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Valuable wisdom in the Himalayas: ITKs in bullock rearing

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Rural community has been utilising natural herbs for treatment of health disorders since time immemorial. The indigenous wisdom possessed by them is of immense importance that must be documented and conserved for future use unless it gets lost or endangered with time. The Himalayan region is home to a number of medicinal plant species that are used for treatment of humans as well as domestic animals. Present study was carried out in the state of Uttarakhand to document various ethnoveterinary practices followed in the treatment of bullocks which form the backbone of hill agriculture. Data were collected in 2017-18 from 240 farmers randomly selected from four districts through a semi-structured schedule. The study revealed that the respondents were using 36 plant species (mainly herbs 52.77%) in combination with household items and other resources in different formulations such as decoction, drink, balls, powder, chutney, etc. to treat their bullocks. It revealed that carom seeds (*Trachyspermum ammi*), Nettle (*Urtica dioica*) and Cumin (*Cuminum cyminum*) had the highest use value (UV) of 1.00, 0.99 and 0.98 respectively. Identified ethnoveterinary practices were being used for different health issues mainly, injury (external and internal), digestive disorders, poisoning, muscular pain, foot and mouth disease (FMD), fever, infection, burns, etc.

Keywords: Bullocks, Ethnoveterinary practices, Himalayas, Indigenous traditional knowledge (ITK), Mountain agriculture

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Since ancient times, herbs and plant formulations have been used to treat various ailments around the world and share a unique relationship with human beings[1]. Such formulations are still the mainstay of around 75–80% of the world's population, particularly in the third world countries, for primary health care because of better cultural acceptability, better compatibility with the human body, and lesser side effects[2,3]. Herbal formulations are an important part of rural India as home remedies to cure various health disorders[4]. The Indian Himalayan region (IHR) is an abode to a plethora of plant species that have been used time and again by the locals to cure many health problems. There are around 8000 species of vascular plants in the Indian Himalayas and 1748 of these have medicinal properties[5,6]. The state of Uttarakhand is home to around thousands of herbs with medicinal properties[7]. These crops and plant species are not only used for treatment of humans but also for taking care of the animals reared for livelihood, especially cattle. Animal husbandry is an integral part of mountain agriculture, since most of the farmers follow agriculture as a means of sustenance rather than commercial use. Various ethnoveterinary practices utilizing the indigenous traditional knowledge are still being followed by the animal rearing farmers in the Himalayan region. There has not been significant research on the medicinal and related aspects of different flora around the world[8] and it needs attention. The traditional knowledge is the identity of the mountain people and it must be documented, validated and conserved. It also makes sure that indigenous cultural heritage is preserved from being lost for the use of both present and future generations[9].

Methodology

Tightly knit communities in villages have a diverse knowledge base which needs to be studied and reported for further study and utilization. The present study was carried out in Uttarakhand, a Himalayan state located in the northern part of India from October 2017 to April 2018. Data were collected from farmers who were rearing bullocks for at least five years through a semi-structured interview schedule. Multistage sampling was followed for selection of

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respondents. Four districts namely Nainital, Almora, Uttarkashi and Tehri were randomly selected from the state followed by two blocks from each selected district. From each selected block, two clusters of villages were selected and finally 15 farmers from each cluster of villages were selected randomly. Thus, a total of 240 respondents were selected for the study. Key informant interviews were also conducted to get in-depth knowledge on the prevailing ITKs in concerned villages. Various plant species reported by the respondents were also authenticated and details on their local names and families were also taken by reviewing relevant literature. Photographs of the plant species in the vicinity, available in the season were also taken for documentation. Use value (UV) of the plant and Informant Consensus Factor (ICF) was also calculated in the study. Use Value (UV) is found to determine the extent of medicinal use for a particular plant species[10]. It can be calculated by the given formula.

$$UV = \frac{\Sigma U}{n}$$

Where,

U = number of use reports cited by the respondent for that plant species

n = number of respondents

ICF tells about the homogeneity of information for a particular plant to treat a particular disease or ailment[11]. It ranges from 0.00 to 1.00 and denoted as F_{IC}. It can be calculated as

$$\mathbf{F_{IC} = (N_{ur}\text{-}N_t) / (N_{ur} - 1)}$$

Where,

N_{ur} = total number of use reports for a particular illness category

N_t = total number of species used for this illness category

Results and Discussion

Respondents' profile

Respondents from the study area belonged to different age groups (ranging from 22 to 85 years), gender and educational background as given in Table 1. The results are in line with study on draught animals[12] that also reported majority of respondents were in middle aged category (69.10 %).

Table 1 — Demographic description of respondents in study area (n=240)

Particulars	Category	Frequency	Percentage
Gender	Male	229	95.42
	Female	11	4.58
Age	Young (up to 35 years)	48	20.00
	Middle (36 to 50 years)	99	41.25
	Old (above 50 years)	93	38.75
Education	Illiterate	21	8.75
	Literate	219	91.25

Ethnoveterinary practices

These were analysed from the study that farmers were utilising a number of plant species along with locally available resources for the treatment of their bullocks and other animals. A total of 36 plant species were found to be utilized by 25 respondents' family for treatment of ailments as displayed in Table 2. Majority of the plants belonged to herbs (52.77%) followed by shrubs (27.78%), trees (16.67%) and climbers (2.78%) as shown in Figure 1. Similar results have been reported by many researchers across India[13-16]. Most of the plant species were collected by the family members from nearby areas i.e., cultivated and uncultivated landholdings, flora in and around the village with communal harmony and plant species from the nearby the forest. Different parts of the plant species in different formulations and preparation were being used to cure diseases and ailments. Majority of the respondents stated that they mainly used leaves and tender branches (12), seeds (11) followed by fruits (4) and root of the plant (2). Other researches have also indicated the use of leaves predominantly in their studies in Pakistan[14] (2014-15) and Bangladesh[16] (2010). Formulations in the form of powders, paste, chutney, decoction, drinks, eating balls (*laddoos*), etc. were used as medication. These practices were utilized for treating external injury such as swelling, wounds or burn, fracture, etc. and internal diseases and ailments such as abdominal disorders, fever, infection, etc. It was also noticed that oral administration of herbal formulations dominated the topical use and the results are in line with another research across India[14]. The study also highlighted that most of the reported ITK use was for treatment of digestive disorders or ailments that has also been reported by other researchers as well[17]. The results obtained through the survey are given in tables below (Table 3 and Table 4) regarding details of various plant species used and the practice used for treatment

Table 2 — Plant species used in ITKs recorded from study area

S.No.	Plant name	Scientific name	Folk name	Family	Plant part used	Used in treatment of animals
1	Pine	*Pinus roxburghii* Sarg.	*Chir*	Pinaceae	Leaves	Bone fracture
2	Himalayan stinging nettle	*Urtica dioica* L.	*Bichchoo, Shisuna*	Urticaceae	Leaves and tender branches	Muscle pain
3	Soapberry	*Sapindus mukorossi* Gaertn.	*Reetha*	Sapindaceae	Fruits	Leech in nose
4	Tobacco	*Nicotiana tabacum* L.	*Tambaaku*	Solanaceae	Leaves	Leech in nose
5	Mugworts	*Artemisia edgeworthii* N.P. Balakr.	*Paati*	Asteraceae	Leaves	Dry nose and shivering
6	Himalayan cherry prinsepia	*Prinsepia utilis* Royle.	*Jhataalu*	Rosaceae	Tender branches	Dry nose and shivering
7	Wheat	*Triticum aestivum* L.	*Gehu*	Poaceae	Flour	Poisoning
8	Black gram	*Vigna mungo* (L.) Hepper	*Urd*	Fabaceae	Flour	Poisoning
9	Coriander	*Coriandrum sativum* L.	*Dhania*	Apiaceae	Seeds	Poisoning, digestive disorder and Afra (fever)
10	Carom seeds	*Trachyspermum ammi* (L.) Sprague.	*Ajwain*	Apiaceae	Seeds	Digestive disorder and constipation
11	Indian barberry	*Berberis aristata* DC.	*Kilmora*	Berberidaceae	Tender branches	Digestive disorders and FMD
12	Black sesame	*Sesamum indicum* L.	*Kale til*	Pedaliaceae	Seeds	Constipation
13	Goosefoot	*Chenopodium album* L.	*Bathua*	Amaranthaceae	Leaves	Constipation and Afra (fever)
14	Myrobalan	*Terminalia chebula* Retz.	*Bharad/Haira*	Combretaceae	Seeds	Constipation
15	Cumin	*Cuminum cyminum* L.	*Jeera*	Apiaceae	Seeds	Constipation and nasal discharge due to cold
16	Red chillies	*Capsicum annuum* L.	*Lal mirch*	Solanaceae	Fruit	Constipation and FMD
17	Wild pomegranate	*Punica granatum* L.	*Dadim*	Punicaceae	Seeds (chutney)	Constipation
18	Black soybean	*Glycine max* (L.) Merr.	*Kale bhatt*	Fabaceae	Seeds	Stomach infection
19	Black pepper	*Piper nigrum* L.	*Kali mirch*	Piperaceae	Seeds	Stomach infection
20	Turmeric	*Curcuma longa* L.	*Haldi*	Zingiberaceae	Raw turmeric rhizomes	Stomach infection and FMD
21	Mediterranean sage	*Salvia lanata*	*Gania*	Lamiaceae	Seeds	Stomach infection
22	Chinaberry tree	*Melia azedarach* L.	*Bakain*	Meliaceae	Young leaves	FMD
23	Peach	*Prunus persica* (L.) Batsch.	*Aadoo*	Rosaceae	Fruit	FMD
24	Flannel weed	*Sida cordifolia* L.	*Babila*	Malvaceae	Ash of leaves	Throat swelling
25	Sugarcane	*Saccharum officinarum* L.	*Ganna*	Poaceae	Leaves	Throat swelling
26	Finger millet	*Eleusine coracana* (L.) Gaertn.	*Mandua, ragi*	Poaceae	Flour	Throat swelling
27	Garlic	*Allium sativum* L.	*Lehsun*	Amaryllidaceae	Raw garlic cloves	Deworming
28	Ginger	*Zingiber officinale* Roscoe	*Adrak*	Zingiberaceae	Rhizome	Digestive disorders
29	Asafoetida	*Ferula foetida* (Bunge) Regel.	*Hing*	Apiaceae	Gum latex	Digestive disorders
30	Barley	*Hordeum vulgare* L.	*Jau*	Poaceae	Seeds	Cough
31	Radish	*Raphanus sativus* L.	*Mooli*	Brassicaceae	Seeds	Anorexia
32	Catechu	*Acacia catechu* L.	*Khair*	Fabaceae	Peel of seed	FMD
33	Kutki	*Picrorhiza kurroa*	*Kutki*	Plantaginaceae	Roots	FMD
34	Sodom apple	*Calotropis procera*	*Aak*	Apocynaceae	Leaves	Muscular pain
35	Onion	*Allium cepa* L.	*Pyaaz*	Amaryllidaceae	Bulb	Muscular pain
36	Hemp	*Cannabis sativa* L.	*Bhaang*	Cannabaceae	Leaves	Muscular pain

of particular disease or ailment respectively. Use value of the plant species revealed that Ajwain (*Trachyspermum ammi)* had the highest use value of 1.00 followed by Himalayan stinging nettle (*Urtica dioica*) with 0.99, Cumin (*Cuminum cyminum*) with 0.98, sesame (*Sesamum indicum*) with 0.81, Turmeric (*Curcuma longa*) with 0.70, Bharad (*Terminalia chebula*) with 0.60, Kutki (*Picrorhiza kurroa*) with 0.55 and Black gram (*Vigna mungo*) & Wheat (*Triticum aestivum*) with least use value i.e. 0.03 and

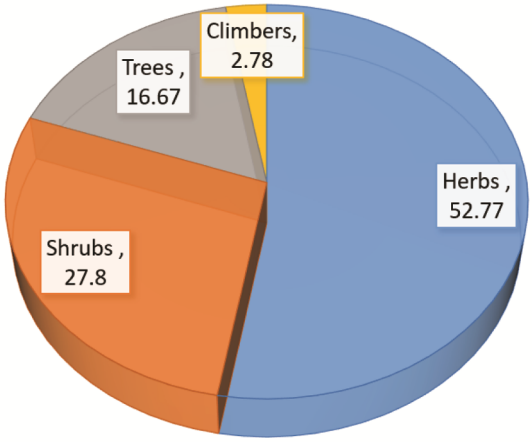

Fig. 1 — Plant diversity in study area

0.07 respectively. High use value indicates the potential of plant species to be used in medicines. Apart from use value, ICF was also determined among 13 diseases/ailments/disorders as per the number of use reports of different plant species. It was found that ICF came under the range value and ranged from 0.98 to 1.00 (Table 3). High value of ICF indicated that the respondents were in strong agreement with the use of a particular plant species in the study area. It was seen especially in case of bone fracture, nasal discharges due to cold, stomach worms, cough and eye infection that the ICF value came as 1.00 which indicated that all the respondents were agreeing the use of same plant species for the treatment of the ailment/disease.

Table 3 — Disease/ailment categories and their Informant Consensus Factor (ICF) values of documented ethnomedicinal uses

Disease/ailment category	Diseases reported in present study	Use reports	Number of taxa		F_{IC}
		Numbers	Total		
Bone fracture	Broken bone, pain and swelling	108	108	1	1
Muscle pain	Muscular pain	446	583	5	0.993
	Joint pain (137)	137			
Leech in nose	Uneasiness due to leech	77	77	2	0.987
Tilla	Dried nose and shivering of body	128	128	2	0.992
Lantana camara poisoning	Swollen abdomen and drooling of saliva	256	256	3	0.992
Abdominal disorders	Digestive disorders	519	1936	15	0.992
	Constipation	776			
	Tympany	641			
FMD	FMD	619	619	7	0.990
Tamas	Standing animal due to cold	234	234	1	1
Knot in throat	Swelling/knots in throat	230	230	3	0.991
Worms in stomach	Worms in stomach	183	183	1	1
Cough	Throat congestion	98	98	1	1
Anorexia	Anorexia	451	451	3	0.995
Eye infection	Watery eyes	86	86	1	1

Table 4 — ITK composition and usage in study area

S.No.	Disease or disorder	Symptoms	ITK composition	Usage	Remarks (if any)
1	Bone fracture	Pain and swelling	Pine leaves/*Chir (Pinus roxburghii*), red soil (*Geru*) and lime	Paste of pine leaves, *geru* and lime is prepared. Mixture is heated and applied on fractured area and tied with a cloth for a month.	Wound is checked once in a while and treatment is stopped when cured.
2	Muscle pain	Muscular pain	Himalayan stinging nettle/*Bicchchoo/Shisuna* leaves (*Urtica dioica*)	Paste of a bunch of leaves is applied or branches are hit (*jhaar-phunk*) with nettle leaf branches at dusk and dawn till the animal is cured.	Treatment is done till cured.
			Hemp/*Bhaang (Cannabis sativa* L.) leaves, pine leaves and black salt (half tsp)	Boiled bhang leaves, pine leaves ash and salt are mixed and the paste is applied topically on affected area	

(*contd.*)

Table 4 — ITK composition and usage in study area (*contd.*)

S.No.	Disease or disorder	Symptoms	ITK composition	Usage	Remarks (if any)
		Knee joint pain	Sodom apple/*Aak* (*Calotropis procera)* leaves, onion (*Allium cepa* L) (one bulb), mustard oil (2 tsp)	Leaves along with onions sautéed in mustard oil and applied topically on affected area	
3	Leech in nose	Uneasiness	4 to 5 Soapberry/*Reetha* (*Sapindus mukorossi* Gaertn) soaked and boiled with water (500 mL)	Drink made with reetha and water is given to animal.	Animal sneezes and the leech comes out
			Tobacco (*Nicotiana tabacum* L.) leaves (one small bunch), salt (5 g) and water (500 mL) soaked for few hours in copper vessel	Drink thus prepared and kept in copper vessel is given to animal.	
4	*Tilla*	Dry nose and shivering of body	Mugworts/*Paati (Artemisia edgeworthii* N.P. Balakr.) leaves	Smoke from burning *paati* leaves is blown towards animal.	In case water deficiency occurs, disease reoccurs in six months.
			Himalayan cherry/*Jhatalu* (*Prinsepia utilis)*	Spiny and leafy branches are hit (*jhaar-phunk*) on animal at dusk and dawn till animal is cured.	After application of ITK, if animal does regurgitation then food and water is given.
5	*Lantana camara* poisoning (*Vish*)	Animal starts drooling, doesn't take feed and distended abdomen	Ghee (1 tsp), wheat (*Triticum aestivum*) flour (50 g) and water (500 mL)	Drink is given to the animal for one-day morning and evening	Treatment is stopped when animal is cured
			Urd (*Vigna mungo*) flour (50 g) and water (500 mL)		
			Buttermilk (1 glass) and coriander (*Coriandrum sativum*) seeds powder (1 tsp)		
6	Digestive disorders				
	Bloat/tympany	Gas develops in animal's stomach or bloating	Black salt, carom seeds/*Ajwain (Trachyspermum ammi)*, coriander (*Coriandrum sativum*) seeds (5 g each), curd (500 mL) and water (500 mL)	One litre Mixture is fed two times a day to the animal in morning and evening	Diet of animal should be kept in mind along with physical exercise
			50 g Jaggery and 10 g Asafoetida/ *Hing* (*Ferula foetida)*	Ball is made and fed to animal once	
			Indian barberry/*Kilmora (Berberis aristata* DC.*)* branches	Spiny branches are hit on animal's stomach and it releases the gas through rectum.	
	Constipation	Indigestion and pellety dung	Black salt, *ajwain* (*Trachyspermum ammi*) and black sesame seeds (*Sesamum indicum* L.) (5 g each) and water (500 mL)	All are ground together and water is added; drink is given to the animal	Feed provided to animal should be kept in mind along with physical exercise
			Bathua (Chenopodium album L.) leaf bunch, 3-4 Myrobalan*/Bharad/Haira (Terminalia chebula)* and water (200 mL)	Paste is made and given along with water twice for a day	
			Cumin/*Jeera (Cuminum cyminum)* seeds (5 g) and jaggery (50 g)	Ball is made and fed to animal once	

(*contd.*)

Table 4 — ITK composition and usage in study area (*contd.*)

S.No.	Disease or disorder	Symptoms	ITK composition	Usage	Remarks (if any)
	Other digestive disorders	Abnormal dung	Black soybean (*Glycine max* (L.) Merr.) flour (100 g), black pepper (5 g) and water (500 mL	Dough or drink (mixed with water) is fed to the animal twice a day in morning and evening	---
			Raw turmeric (2 g), sage/ *Gania* (*Salvia lanata)* seeds (5 g) and water (100 mL)	Drink is given to animal once	---
	Afra (Tympany)	Pyrexia and bloating	*Bathua* (*Chenopodium album L.*) *(Bathua)* leaves (1 bunch), coriander seeds (5 g) and water (100 mL)	One glass sherbet is given to animal twice a day	
			Ajwain (*Trachyspermum ammi*)(1 tsp), ginger (1 inch piece), black pepper (3-4 grounded), asafoetida/*hing* (*Ferula foetida*) (a pinch) and water (as required)	Given as a thick decoction once a day	
7	FMD	Wounds on feet, hoofs and mouth	*Geru* (red soil) and water	Applied on horns or hoofs	
			Young leaves of chinaberry/ *Bakain* tree (*Melia azedarach* L*)* and peach (small bunch), chillies (1-2) and clay	Mixture is applied on affected area for one to two weeks.	---
			Indian barberry/*Kilmora (Berberis aristata*) branches	Spiny leafy branches are hit *(Jhaar-phunk)* on animal at dusk and dawn weekly till the animal is cured	
			Khair (Acacia catechu) seed bark and water	Boiled in water and given to the animal	
			Jaggery (50 g), Turmeric (5-10 g) and mustard oil (100 mL)	Paste is applied on the affected area for 1-2 weeks	
			Kutki (Picrorhiza kurroa) roots, sugar and water (250 mL)	Roots are powdered after drying and a drink is given to animal by adding sugar	
8	*Tamas* (cold)	Animal keeps standing due to cold	Jaggery (10 g), cumin (*Cuminum cyminum*) seeds (2-3 g), tea (1tsp), salt (2-4 g) and water (100 mL)	Tea is given to the animal once a day when symptoms occur	
			Calcium salt (400-500 g) and water (1 L)	Drink is given to animal	
9	Knot or swelling on throat	Swelling in throat	Brass utensil	Hot utensil with tolerable heat is gently applied on affected area to provide hot fomentation	---
			Flannel weed/*Babila (Sida cordifolia* L.)	Ash of the plant is massaged on throat and then hot metal (*tawa*) with tolerable heat is gently applied as hot fomentation	
			Sugarcane leaves (one small bunch) and jaggery (25 g)	Jaggery along with sugarcane leaves is fed to the animal three times a day for 1-2 days	

(*contd.*)

Table 4 — ITK composition and usage in study area (*contd.*)

S.No.	Disease or disorder	Symptoms	ITK composition	Usage	Remarks (if any)
			Finger millet/*Mandua* (*Eleusine coracana* (L.) Gaertn) flour (50 g), mustard oil (1tsp), jaggery (20 g) and water (250 mL)	Drink is given to the animal once a week	
10	Injury	Wounds on body parts	Indigenous cow urine, cow dung and mustard oil (as required)	Affected area is daily washed with cow urine. Mixture of burnt cow dung and mustard oil is applied on affected area	---
11	Burn	Burning sensation	Indigenous Cow urine, cow dung, coconut oil	Affected area is daily washed with cow urine. Mixture of burnt cow dung and coconut oil is applied on affected area	---
12	Worms in stomach	Diarrhoea and dehydration	Mustard oil (1 tsp) and raw garlic (5-6 cloves)	Raw paste with oil is given to animal once a day	Feed provided to animal should be kept in mind
13	Cough	Throat congestion	Barley seeds (250 g)	Fed to the animal once a day occasionally for a week	
14	Anorexia	Loss of appetite	Bark of Myrobalan/ *Bharad/Haira* (*Terminalia chebula*), *Ajwain (Trachyspermum ammi)* seeds (1 tsp), black salt as per taste and radish seeds (half tsp).	Mixed and fed to the animal occasionally along with feed.	Proper care and monitoring of the animal needs to be done
15	Eye infection (Cataract)	Blurry vision	Indian barberry/*Kilmora* (*Berberis aristata)* roots and water	Decoction is made from boiling the roots along with water, cooled down and applied on eye as drops occasionally	

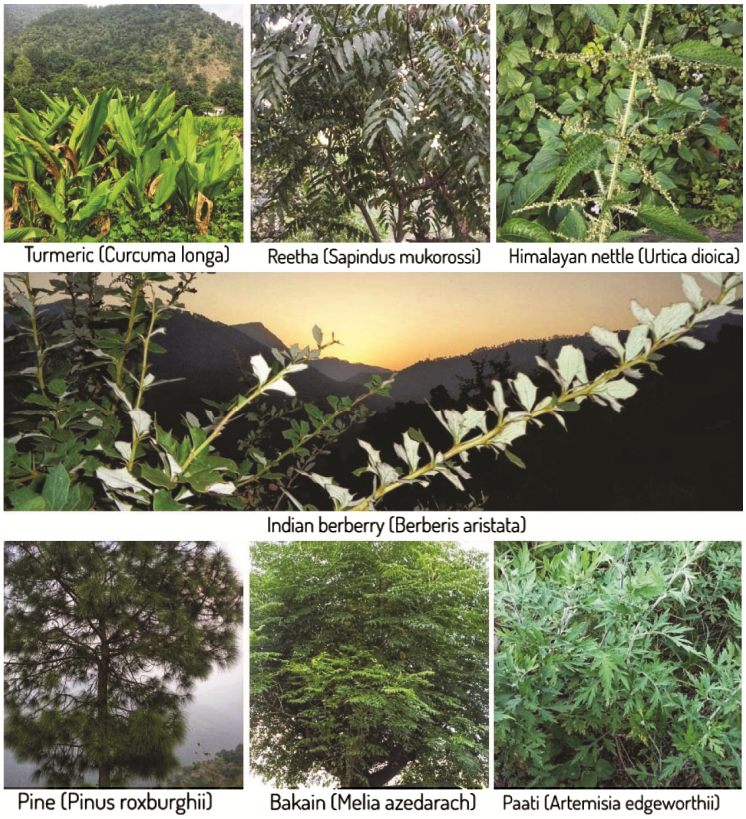

Fig. 2 — Few plant species used as ITKs in study area

Results on usage of various plant species for treating disease/ailment are also supported by similar findings in the region. Use of *Ajwain* (*Trachyspermum ammi*) for treating *Afra*, *Urd* (*Vigna mungo*) for treating poisoning, *Bharad* (*Terminalia chebula*) for Anorexia, *Khair* (*Acacia catechu L.*) for treating FMD, Berberry (*Berberis aristata DC*) for eye infection, etc. has also been reported by a study conducted in Uttarakhand[18].

Photographs of plant species used in the ITK practices that were available in the season and were in accessible areas are also documented in Figure 2.

Conclusions

Indigenous wisdom is the cultural heritage that has been passed down since ages in the indigenous community that must be conserved for betterment of the community. The mountain community in India holds a number of such indigenous practices that are needed to be explored. Diverse flora in the Central Himalayan region is rich in different kinds of medicinal plants and herbs that form the basis for curing animals through local indigenous wisdom and has been practiced by farmers since ages. Being a part of cultural heritage of the indigenous communities, exploring their indigenous knowledge is critical and it is imperative to identify, document and validate their knowledge before it gets endangered or completely lost with passage of time. Indigenous knowledge and technologies are considered to be cost-effective, sustainable and can help provide better insights for policy formulation[19]. The study opens an insight into the valuable ITKs especially in the context of bullocks in mountain agriculture and can help in creating pathways in further research on natural flora and their compositions and uses. Plant species with high use value indicate their diverse medicinal characteristics which can be further studied for development of drugs and medicines to benefit human and animals. It is equally important to frame righteous conservation strategies for these ethno-medicinal floras to curb their depletion.

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Conflicts of Interest

The authors hereby declare that there is no conflict of interests in the concerned paper.

Author Contributions

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