibetica* [70], *Trigonella foenum-graecum*[71] etc. Similarly essential oil constituents are reported in *Perovskia abrotanoides* [72], *Seriphidium brevifolium* [73] etc. However further details about the phytochemicals from several other plant species are given in Table 9.

Table 9. Phytochemical review of some species

S. No.	Plant species (voucher number)	Vernacular name	Active principles	Reference
1	*Aconitum napellus* L. (SK-42)	*Booma*	Diterpene alkaloids	[63]
			Flavonol glycosides	[92]
2	*Artemisia santolinifolia* (SK-10)	*Kho bursay*	Sesquiterpene lactones	[66]
3	*Artemisia sieversiana* (SK-11)	*Hampa*	Dimeric guaianolide	[93]
			Sesquiterpenes	[67]
4	*Betula utilis* D. Don. (SK-18)	*Staqpa*	Betulin, lupeol, Karachic acid etc	[94]
5	*Delphinium brunonianum* Royle (SK-43)	*Makhoting*	Anthriscifoldine etc	[95]
6	*Gentiana olivieri* Griseb. (SK-29)	*Tikta*	C-glycosylflavone etc	[96]
7	*Haracleum pinnatum* (SK-06)	*Hltireet*	Presence of alkaloids, saponin etc	[64]
8	*Hippophae rhamnoides* L. (SK-25)	*Soq / Rema*	Flavonol glycosides	[69]
9	*Mentha haplocalyx*Briq. (SK-34)	*Shoma*	Monoterpenoid glycosides	[68]
			Essential oil	[97]
10	*Perovskia abrotanoides* Kar. (SK-36)	*Pharring bursay*	Essential oil	[72]
			Triterpene	[98]
11	*Potentilla bifurca* L. (SK-46)	*Targan*	Kaempferol	[99]
12	*Seriphidium brevifolium* (SK-13)	*Buirsay*	Essential oil	[73]
13	*Sophora mollis* (SK-27)	*Khakhool*	Lupeol ether etc	[100]
14	*Stachys tibetica* (SK-31)	*Khampa*	Apigenin 7-glucoside etc	[70]
15	*Tanacetum gracile* (SK-15)	*Cerpho bursay*	Flavonoids etc	[101]
16	*Tribulus terrestris* (SK-51)	*Kokoluq*	Cinnamic acid amides	[102]
			Saponins, flavonoids, alkaloids etc	[65]
17	*Trigonella foenum-graecum* L. (SK-28)	*Shamelic*	Essential oil	[71]
			Flavonoid glycosides	[103]

Discussion

The ethno veterinary studies contribute to understand the indigenous knowledge about the herbal and non-herbal remedies and to present the list of the plant species with therapeutic properties. Thus the traditional knowledge is documented [74] and used for further scientific research [75]. Moreover the scientifically validated ethno veterinary practices contribute to poverty alleviation and increased livestock production in the rural areas [76]. And such reports could be used for the sustainable use and conservation of the local flora [77]. Generally the leaves among the plant parts have been reported to be used for floral remedies for the treatment of livestock diseases [26, 35, 78].

The ICF values were calculated to identify the most important use categories and FMD (0.96), retention of placenta (0.94) and mange (0.93) exhibited the highest values. The ICF values range from 0 to 1. The ICF values are low (close to zero) when the plant species are randomly selected from a wide range without relying on specific proven ones or when the informants or ethno-practitioners do not share and exchange information about their use amongst themselves. A high ICF value (close to one) is obtained when the selection criteria are based on well-defined selection principle for certain specific plants traditionally used to treat the livestock diseases and the usage information is shared amongst the informants or ethno-practitioners offering ethno veterinary services in that particular community [61]. The main livestock problems included in the categories with highest ICF values were FMD, retention of placenta and mange which are common in the livestock, hence most easily identified by the livestock holders, healers, ethno-practitioners etc. Moreover the high ICF values indicate the importance to identify plants of particular interest in the search for bioactive principles [79-81].

The studies conducted in different parts of Gilgit-Baltistan and some other parts of Pakistan also support the findings of the present paper. Some of the plants mentioned in the present study have been reported to treat the diseased animals in different parts of Pakistan. According to Shedayi and Gulshan (2012), the livestock including sheep (35%), bafalo (30%), goat (24%) and horse (20%) were treated with the medicinal plants [43]. *Artemisia sp.* and *Hippophae sp.* were the mostly used species by the local community of Gahkoch, Ghizer for the treatment of livestock diseases. The plant species of the genera *Artemisia, Tanacetum, Gentiana, Astragalus, Mentha, Delphinium* and *Berberis* have been reported to be used for ethno veterinary therapeutic properties. As a whole 27 species were reported in Naltar valley that were used for the treatment of livestock diseases [44]. Fifty-four plant species were reported in Abbotabad that were used as medicines in veterinary practices by the local livestock farmers [42]. Among the different parts of the plant species used for the treatment of livestock ailments, leaves (55%) rank first in the present study. And some of the therapeutic properties of the flora mentioned in the present paper have already been scientifically validated. The antimicrobial activity has been reported to be exhibited by the extracts of *Aconitum napellus*[82], *Allium cepa* and *A. sativum*[83]. Similarly the extract of *Avena sativa* has revealed the antioxidant and antimicrobial activities [84]. The plant *Bergenia ciliata* has been reported to exhibit antifungal [85], antioxidant [86] and antibacterial [87] activities. El-Wahab et al. (2013) has reported the antioxidant, anticholinesterase, antidiabetic and anticancer activities of *Berberis vulgaris* [88]. The antioxidant, anti-inflammatory [89] and antibacterial [90] activities have been exhibited by *Betula utilis*. However the data provided in the present paper serves as a base for further scientific validation.

The preliminary findings presented in this paper need further scientific studies for authentication. Moreover the future phytochemical and pharmacological studies of ethno veterinary herbal therapeutics will lead to further confirmation of the indigenous ethno veterinary knowledge. Thus the concepts of ethno veterinary practices and bio-cultural diversity could be promoted with such indigenous information. And the further investigation of the reported plants will enable the local community especially livestock farmers to utilize the local flora in a more safe, efficient and profitable manner.

Conclusions

This study includes the indigenous knowledge about the traditional treatment practices of the livestock diseases. There is still a small number of quantitative data upon the ethno veterinary practices in the valleys inside CKNP region Gilgit-Baltistan. The local community including the livestock holders have proximate relationship with flora for various purposes including treatment practices. The traditional knowledge received from the herbalists, traditional healers and livestock holders needs to be documented before it disappears because the new generation is not very much involved in the traditional treatment practices. In addition the present survey of ethno veterinary practices will be useful for the scientists for knowing the medicinal properties through biochemical analysis, phytochemical investigation and pharmaceutical screening to cross-check the local information. Since mostly the leaves of the plants have been reported for therapeutic purposes and according to literature [91] the collection of leaves causes no significant threat to the survival of individual plants. Thus the leaves of the individual plants could easily be collected and scientifically investigated thoroughly.

Acknowledgements

This work is a part of a research project supported by the EvK2CNR through SEED (Social, Economic and Environmental Development) project in collaboration with Karakoram International University, Gilgit-Baltistan, Pakistan. The authors convey special thanks to Dr. Sher Wali Khan, a known taxonomist, Department of

Biological Sciences, Karakoram International University, for his services to identify the plant species and provide the voucher numbers to the specimens. The authors also wish to acknowledge the livestock holders, the veterinarians and other respondents for sharing their indigenous knowledge about the ethno veterinary practices.

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