Traditional Uses of Plants by Indigenous Communities for Veterinary Practices at Kurram District, Pakistan

Maroof Ali, Ali Aldosari, David Y. P. Tng, Manzoor Ullah, Wahid Hussain, Mushtaq Ahmad, Javid Hussain, Ajmal Khan, Hidayat Hussain, Hassan, Sher Rainer W. Bussmann and Jian-Wen Shao

Research

Abstract

Background: In Kurram district of Pakistan, people use medicinal plants to cure a variety of livestock diseases. This study was conducted with the aims to document the indigenous knowledge of medicinal plants used in veterinary practices in the district.

Methods: Ethnoveterinary data were collected through semi-structured interviews with 97 participants that were purposely chosen at random locations and data was quantitatively analyzed using relative frequency of citation (RFC) and use value (UV).

Results: In total 81 plants belonging to 43 families were recorded. Asteraceae and Lamiaceae were the most cited botanical families. The plants were used to treat 28 livestock diseases. Among the plant parts, leaves were the most used parts (38 %) followed by the flowers (13 %), seeds (10 %), stem (10 %), fruit (8 %), and roots (7 %). The results showed that (22) plants were used for digestive diseases, (10) for skin problems, (8) against flatulence, (7) as anthelmintic and as refrigerant, and (4) to treat diarrhea and as anti-inflammatory.

Conclusions: The study provides an inventory of traditional ethnoveterinary plants from Kurram district of Pakistan for further phytochemical and pharmacological studies in order to explore their active ingredients.

Correspondence

Maroof Ali[1,2], Ali Aldosari[3], David Y.P. Tng[4], Manzoor Ullah[5], Wahid Hussain[6], Mushtaq Ahmad[1], Javid Hussain[7], Ajmal Khan[7], Hidayat Hussain[8], Hassan Sher[9] and Jian-Wen Shao[1] *

[1]College of Life Science, Anhui Normal University, Wuhu 241000.
[2]Department of Plant Sciences, Quaid-e-Azam University, Islamabad, Pakistan
[3]Department of Geography, King Saud University, Saudi Arabia
[4]Institute of Biology, Federal University of Bahia, R. Barão Jeremoabo, Ondina, s/n, Ondina, 40170-115, Salvador, Bahia, Brazil
[5]Department of Botany, University of Science & Technology Bannu, Pakistan
[6]Department of Botany, Government Post Graduate College Parachinar, Kurram, Pakistan
[7]Department of Biological Sciences and Chemistry, University of Nizwa, PO Box 33, 616 Birkat Al Mauz, Nizwa, Oman
[8]Leibniz-Institut für Pflanzenbiochemie: Halle, Sachsen-Anhalt, Germany
[9]Center for Plant Sciences and Biodiversity University of Swat
[10]Department of Ethnobotany, Institute of Botany, Ilia State University, Tbilsi, Georgia
*corresponding author: email: shaojw@mail.ahnu.edu.cn

Ethnobotany Research & Applications 18:24 (2019)

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

Keywords: Quantitative study, Folk knowledge, Livestock, Ethnoveterinary medicines, Pakistan.

خلاصہ

پس منظر: پاکستان کے کرم ضلع میں لوگ مختلف مویشیوں کی بیماریوں کا علاج کرنے کے لئے پودوں سے دواؤں کا علاج کرتے تھے. یہ مطالعہ واہ منعقد کیا گیا تھا جس کا مقصد پاکستان کے ضلع کر م میں اخلاقیاتی کے طریقوں میں استعمال ہونے والی دواؤں کے .مقامی علم جو پاکستان کے کرم ڈسٹرکٹ میں استعمال کیا جاتا ہے -

طریقہ: یہ مواد اخلاقیاتی اعداد و شمار اور نیم ساختہ انٹرویو کے ذریعہ جمع کیے گئے ہیں جو 97 شرکاء سے لی گئی. ترتیب جگہوں پر مقاصد کی بنیاد پر منتخب کیے گئے ہیں اور اعداد و شمار کو اور قیمت (RFC) کے قریبی تعدد (RFC) حوالہ دیتے ہوئے .(یووی) کا استعمال کرتے ہوئے کافی مقدار میں تجزیہ کیا گیا ہے

.

نتائج: مجموعی طور پر، 81 پودوں کو ریکارڈ کیا گیا، جس میں 28 پودوں سے مویشیوں کی بیماریوں کا علاج کیا گیا تھا. تارا پھول(نجمان، دو دالہ پودوں سے تعلق رکھنے والے پودوں کا ایک خاندان) اور لامیاسی سب سے زیادہ حوالہ جات والے باجوانی خاندان تھے. پودوں کے حصوں میں، پتیوں میں سب سے زیادہ استعمال شدہ حصوں (38٪) تھے جس کے نتیجے میں پھولوں (13٪)، بیج (10٪)، تنے (10٪)، پھل (8٪)، اور جڑیں (7٪) کی طرف سے. پودوں میں، نتائج سے ظاہر ہوتا ہے کہ (22) پودوں کے طور پر عمل انہضام کے طور پر استعمال کیا گیا تھا (10) جلد کے مسائل کے لئے, (8) پیٹرن کے خلاف, (7) اینٹی ہتھیار اور سردی کے طور پر، اور (4) اسہال اور انسٹی ٹیوٹ کے علاج کے طور پر

نتیجہ: مطالعہ روایتی اخلاقیاتی ادویات کی ایک فہرست فراہم کرتا ہے؛ اور ان کی فعال صلاحیتوں کو تلاش کرنے کے لئے مزید روشنی سے لائی گئی تبدیلیوں اور فن دواساز ی کے مطالعہ کے مواقع. اس مطالعہ کو بھی مقامی طبی ادویات اور منسلک علم کی حفاظت کی طرف سے مقامی ثقافت کو استعمال کرنے کے لئے بھی واضح ہے

نتیجہ: مطالعہ روایتی کررم ضلع سے روایتی اخلاقیاتی ادویات کی ایک فہرست فراہم کرتا ہے؛ اور ان کی فعال صلاحیتوں کو تلاش کرنے کے لئے مزید روشنی سے لائی گئی تبدیلیوں اور فن دواساز ی کے مطالعہ کے مواقع فراہم کرتا ہے.

کلیدی الفاظ: مقدار کا مطالعہ، لوک علم، جانوروں، اخلاقیات کے ادویات، پاکستان

کلیدی الفاظ: مقدار کا مطالعہ، لوک علم، لائیوسٹری، ایتھوترینٹک ادویات، پاکستان

لنډیز:

پس منظر: د پاکستان د کرم په ولسوالي کي، خلکو مویشیانو ناروغی د نباتاتو درمل جوړ کړل.

دا څیړنه په هغه وخت کي ترسره شوه چې د پاکستان په ولسوالی کي اخلاقي خلکو مویشیانو ناروغی د نباتاتو درمل شوی و سیمه ایز پوهه د .پاکستان په کرم ولسوالی کی کارول کیږي

میتود: د نیمه جوړښت لرونکو مرکو له الرې راټول شوي 97 د ګډون کونکو سره چې په ناڅاپي ځایونو کي د هدف بیس پر ځای ټاکل شوي (UV) او د ارزښت (RFC) وو او معلومات په کمیت سره د تفتیش کارولو څخه کار اخیستل شوي و

پایلې: په ټولیزه توګه، 81 پ نباتات ثبت شوي، د 28 سبزیانو سره د انارو تغذیه. تارا ګلان (د نانج کورنۍ، د نباتاتو اړوند دوه ورځني نباتات) او لامیاسي د کورنۍ ترټولو معرفي شوي کورنۍ وې. د نباتاتو د برخو په مینځ کي، پاڼي ډیر عام استعمال شوي برخي (38٪) وو، چې نتیجه یې ګلونه (13٪)، تخمونه (10٪)، ډډونه (10٪)، میوه (8٪) او ریښي (7٪). په نباتاتو کي، پایلې ښیي چې (22) نباتات د پوستکي د ستونزو لپاره (10) د جلد د ستونزو لپاره، (8) د نمونو پر ضد، (7) د وسلو ضد او سرد او، 4 (د نس ناستي او فوري درملني په توګ

پایله: دا څیړنه د دودیزو توقیف ځایونو لپاره مویشیانو ناروغی لیست چمتو کوي؛ او د فاسیکیمیک او فارممولوژیکي مطالعو فرصتونو لپاره چې د دوی فعاله توانایئ کشف کړي. دا څیړنه هم په ګوته کوي چې د داخلي مویشیانو ناروغی پوهاوي ساتلو له الري د کورنۍ کلتور کارول .ساتل دي

Background

Folk knowledge on to the use of medicinal plants as therapies for humans and animals is thousands of years old. Documentation of folk knowledge has gained substantial importance around the world especially with the ratification of the Nagoya Protocol in order to maintain cultural heritage (Ayeni and Basiri, 2018). The Convention on biodiversity signifies to preserve and maintain knowledge, innovations and practices of indigenous communities embodying traditional lifestyle relevant for conservation and sustainable use of biodiversity (Salgotra *et al*. 2018).The knowledge is normally passed down through generations via word of mouth (Hussain *et al*. 2018), in stories, poems, proverbs, and songs. The transmission of traditional knowledge through oral methods is however unreliable, and preservation through documentation is needed (Ullah *et al*. 2013).

Ethnoveterinary medicines have the ability to fight different kinds of animal disorders (Bullitta *et al*. 2018) and have several advantages over synthetic drugs. Ethnoveterinary medicines are easy to use, cheap, and readily available (Lans *et al*. 2007). Ethnoveterinary medicines are now gaining popularity in both developed and developing countries, as they are easily obtainable and can be collected from farmers at a very low cost (Njoroge and Bussmann 2006). Indigenous people including pastoral societies living both in urban and remote regions of less developed countries rear animals as an important source of food, income, and social security (Pica-Ciamarra *et al.* 2014, FAO 2002). In less developed countries, an estimated 30–35 % of livestock loss can be attributed to the lack of suitable animal husbandry practices (Dilshad *et al*. 2010). The modern veterinary health curative system is inadequate in less developed countries, and therefore they utilize traditional ethnoveterinary medicinal systems for health care. Communities of Pakistan who practice ethnoveterinary medicines do not usually have their methods documented.

Ethnoveterinary research has been carried out in the rural and remote areas of Pakistan where communities commonly use herbal remedies for the treatment of domestic animal ailments, including

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

South Waziristan and Bajaur Agency (Aziz *et al*. 2018), Karak district (Khattak *et al*. 2015), Malakand Valley, Lower Dir (Hassan *et al*. 2014), Indus River (Mussarat *et al*. 2014), Sulaiman Range (Tariq *et al.* 2014), Himalayas (Abbasi *et al.* 2013), Poonch valley Azad Kashmir (Khan *et al*. 2012), selected hilly areas (Sindhu *et al.* 2010) and Cholistan desert (Farooq *et al*. 2008). However, no study has been conducted from the Kurram district of Pakistan.

Very limited opportunities are available to the people of Kurram district, and most are pastoralists in the mountainous part of the district, and famers in the fertile valley. Livestock plays a key role, as they provide farm power, rural transport, manure, fuel, milk and meat, but have also a major role in rural economy by providing income and employment to the small hold farmers and poor people of the society. Easily accessible and available ethnoveterinary medicinal plants provide a cheaper source for treatment of various diseases. The only restriction in the area is the seasonal accessibility of certain plants, for which farmers have acquired different ways to preserve them for off-season uses. In such communities the modern veterinary health curative system is inadequate, and therefore the inhabitants utilize traditional ethnoveterinary medicinal systems for health care. Most of the inhabitants cannot afford modern allopathic drugs, which ultimately leads to poor livestock production and financial losses due to poor health of animals. Under such conditions, ethnoveterinary medicine can be promoted as an alternative of modern drugs and it will help in poverty alleviation by empowering the people to make use of their own resources for healing of their livestock.

The mountain communities of Kurram district, similar to other parts of the world, contribute to ecosystem maintenance through rich culture, religious and spiritual beliefs and maintain a knowledge that has evolved over generations (Saltan and Ozaydin 2013). This indigenous knowledge of the veterinary health care system is orally transferred from one generation to other, therefore, traditional veterinary medicine knowledge may be lost due to rapid socioeconomic, technological, environmental changes and as a result of the loss of cultural heritage under the guise of civilization (Nfi *et al*. 2001). Changes in income generating systems and lack of interest in coming generation to utilize conventional methods of treatment may bring such traditional use to the verge of extinction in future. It was direly needed to preserve the indigenous use of medicinal plant having therapeutic importance in livestock diseases from the area. Therefore, this study was initiated with the aims to explore and record indigenous ethnoveterinary knowledge from the Agro-pastoralist communities in Kurram district towards preserving folk knowledge of medicinal plants.

Materials and Methods

Study area

Kurram district is a remote area administrated by the Khyber Pakhtunkhwa Pakistan, situated between 33°20´ to 34°10´ N and 69°50´ to 70°50´ E Fig. 1). The district is surrounded to the east by Orakzai and Khyber districts, in the southeast by Hangu district, and in the south by the North Waziristan district; Nangarhar and Pukthia of Afghanistan lie to the west. The highest peak of the Koh-e-Safaid range is Mt. Sikaram, which is 4728 meters high (Hussain *et al.* 2018). According to the latest census report of 2017, the overall population of the research area is 253478 (www.pbs.gov.pk/content/population-census).

Generally, the people of Kurram district are poor, mostly pastoralists and farmers. Other tribes living in Upper Kurram includes Sayed, Bangash, Turi, Maqbal, Hazara, Khushi, Mangel, Hazara, Kharote and Jaji. The people of the area believe in Jirga, which is one of the most active social institutions in the area or community committees to resolve their dispute and other issues. Hussain *et al.* 2018).

Kurram district is very rich in historical places, ethnic diversity and natural beauty, and its population is known for its hospitality. People take collective action in support of economic and social activities, supporting each other on special occasions like death and marriage ceremonies, harvesting and threshing of crops, construction of Hujras (a meeting place), mosques and other buildings, the cleaning of irrigation channels, protection from floods, maintaining paths, wood and grass cutting etc.

Ethnoveterinary field work and interviews

Data were collected from different localities between January 2015 to August 2016. Informants were selected using the purposive sampling technique, (Tongco, 2007). In total 19 indigenous village heads were interviewed and the villages included were *Sultan, Daal, Mali kali, Alam Sher, Kirman, Malana, Luqman Khail, Shalozan, Bughdi, Pewar, Teri Mangal, Kharlachi, Burki, Shingak, Nastikot, Karakhila, Zeran and Parachinar*. Only participants over forty years of age were interviewed, assuming that most knowledge is held by elders (Ullah *et al*. 2013). The survey targeted farmers, pastoralists,

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

traditional healers, shopkeepers, plant collectors and gardeners who have the knowledge about the ethnoveterinary practices. The diseases conditions were charaterised by healers and they prescribed the remedies in time of need. Ethnomedicinal plant data was collected through semi-structured interviews and a questionnaire was set in the local language (Pashto).

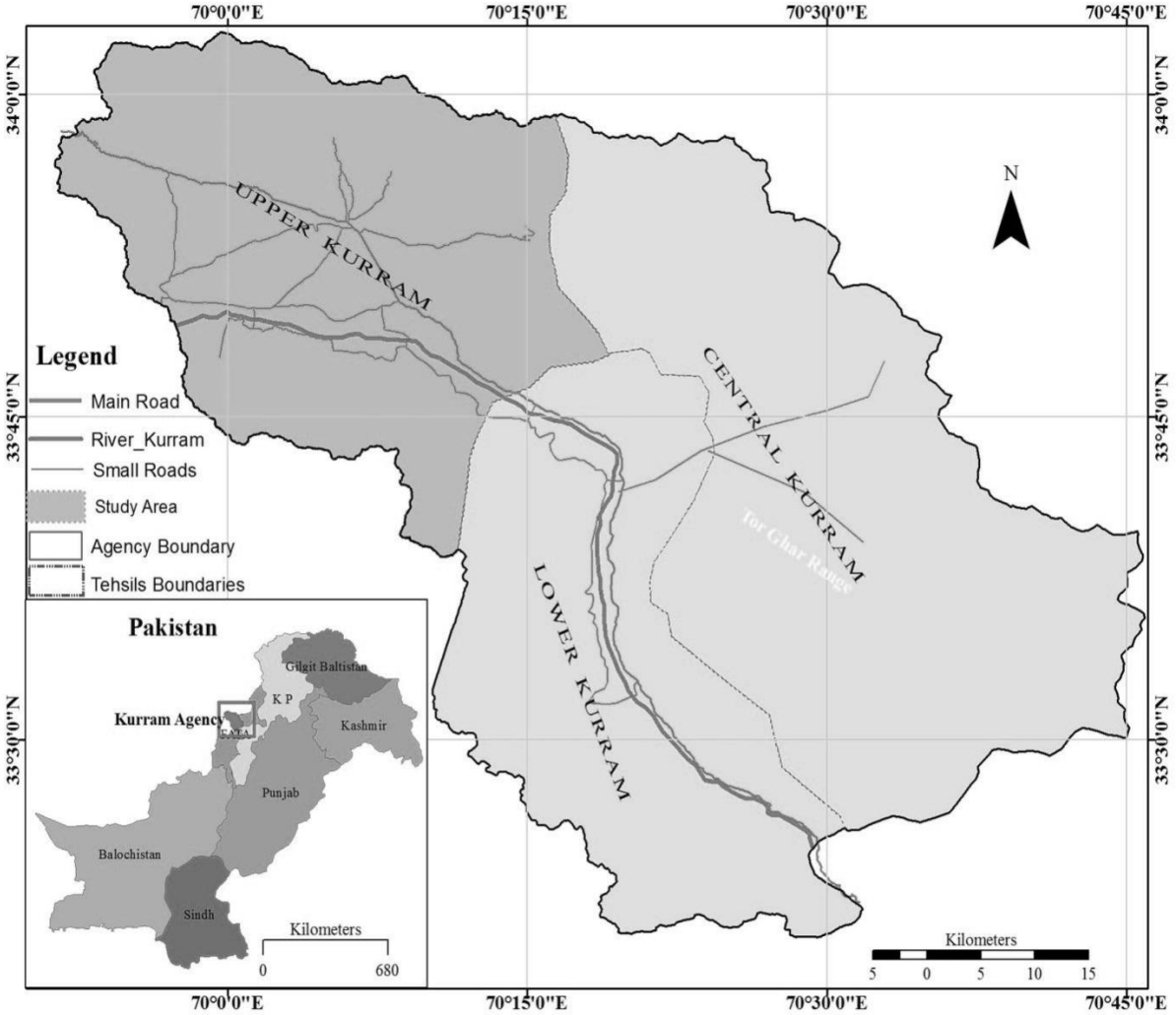

Fig. 1

Fig. 1. Study area map

Plant identification and herbarium deposition

The identified medicinal plants were dried under shade, preserved by using 1 % $CuSO_4$ solution and mounted on herbarium sheets. A voucher number was given to each plant samples. The collected plants were identified by taxonomists at the Department of Plant Science,Quaid-i-Azam University Islamabad and compared with the Flora of Pakistan (Ali and Qaiser, 1995). All specimens were placed in the Herbarium unit of the Plant Science Department, Quaid-e-Azam University Islamabad Pakistan for future reference.

Data analysis

Relative Frequency Citation (RFC)

Relative frequency of citation was computed using RFC=FC/N

Where FC=is the number of informants reporting the use of plant divided by the sum of informants who took part in the study (N) (Ullah *et al*. 2019)

Use Valve (UV)

The relative importance of each species was computed according to the given formula;

UVs= ∑ UVi / Ni, proposed by Phillips and Gentry (1993); Where '*UVi'* represents use value for a given

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

species among the informants who participated and '*Ni'* represents the sum of informants.

Results

Demographic information of the participants

In the current survey 97 participants were either interviewed in their homes, or meeting places (Hujras), fields and religious places. Of the 97 participants 76 were men and 21 women (Table 1).

Table 1. Informants demographics

Gender	***Education level***	***Occupation***	***Number of informants***
F	Illiterate	Healer	1
		Plant collector	7
		Shepherd	4
	Illiterate Total		12
	Matric	Plant collector	5
		Shepherd	2
	Matric Total		7
	Graduation	Plant collector	1
	Graduation Total		1
	Illiterate	Plant collector	1
	Illiterate Total		1
F Total			21
M	Matric	Elder Non professional	15
		Farmer	1
		Gardeners	6
		Healer	4
		Plant collector	1
		Shepherd	3
		Shopkeeper	1
		Trader	4
	Matric Total		35
	Illiterate	Elder Non professional	6
		Farmer	1
		Gardeners	5
		Plant collector	3
		Shepherd	2
	Illiterate Total		17
	Intermediate	Elder Non professional	4
		Farmer	2
		Gardeners	2
		Healer	1
		Shepherd	2
		Shopkeeper	1
		Trader	1
	Intermediate Total		13
	Graduation	Elder Non professional	3
		Farmer	2
		Healer	2
		Plant collector	1
		Shopkeeper	2
	Graduation Total		10
	Illiterate	Healer	1
	Illiterate Total		1
M Total			76
Grand Total			97

Taxonomic distribution and growth form of medicinal plants

The current survey reported 81 medicinal plants belonging to 43 families, which were used for treating various livestock diseases (Table 2). Asteraceae was the dominant family with (12 species); followed by Lamiaceae (9), Fabaceae (4), Amaranthaceae, Pinaceae, Poaceae and Solanaceae with three species each, and the remaining of the 36 plant families were represented by one or two species.

Plant parts used, pormulation and use categories

The participants mentioned different parts of the plants used for preparation of remedies. Leaves were the most used parts (38 %) followed by flowers (13 %), seeds (10 %), stem (10 %), fruit (8 %), roots (7 %), shoot (4 %), aerial parts (4 %), bulb (2 %), oil (2 %), whole plant (1 %) and resin (1 %). The main method of preparation of remedies was powder (32 species), followed by decoction (31), paste (8) and juice (6). Several plants parts were used directly. The key informants in this study noted 28 different therapeutic uses of the plants and this include abdominal pain, analgesic, anthelmintic, antidote, antifungal, anti-inflammatory, antiseptic, anti-ulcergenic, colic pain, constipation, control bleeding, delivery, digestive, diarrhoea, indigestion, eggs production, eye infection, flatulence, flu, galactagogue, indigestion, mouth sores, refrigerant, respiratory problem, skin problems, stomach disorders, urinary disorders and vigour (Table 3) and (Fig. 2). A total of 22 species were used as digestive, skin problems (10), flatulence (9), anthelmintic and refrigerant (7), diarrhea and as anti-inflammatory (4). The medicinal plants used in aiding digestion includes; *Ajuga parviflora*, *Allium cepa*, *Artemisia absinthium*, *Brassica rapa*, *Cichorium intybus*, *Foeniculum vulgare*, *Galium tricornutum*, *Glycyrrhiza glabra*, *Lathyrus aphaca*, *Melia azedarach*, *Mentha arvensis*, *Mentha longifolia*, *Oxalis corniculata*, *Quercus semicarpifolia*, *Sagittaria cuneata*, *Scabiosa olivieri*, *Scutellaria orientalis*, *Setaria viridis*, *Sonchus asper*, *Thymus linearis*, *Vicia sativa* and *Zea mays*. The plant species used for treatment of skin problems were *Artemisia biennis*, *Cedrus deodara*, *Conyza bonariensis*, *Datura stramonium*, *Euphorbia helioscopia*, *Pinus g erardiana*, *Pinu swallichiana*, *Silene conoidea*, *Taraxacum officinale*, *Verbascum thapsus*. *Fumaria indica*, *Hibiscus trionum*, *Linum usitatissimum*, *Olea ferruginea*, *Plantago lanceolata*, *Plantago major*, *Rosa webbiana*, *Sisymbrium irio*, *Ziziphus nummularia* were used for flatulence, and *Ajuga parviflora*, *Calotropis procera*. *Capsicum annuum*,

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

Chenopodium album, *Clematis grata*, *Perovskia atriplicifolia*, *Seriphidium kurramensis* were used as anthelminthic. The detail of the remaining plants and their use categories is shown in (Table 4).

Table 2. Medicinal plants species for veterinary practices at Kurram district, Pakistan

Scientific name	Local names	Cultivation status	Parts used	Recipes and medicinal uses	Ailments treated	Total citations
Acanthaceae						
Dicliptera abuensis Blatt M-ISL-81	Sowazak	Wild	Leaves, Flowers	Powder mixed with oil used for digestive problems.	Digestive problems	21
Aceraceae						
Acer oblongum Wall. ex DC. M-ISL-23	Shalwala	Wild	Leaves	Decoction prepared and mixed with sugar and salt, given 2 table spoons to lambs for diarrhoea two times a day for a week.	Diarrhea	20
Adoxaceae						
Sambucus nigra L. M-ISL-68	Lantas	Domesticated	Fruits	Powder used orally 2 times a day for 4-5 days, as antifungal agent.	Antifungal	19
Alismataceae						
Sagittaria cuneata E. Sheld. M-ISL-18	Jazoponri	Wild	Leaves	Whole plant as fodder for goats and sheep,digestive.	Digestive	21
Amaranthaceae						
Amaranthus viridis L M-ISL-82	Babara Ranzaka	Wild	Leaves, Roots	Powder boiled in water with salt and taken with wheat flour twice a day for constipation; root juice applied topically to reduce inflammation in case of snake and scorpion stings.	Anti-inflammatory	2
Atriplex rosea L. M-ISL-04	Khara Rinzaka	Wild	Leaves	Crushed leaves and roots boiled in water given orally 2 times a day for 2-3 months to increase body weight .	Vigour	21
Chenopodium album L. M-ISL-06	Naray Rinzaka	Wild	Leaves	Decoction of leaves taken orally twice a day to kill intestinal worms and urinary problems.	Anthelmintic Urinary disorders	8 7
Amaryllidaceae						
Allium cepa L. M-ISL-30	Piaz	Cultivated	Bulb	Pieces of bulb taken twice a day and applied topically on skin inflammation, also cooked with oil or ghee along with wheat flour given two times a day for 2 weeks for indigestion.	Digestive Skin inflammation	13 9
Allium sativum L. M-ISL-32	Ogha	Cultivated	Bulb	Paste is recommended for eye infection.	Eye infection	5
Apiaceae						

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

Ammi copticum L. M-ISL-24	Jowanee	Cultivated	Seeds	Decoction obtained from dried seeds mixed with wheat flour is used to stop diarrhoea given two times a day for 2 weeks.	Diarrhoea	31
Foeniculum vulgare Mill. M-ISL-46	Kogilani	Cultivated/ domesticated	Seeds	Powder mixed with ghee and wheat flour used for colic pain and indigestion in cows, goats 2 times a day for 4-5 days.	Colic pain Digestive	9 17
Apocynaceae						
Calotropis procera (Aiton) Dryand M-ISL-41	Shoowdo boti	Wild	Shoot	A decoction of shoot is made mixed with sugar taken orally 2-3 times a day to kill the internal worms in young ones in goats and cows.	Anthelmintic	7
Asteraceae						
Anaphalis acutifolia Hand.-Mazz. M-ISL-74	Spen Gul	Wild	Flowers	Flower powder is cooked in oil and paste is applied on insect bite in cows and goats.	Antidote	16
Artemisia biennis Willd M-ISL-38	Jangli Tarkha	Wild	Shoots	A decoction is topically applied on whole body for treatment of skin allergies.	Skin problems	12
Artemisia absinthium L. M-ISL-37	Mastayra	Wild	Leaves	Extracted oil from flower is orally used as refrigerant; leaf decoction is administered orally to cattle, goats and sheep twice a day for abdominal pain and indigestion.	Refrigerant Abdominal pain Digestive	6 4 3
Cichorium intybus L. M-ISL-07	Shinguli	Cultivated	Stem, leaves	Powder is used in indigestion.	Digestive	9
Conyza bonariensis L. M-ISL-09	Karmal	Wild	Leave, Stem	Paste is applied topically on skin to remove pimples	Skin problems	15
Lactuca serriola L. M-ISL-12	Spena Tarhizha	Wild	Leaves	Crushed leaves mixed with water are administered orally in beverages to cattle, goats and sheep twice a day for abdominal pain.	Abdominal pain	11
Matricaria chamomilla L. M-ISL-14	Speen guli	Wild	Leaves	Crushed leaves are useful in diarrhoea two times a day for a week	diarrhoea	9
Seriphidium kurramensis (Qazilb) Y.R. Lin. M-ISL-79	Tarkha	Wild	Leaves	Leaf paste is applied on insect bite part; powder given two times a day for 5-6 days as anthelmintic for cows.	Antidote	10
Silybum marianum (L) Gaertn. M-ISL-70	Dum	Wild	Roots	Decoction is made effective against urinary disorders	Urinary disorders	15
Sonchus asper L. M-ISL-17	Shena Tarhizha	Wild	Root	Root in wheat flour is given to goats and sheep's as digestive.	Digestive	41
Sonchus oleraceus L. M-ISL-21	Tarhizha	Wild	Leaves, Roots	The plant as fodder is given two times a day	Galactagogue	16

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

				for 3-4 weeks as galaktagogue.		
*Tanacetum artemisioide*s Sch. Bip. ex Hook. f. M-ISL-72	Zawel	Wild	Flowers	Powder mixed with sugar and oil used for treatment of flu	Flu	10
Taraxacum officinale Weber M-ISL-66	Chechopaska	Wild	Leaves	Leaves paste mixed with one g oil and put on burnt part 2-3 times a day.	Skin problems	14
Balsaminaceae						
Impatiens lemannii subsp. kurramensis Grey-Wilson M-ISL-49	Chawdaly booti	Wild	Flowers	Flower paste is applied topically on broken bones as pain killer.	Analgesic	11
Berberidaceae						
Berberis lycium Royle M-ISL-40	sarazghay	Wild	Roots, Flowers	Powder for livestock to treat internal wounds.	Antiulcer	10
Brassicaceae						
Brassica rapa L. M-ISL-29	Sharshamo booti	Cultivated	Oils	Seed oil is given in delivery period to cows and goats; also mixed with wheat flour and taken orally for cattle 2 times a day for 3-5 days for indigestion.	Delivery Digestive	7 7
Sisymbrium irio L. M-ISL-71	Khobe kalan	Wild	Leaves	As fodder against flatulence	Flatulence	17
Cannabaceae						
Cannabis sativa L. M-ISL-05	Marchak	Cultivated	Fruits	Crushed fruits along with salt are used as anthelmintic and as antiseptic to wash dogbites	Anthelmintic Antiseptic	7 5
Caprifoliaceae						
Scabiosa olivieri Coult. M-ISL-19	Nari Sahra Buti	Wild	Leaves	Leaves powder is given to sheep and goats for promotion of regurgitation	Digestive	17
Caryophyllaceae						
Silene conoidea L. M-ISL-69	Kozoo gul	Wild	Flowers	Powder mixed in water is applied on itchy skin.	Skin problems	13
Ephedraceae						
Ephedra gerardiana Wall. ex Stapf M-ISL-44	Mawa	Wild	Roots	Powder mixed with oil is used in digestive problem.	Digestive problem	12
Euphorbiaceae						
Euphorbia helioscopia L. M-ISL-45	Peshkhuti	Wild	Shoots	Milky latex mixed with oil or ghee applied topically on burn part of skin	Skin problems	11
Fabaceae						
Astragalus spinosus Muschl. M-ISL-39	Sahra Shasha	Wild	Flowers	Flowers soaked in water are topically recommended thrice a day to treat wounds.	Antiulcergenic	3
Glycyrrhiza glabra L. M-ISL-11	Khwagawon	Wild	Seeds, leaves	Powder given with bread (chapatti) to control bleeding after delivery and is also useful in respiratory problems in sheep and indigestion in cattle	Control bleeding Control bleeding Digestive	13 11 7

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

Lathyrus aphaca (L.) Doll M-ISL-13	Marghano/Khpay	Wild	Stem, leaves	Whole pant is used as fodder and good digestive in goats and	Digestive	13
Vicia sativa L. M-ISL-22	Zangali Matar	Wild	Aerial parts	Aerial parts as fodder are digestive	Digestive	20
Quercus semicarpifolia Smithin Rees. M-ISL-65	Sery	Wild	Fruits	Fruit is considered as good digestive	Digestive	21
Lamiaceae						
Ajuga parviflora (L.) Roxb. M-ISL-03	Spairapony	Wild	Leaves, Roots	Decoction given twice a day for 1 week to cure indigestion and to kill intestinal worms, the root juice is applied on affected area in cattle 2 - 3 times a day to cure mouth sores.	Digestive Anthelmintic Mouth sores	4 3 2
Marrubium vulgare L M-ISL-51	Darshool	Wild	Leaves	Decoction is used topically on wounds as antiseptic.	Antiseptic	18
Mentha arvensis L. M-ISL-15	Pudina	Cultivated	Leaves, stem	Decoction is used as refrigerant and digestive.	Refrigerant Digestive	9 5
Mentha longifolia L. M-ISL-53	Wilani	Wild	Leaves, stem	Decoction is used as refrigerant and digestive.	Refrigerant Digestive	9 8
Perovskia atriplicifolia Benth. M-ISL-59	Sonsobay	Wild	Flowers	Decoction mixed with sugar is anthelmintic	Anthelmintic	8
Scutellaria orentalis Hedgeang & B.Wang M-ISL-60	Sara panny	Wild	Seed	As fodder consider one of the best digestive s	Digestive	23
Thymus linearis Benth. in Wall. M-ISL-73	Maweray/Panny	Wild	Flowers Leaves	Decoction is prepared are mixed oil or ghee is administered orally twice day for 4 days used for indigestion in cattle.	Digestive	19
Linaceae						
Linum usitatissimum L. M-ISL-27	Alasi	Cultivated	Seeds	Seeds used for flatulence two times a day for a week	Flatulence	9
Malvaceae						
Hibiscus trionum L. M-ISL-48	Ghazan	Wild	Leaves	Powder mixed with oil and wheat flour used for colic pain and as flatulence in cows and goats 2 times a day for 4- 5 days	Colic pain Flatulence	9 6
Malva neglecta Wall. M-ISL-00	Tikalay	Wild	Leaves	Powder mixed with wheat flour is used for colic pain and as flatulence in goats 2 times a day for 4- 5 days	Colic pain	9
Meliaceae						
Melia azedarach L. M-ISL-52	Bakyana/Daraka	Domesticated	Leaves	Powder is given orally in case of indigestion and leaves decoction used as refrigerant	Digestive Refrigerant	13 8
Moraceae						
Ficus carica L. M-ISL-33	Enzar	Wild	Fruits	Powder is given to goats to increase milk after delivery.	Galactagogue	17
Morus alba L. M-ISL-55	Tor Toot	Wild	Fruits	Crushed fruit with water is given to cure flu in sheep.	Flu	11

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

Myrtaceae						
Myrtus communis L. M-ISL-56	Manray	Cultivated	Fruits	Powder mixed in water is topically applied as refrigerant.	Refrigerant	19
Oleaceae						
Olea ferruginea Royle M-ISL-57	Khawand	Wild	Fruits	Oil in flour is given for flatulence to cattle.	Flatulence	6
Oxalidaceae						
Oxalis corniculata L. M-ISL-58	Bibimalaga	Wild	Leaves and flowers	Powder is administered 2 daily for 3 days as digestive and for diarrhoea	Digestive Diarrhea	8 6
Papaveraceae						
Fumaria indica L. M-ISL-47	Shahtara	Wild	Whole plant	Dried plant given to goats for flatulence.	Flatulence	15
Pinaceae						
Cedrus deodara (Roxb.) G.Don M-ISL-36	Almanza	Wild	Resin	Paste is applied on scabies.	Skin problems	12
Pinus gerardiana Wall M-ISL-26	Zarghunze booti	Wild	Oil	Oil is extracted, mixed with milk and orally given for skin rashes and also topically used to improves sex vigour.	Skin problems Vigour	9 4
Pinus wallichiana A.B. Jacks. M-ISL-02	Nahshthar	Wild	Leaves	Leaf decoction topically applied on itchy skin.	Skin problems	15
Piperaceae						
Piper angustifolium Ruiz & Pav M-ISL-28	Kali Murch	Cultivated	Seeds	Powder in wheat flour is given to cows to enhance reproduction	Vigour	12
Plantaginaceae						
Plantago lanceolata L. M-ISL-61	Paley spara	Wild	Leaves	Leaves and seeds for flatulence.	Flatulence	17
Plantago major L. M-ISL-62	Ghwayazha ba	Wild	Leaves, seeds	Leaves and seeds for flatulence.	Flatulence	13
Poaceae						
Oryza sativa L. M-ISL-31	Warezay	Cultivated	Aerial parts	Fruit flour mixed with sugar (gur) enhances milk production	Galactagogue	9
Setaria viridis (L.) P. Beauv. M-ISL-20	Peshay Wakha	Wild	Aerial parts	Dried whole plant is given to cattle after delivery to promote regurgitation.	Digestive	12
Zea mays L. M-ISL-34	Jiwar	Cultivated	Shoot	Shoot given daily as fodder to cows after delivery to promote feeding and digestion.	Digestive	9
Polygonaceae						
Polygonum plebejum R. Br. M-ISL-63	Bandooky	Wild	Leaves, Flowers	Decoction is administrated orally twice a day for flu.	Flu	12
Ranunculaceae						
Clematis grata Wall M-ISL-08	Prewati	Wild	Leaves, Stem	Decoction mixed with sugar given orally 2-3 times a day to kill internal worms in calves.	Anthelmintic	21
Rhamnaceae						
Ziziphus nummularia (Burm.f.) Wight & Arn. M-ISL-80	Bayra	Wild	Leaves,	Leaf decoction is used as refrigerant in cattle while fruit is used for flatulence.	Refrigerant Flatulence	14 5
Rosaceae						
Potentilla gerardiana Lindl. ex. Lehm Richardson.	Zorbooti	Wild	Leaves	Powder is made improve sex vigour.	Vigour	31

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

M-ISL-64						
Rosa webbiana Wall. ex Royle M-ISL-67	Ghara Gulab	Wild	Flowers	Powder is used for flatulence in cows and goats	Flatulence	17
Rubiaceae						
Galium tricornutum Dandy M-ISL-10	Zagook	Wild	Aerial parts	Aerial parts given to cattle for indigestion.	Digestive	25
Scrophulariaceae						
Verbascum thapsus L. M-ISL-76	Kharghugy	Wild	Leaves	Leaf juice is used for skin disorders in cows and goats	Skin problems	19
Solanaceae						
Capsicum annuum L. M-ISL-35	Merch	Cultivated				
Datura stramonium L. M-ISL-43	Toora	Wild	Seeds, Leaves	Mixed with mustard oil applied topically on itchy skin.	Skin problems	15
Withania coagulans (Stocks) Dunal M-ISL-78	Khapyanga	Wild	Seeds	Powder taken orally twice a day for constipation in cattle	Constipation	16
Thymelaceae						
Daphne mucronata Royle M-ISL-42	Laghony	Wild	Leaves and stem	Leaves and stem smoke considered useful as anti-inflammatory agent after delivery in goats and cows.	Anti-inflammatory	21
Urticaceae						
Urtica dioica L. M-ISL-75	Sezawoonky	Wild	Leaves	Decoction mixed with wheat flour is given orally two times a day for 3-4 days to treat stomach disorders in cows and goats.	Stomach disorders	5
Violaceae						
Viola canescens L. M-ISL-77	Babafaha	Wild	Flowers	A decoction of leaves and flowers in sugar is used in case of indigestion.	Indigestion	15
Zingiberaceae						
Curcuma longa L. M-ISL-01	Kurkama	Cultivated	Stem	Powder mixed with flour is given to hens 2 or 3 days to enhance egg production.	Eggs production	12
Zingiber officinale Roscoe M-ISL-25	Adrak	Cultivated	Stems	Powder mixed with flour is administered for internal injuries as anti-inflammatory agent in cattle.	Anti-inflammatory	11
Zygophylaceae						
Peganum harmala L. M-ISL-16	Spenalay	Wild	Seeds	Paste is used as anti-inflammatory agent in sheep and goats.	Anti-inflammatory	15

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

Fig. 2. Images of some of the animals treated with medicinal plants

Table 3. Plant parts use in preparation of remedies

Used parts	*Number of uses*
Leaves	39
Flowers	13
Seeds	10
Stem	10
Fruits	8
Roots	7
Shoot	4
Aerial parts	4
Bulb	2
Oils	2
Whole plant	1
Resin	1

Table 4. Medicinal use and absolute value of plants in each category

Ailments	*Number of plant species used*
Digestive	22
Skin problems	10
Flatulence	9
Anthelmintic	7
Refrigerant	7
Diarrhea	4
Anti-inflammatory	4
Vigor	4
Colic pain	3
Galactagogue	3
Flu	3
Antidote	2
Anti-ulcerogenic	2
Abdominal pain	2
Urinary disorders	2
Antiseptic	2
Constipation	2
Digestive problems	2
Stomach disorders	1
Respiratory problems	1
Delivery	1
Control bleeding	1
Eggs production	1
Indigestion	1
Eye infection	1
Mouth sores	1
Antifungal	1
Analgesic	1

Relative Frequency of Citation and Use Value

Relative frequency of citation (RFC); and use value (UV) of medicinal plants was calculated ranging between (42.27) to (3.09) (Table 5).

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

Table 5. Medicinal use categories and plant species

Medical application	***Plant name***
Abdominal pain	*Artemisia absinthium* *Lactuca serriola*
Analgesic	*Impatiens lemannii*
Antidote	*Anaphalis acutifolia* *Seriphidium kurramensis*
Antifungal	*Sambucus nigra*
Anti-inflammatory	*Amaranthus viridis* *Daphne mucronata* *Peganum harmala* *Zingiber officinale*
Antiseptic	*Capsicum annuum* *Marrubium vulgare*
Antiulcergenic	*Astragalus spinosus* *Berberis lyceum*
Colic pain	*Foeniculum vulgare* *Hibiscus trionum* *Malva neglecta*
Constipation	*Amaranthus viridis* *Withania coagulans*
Control bleeding	*Glycyrrhiza glabra*
Delivery	*Brassica rapa*
Diarrhea	*Acer oblongum* *Ammi copticum* *Matricaria chamomilla* *Oxalis corniculata*
Digestive problem	*Dicliptera abuensis* *Ephedra gerardiana*
Eggs production	*Curcuma longa*
Eye infection	*Allium sativum*
Flu	*Morus alba* *Polygonum plebejum* *Tanacetum artemisioides*
Galactagogue	*Ficus carica* *Oryza sativa* *Sonchus oleraceus*
Indigestion	*Viola canescens*
Mouth sores	*Ajuga parviflora*
Refrigerant	*Artemisia absinthium* *Cannabis sativa* *Melia azedarach* *Mentha arvensis* *Mentha longifolia* *Myrtus communis* *Ziziphus nummularia*
Respiratory problem	*Glycyrrhiza glabra*
Stomach disorders	*Urtica dioica*
Urinary disorders	*Chenopodium album* *Silybum marianum*
Vigor	*Atriplex rosea* *Pinus gerardiana* *Piper angustifolium* *Potentilla gerardiana*

The highest relative frequency citation was found for *Sonchus asper* (42.27), followed by *Potentilla gerardiana* (31.96), *Ammi copticum* (31.96), *Glycyrrhiza glabra* (27.84), *Galium tricornutum* (25.77) *Scutellaria orientalis* (23.71). Lowest relative frequency of citation was recorded by *Astragalus spinosus* (3.09).

The highest use value was recorded for *Sonchus asper* (0.42) followed by *Glycyrrhiza glabra* (0.32), *Potentilla gerardiana*.(0.32), *Ammi copticum* (0.32), *Foeniculum vulgare* (0.27), *Seriphidium kurramensis* (0.26), *Galium tricornutum* (0.26), *Scutellaria orientalis* (0.24), *Brassica rapa* (0.24) (Table 6). *Atriplex crassifolia*, *Conyza aegyptiaca*, *Galium kurramensis*, *Sagittaria cuneata*, *Scabiosa olivieri*, *Sonchus oleraceus*, *Astragalus spinosus, Hisbiscu trionum*, *Malva parviflora*, *Olea ferruginea*, *Perovskia atriplicifolia*, *Pericardia barbata*, *Polygonum plebium*, *Potentilla johnstonii*, *Quercus semicarpifolia*, *Rununculus muricatus*, *Tanacetum artemisioides* were recorded for the first time in the study area.

Table 6. Frequency of citation, use value and relative frequency of citation of the reported species

Plant species	*FC*	*UV*	*RFC*
Acer oblongum Wall. ex DC.	20	0.21	21
Ajuga parviflora (L.) Roxb.	8	0.09	8
Allium cepa L.	13	0.13	13
Allium sativum L.	5	0.05	5
Amaranthus viridis L.	13	0.14	13
Ammi copticum L.	31	0.32	32
Anaphalis acutifolia Hand.-Mazz.	16	0.16	16
Artemisia biennis Willd.	12	0.12	12
Artemisia absinthium L.	10	0.13	10
Astragalus spinosus (Forssk) Muschl.	3	0.03	3
Atriplex rosea L.	21	0.22	22
Berberis lycium Royle	10	0.10	10
Brassica rapa L.	20	0.24	21
Calotropis procera (Aiton) Dryand.	7	0.07	7
Cannabis sativa L.	17	0.18	18
Capsicum annuum L.	16	0.18	16
Cedrus deodara (Roxb. ex D. Don) G. Don	12	0.12	12
Chenopodium album L.	12	0.15	12
Cichorium intybus L.	9	0.09	9
Clematis grata Wall	21	0.22	22
Conyza bonariensis L.	15	0.15	15
Curcuma longa L.	12	0.12	12
Daphne mucronata Royle	21	0.22	22
Datura stramonium L.	15	0.15	15
Dicliptera abuensis Blatt.	21	0.22	22
Ephedra gerardiana Wall. ex Stapf	12	0.12	12
Euphorbia helioscopia L.	11	0.11	11
Ficus carica L.	17	0.18	18

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

Foeniculum vulgare Mill.	18	0.27	19
Fumaria indica L.	15	0.15	15
Galium tricornutum Dandy	25	0.26	26
Glycyrrhiza glabra L.	27	0.32	28
Hibiscus trionum L.	10	0.15	10
Impatiens lemannii subsp. *kurramensis* Grey-Wilson	11	0.11	11
Lactuca serriola L.	11	0.11	11
Lathyrus aphaca (L.) Doll	13	0.13	13
Linum usitatissimum L.	9	0.09	9
Malva neglecta Wall.	9	0.09	9
Marrubium vulgare L.	18	0.19	19
Matricaria chamomilla L.	9	0.09	9
Melia azedarach L.	18	0.22	19
Mentha arvensis L.	11	0.14	11
Mentha longifolia L.	11	0.18	11
Morus alba L.	11	0.11	11
Myrtus communis L.	19	0.20	20
Olea ferruginea Royle	6	0.06	6
Oryza sativa L.	9	0.09	9
Oxalis corniculata L.	12	0.14	12
Peganum harmala L.	15	0.15	15
Perovskia atriplicifolia Benth.	8	0.08	8
Pinus gerardiana Wall	10	0.13	10
Pinus wallichiana A.B. Jacks.	15	0.15	15
Piper angustifolium Ruiz & Pav.	12	0.12	12
Plantago lanceolata L.	17	0.18	18
Plantago major L.	13	0.13	13
Polygonum plebejum R.Br.	12	0.12	12
Potentilla gerardiana Lindl. ex. Lehm Richardson.	31	0.32	32
Quercus semicarpifolia Smithin Rees.	21	0.22	22
Rosa webbiana Wall. ex Royle	17	0.18	18
Sagittaria cuneata E. Sheld.	21	0.22	22
Sambucus nigra L.	19	0.20	20
Scabiosa olivieri Coult.	17	0.18	18
Scutellaria orentalis Hedgeang & B. Wang	23	0.24	24
Seriphidium kurramensis (Qazilb) Y.R. Lin.	21	0.26	22
Setaria viridis (L.) P. Beauv.	12	0.12	12
Silene conoidea L.	13	0.13	13
Silybum marianum (L.) Gaertn.	15	0.15	15
Sisymbrium irio L.	17	0.18	18
Sonchus asper L.	41	0.42	42
Sonchus oleraceus L.	16	0.16	16
Tanacetum artemisioides Sch. Bip.ex Hook.f.	10	0.10	10
Taraxacum officinale Weber	14	0.14	14
Thymus linearis Benth. in Wall.	19	0.20	20
Urtica dioica L.	5	0.05	5
Verbascum thapsus L.	19	0.20	20
Vicia sativa L.	20	0.21	21
Viola canescens L.	15	0.15	15
Withania coagulans (Stocks) Dunal	16	0.16	16
Zea mays L.	9	0.09	9
Zingiber officinale Roscoe	11	0.11	11
Ziziphus nummularia (Burm. f.) Wight & Arn.	18	0.20	19

Discussion

In current study the number of male participants was higher due to ease of access while the number of female informants was less due to the culture of female concealment in the study area (Hussain *et al*, 2018). The wide use of identic common names indicates a broad transmission of indigenous knowledge of ethnoveterinary plants holding different uses (Hart and Bussmann, 2018). The results show that people above sixty years old had more knowledge concerning the traditional knowledge of use of medicinal plants for the cure of various ailments of domestic animals. Asteraceae was the most used plant family (Liu *et al.* 2009; Bonet 2003), congruent with its high species number and wide distribution (Mussarat *et al.* 2014). The broad use of Asteraceae species may also be linked to their chemical constituents, which are commonly used against microorganisms (Uncini *et al.* 2001). In this study the leading growth form of the medicinal species was herbs (67 %), shrubs (19 %) and trees (14 %). Herbs are often used due to ease of collection, and storage (Marwat 2008; Barboza *et al.* 2007). Leaves were the most used part of the plant due to ease of collection and high amount of active ingredients (Ahmad and Schroeder 2003).The high relative frequency some plants may allow researchers in related academic disciplines for future drug discovery (Khattak *et al.* 2015). These plants species should be prioritized for conservation as their preferred use may cause threats to their population by over harvesting.

The ethnobotanical studies survey in other parts of Pakistan and around the world also strengthens the traditional use of the reported plant in veterinary practices. *Allium cepa* bulb was used in skin inflammation in cattle and indigestion while this plant is used for cure of indigestion, colic pain and ear infection in other parts of Pakistan (Dilshad *et al.* 2010). The use of *Chenopodium album* as anthelmintic and for urinary problems in livestock in the study area agreed with the results of researchers from other parts of the World (Bilal *et al.* 2009; Gabalebatse *et al.* 2013;). *Chenopodium album* was also reported as being used for flatulence, as purgative, anti-jaundice, urinary tract infections, snake bite treatment, vegetables, fodder,

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

insecticides and pesticides in the Khyber Pakhtunkhwa Pakistan (Hassan *et al.* 2014;Butt *et al*. 2015;). Leaves and flowers of *Cannabis sativa* were dried and crushed and used as anodyne and for gonorrhea, pregnancy, lice, relished by horse and mules from Khyber Pakhtunkhwa (Tolossa *et al.* 2013; Adnan *et al.* 2015; Hassan *et al.* 2014;). *Foeniculum vulgare* is used as colic and in adjacent area it is used for cough in livestock (Raza *et al.* 2014). *Fumaria indica* has a significant usage in the study area and is widely known among local populations owing to its usage against flatulence in goats and in literature it is mentioned as wound healing agent, for cough, fever and abdominal disorders (Cowan 1999; Abbas *et al.* 2002;). *Taraxacum officinale* was used for skin problems while it was used for renal diseases and increase of milk production in cows in Naran Valley, Pakistan (Khan 2011). The fruits of *Withania coagulans* were given to domestic animals for constipation, while people of different ethnic communities living in Lesser Himalayas Pakistan used *Withania coagulans* for mammary gland infections in cows, sheep, goats and buffalo (Abbasi *et al*. 2013; Khattak *et al*. 2015;). Moreover, the plant was used as a treatment for abdominal pain, digestion, wound healing and against sunstroke, abdominal disorders (Mussarat *et al*.2014; Ahmad *et al*.2015;). *Zingiber officinale* was used as anti-inflammatory for internal injuries in the research area while it was used to cure cough and stomach ache in Faisalabad, Pakistan (Bilal *et al.* 2009).

To study relative cultural diversity of medicinal plants' uses in ethnoveterinary preparations, we compared our findings to different studies carried out in different tribal areas of Pakistan (Aziz *et al.* 2018 a,b). The most commonly used plant species reported in our study were also reported from South Waziristan District and Bajaur District. These plants included *Allium cepa, Allium sativum, Brassica rapa*, *Calotropis procera*, *Cannabis sativa, Chenopodium album*, *Cichorium intybus*, *Foeniculum vulgare*, *Mentha longifolia*, *Peganum harmala, Quercus semicarpifolia* and *Withania coagulans* (Aziz *et al.* 2018 a,b). Some differences in the use of these plants were found in both regions. *Allium cepa* was used as digestive in the study area while this plant was used for milk production in animals by Waziristanian communities and in the Bajaur District, where the plant was also used for stomach illness (Aziz *et al.* 2018 a,b). *Brassica rapa* seeds were commonly used for digestive problems in the research area while the same plant was used for cough in the Bajaur District and for skin infections in South Waziristan District, and in other regions it was used only against gastro-intestinal disorders. *Calotropis procera* extract mixed with sugar was used as anthelmintic and as cure for the digestive problems of cattle in the study area while this plant was used for joint pain in Waziristan District and the latex was used against skin problems in Bajaur District (Aziz *et al.* 2018 a,b). The probable reason for low consensus among the three regions in ethnoveterinary medicinal plants may be diverse socio-cultural values. Some plants in the current study were used in treatment of more than one ailment, e.g. *Oxalis corniculata* which was used as digestive and for diarrhea. Some herbal preparations used for livestock were made by a combination of two or more plants species by mixing ghee and sugar. Ingredients like sugar and ghee reduced the relative potency of the remedy (Jabbar *et al.* 2006). On the other hand, a search through the literature revealed that no such indication was found on the use of *Curcuma longa* as reported in this survey. The method of administration of ethnoveterinary plant remedies varied among different ethnic communities (Eswaran *et al.* 2013; Bharati 2012). For example, in the study area a decoction of *Pinus wallichiana* leaves were used for treatment skin problems while literature indicates that *P. wallichiana* resins can be used for gastrointestinal problems, skeletal and muscular ailments, dermatological, respiratory diseases (Farooq *et al*. 2008).

In the current survey, we observed that farmers, shepherds and aged community members were familiar with veterinary preparations, diagnosis and herbal therapies due to their close interaction with domestic animals. The uses of medicinal plants are still very common, although the use of some medicinal plants have been abandoned already (Hussain *et al*. 2018). The under-utilization of the local plants could be attributed to the limitations of infrastructure, communication, transport, markets, and increasing preferences towards allopathic medicines (Kunwar *et al*. 2012).

The indigenous people used medicinal plants not only for treatment of livestock but also for the food. Evaluation of the nutritional values of each ethnoveterinary plant species would be very interesting, and it would be important to check the biological efficacy through phytochemical, pharmacological, toxicological and clinical studies for wider application (Disler *et al*. 2014). The study reveals that most plants reported in this study are wild. The area is remote, and locals exploit the available natural resource including flora. But there is lack of conservation strategies in the area.

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

Therefore, it is recommended, that conservation strategies should be adopted for the protection of medicinal plants and traditional knowledge in the study area to maintain better health conditions of animals

Conclusions and Recommendations

In the Kurram district of Pakistan people practiced (82) medicinal plants to cure (28) livestock diseases. Asteraceae and Lamiaceae were the dominant botanical families and leaves (38%) were the most used plant parts. Most plant were used in problems of digestive systems as digestive(22), skin problems (10) and antiflatulence (8).

The frequently used plant species should be prioritized for conservation as their preferred use may cause threats to biodiversity. The study also specifies to maintain the indigenous cultural uses by preserving the indigenous medicinal plants and associated knowledge.

Declarations

Abbreviations

MP: Medicinal Plants; FC; Frequency Citation, RFC; Relative Frequency Citation, UV: Use Value; UVi: the number of citations for a species across all informants; Ni: the number of informants.

Ethical approval and consent to participate

The project was approved by the ethics committee at the Department of Plant Science Quaid-i-Azam University Islamabad and a permission letter was taken from the local administration office prior to the data collections. Oral prior informed consent was also obtained from the local informants prior to the interviews.

Consent for publication

We have obtained oral consent from the locals to publish the information they shared in this research.

Availability of data and materials

All the supporting data is available in the “Appendix” as a supplementary information file.

Competing interests

The authors declared that they have no competing interest.

Author’s contributions

MA conducted and collected the field data and wrote the initial draft of the manuscript and, AA assisted in the revision of manuscript. WH participated in the field survey. MA worked with the taxomist in identification of plants. MU AA, SA, HH, RB and JW helped in data analysis and in revision of the manuscript. All the authors approved the final manuscript after revision.

Acknowledgments

The authors acknowledged the Deanship of Scientific Research at King Saud University for financial support through the Research Group Project no. RGP-VPP-275. And are also thankful to Professor Andrea Pieroni, University of Gastronomic Sciences, Bra, and Pollenzo, Italy for evaluation of the manuscript.

Literature cited

Abbasi AM, Khan SM, Ahmad M, Khan MA, Quave CL, Pieroni A. 2013. Botanical ethnoveterinary therapies in three districts of the Lesser Himalayas of Pakistan. Journal of Ethnobiology and Ethnomedicine 9(1): 84.

Adnan M, Tariq A, Mussarat S, Begum S, Abd el Salam NM, Ullah R. 2015. Ethnogynaecological Assessment of Medicinal Plants in Pashtun’s Tribal Society BioMedical Research International 9.

Ahmad K, Ahmad M, & Weckerle C. 2015. Ethnoveterinary medicinal plant knowledge and practice among the tribal communities of Thakht-e-Sulaiman hills, west Pakistan. Journal of Ethnopharmacology 170: 275-283.

Ahmad S, Schroeder RG. 2003. The impact of human resource management practices on operational performance: recognizing country and industry differences. Journal of Operations Management 21(1): 19-43.

Ali S, Qaiser M. 1995. Flora of Pakistan. Department of Botany, University of Karachi, Pakistan.

Ayeni EA, Basiri B. 2018. Ethnoveterinary survey of plants used in treating livestock among the Fulani people of Girei, Adamawa State, Nigeria. World News of Natural Sciences 16: 53-66.

Aziz M.A, Khan AH, Adnan M, Ullah H. 2018. Traditional uses of medicinal plants used by Indigenous communities for veterinary practices at Bajaur Agency, Pakistan. Journal of Ethnobiology and Ethnomedicine 14(1): 11.

Barboza RR, De MS, Souto W, Da S Mourão J. 2007. The use of zootherapeutics in folk veterinary medicine in the district of Cubati, Paraíba State, Brazil. Journal of Ethnobiology and Ethnomedicine 3(1): 32.

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

Bharati KA, Sharma BL. 2012. Plants used as ethnoveterinary medicines in Sikkim Himalayas. Ethnobotany Research and Applications 10: 339-356.

Bilal MS, Muhammad G, Atif FA, Hussain I. 2009. Ethnoveterinary practices of buffalo owners regarding mastitis in Faisalabad. International Journal of Applied Agricultural Sciences 1: 93-97.

Bullitta S, Re GA, Manunta MDI, Piluzza G. 2018. Traditional knowledge about plant, animal, and mineral-based remedies to treat cattle, pigs, horses, and other domestic animals in the Mediterranean island of Sardinia. Journal of Ethnobiology and Ethnomedicine 14(1): 50.

Bonet MA, Valles J. 2003. Pharmaceutical ethnobotany in the Montseny biosphere reserve (Catalonia, Iberian Peninsula). Genera results and new or rarely reported medicinal plants. Journal of Pharmacy and Pharmacology, 55(2): 259-270.

Butt MA, Ahmad M, Fatima A, Sultana S, Zafar M, Yaseen G, Ashraf MA, Shinwari ZK, Kayani S. 2015. Ethnomedicinal uses of plants for the treatment of snake and scorpion bite in Northern Pakistan. Journal of Ethnopharmacology 168: 164-181.

Cowan MM. 1999. Plant products as antimicrobial agents. Clinical Microbiology Review 12: 564-582.

Dilshad SR, Rehman NU, Ahmad N, Iqbal A. 2010. Documentation of ethnoveterinary practices for mastitis in dairy animals in Pakistan. Pakistan Veterinary Journal, 30(3): 167-171.

Disler M, Ivemeyer S, Hamburger M, Vogl CR, Tesic A, Klarer F, Walkenhorst M. 2014. Ethnoveterinary herbal remedies used by farmers in four north-eastern Swiss cantons (St. Gallen, Thurgau, Appenzell Innerrhoden and Appenzell Ausserrhoden). Journal of Ethnobiology and Ethnomedicine, 10(1): 32.

Eswaran S, Boomibalagan P, Rathinavel S. 2013.Ethnoveterinary medicinal practices of the villagers of UsilampattiTaluk of Madurai district, India. International Journal of Botany 9: 37-43.

FAO. 2002 Genetics and animal health Spotlight. Rome.

Farooq Z, Iqbal Z, Mushtaq S, Muhammad G, Iqbal MZ, Arshad M. 2008. Ethno veterinary practices for the treatment of parasitic diseases in livestock in Cholistan desert Pakistan. Journal of Ethnopharmacology 118: 213-219.

Gabalebatse M, Ngwenya BN, Teketay D, Kolawole OD. 2013. Ethno-veterinary practices amongst livestock farmers in Ngamiland District, Botswana. African Journal of Traditional, Complementary and Alternative Medicines 10(3): 490-502.

Godambe VP. 1982. Estimation in survey sampling: robustness and optimality. Journal of the American Statistical Association 77(378): 393-403.

Hart R, Bussmann R. 2018. Trans-Himalayan Transmission, or Convergence? Stauntonia (Lardizabalaceae) as an Ethnoveterinary Medicine. Medicina nei Secoli 30(3): 929-948.

Hussain W, Badshah L, Ullah M, Ali M, Ali A, Hussain F. 2018. Quantitative study of medicinal plants used by the communities residing in Koh-e-Safaid Range, northern Pakistani-Afghan borders. Journal of Ethnobiology and Ethnomedicine 14(1): 30.

Hussain W, Ullah M, Dastagir G, Badshah L. 2018. Quantitative ethnobotanical appraisal of medicinal plants used by inhabitants of lower Kurram, Kurram agency, Pakistan. Avicenna Journal of Phytomedicine 8(4): 313.

Jabbar A, Raza MA, Iqbal Z, Khan N. 2006. An inventory of the ethnobotanicals used as anthelmintics in the southern Punjab (Pakistan). Journal of Ethnopharmacology 108: 152-154.

Khan MA, Khan MA, Mujtaba G, Hussain M. 2012. Ethnobotanical study about medicinal plants of Poonch valley Azad Kashmir. Journal of Animal and Plant Sciences 22: 493-500.

Khattak NS, Nouroz, F, Rahman IU, Noreen S. 2015. Ethno veterinary uses of medicinal plants of district Karak, Pakistan. Journal of Ethnopharmacology 171: 273-279.

Kunwar RM, Mahat L, Sharma LN, Shrestha KP, Kominee H, Bussmann RW. (2012). Underutilized plant species in far west Nepal. Journal of Mountain Science. 19(5): 589-600.

Lans C, Turner N, Khan T, Brauer G, Boepple W. 2007. Ethnoveterinary medicines used for ruminants in British Columbia, Canada. Journal of Ethnobiology and Ethnomedicine, 3(1): 11.

Liu YC, Dao ZL, Yang CY, Liu YT, Long CL. 2009. Medicinal plants used by Tibetans in Shangri-la, Yunnan, China. Journal of Ethnobiology and Ethnomedicine 5: 15.

Marwat SK. 2008. Ethnophytomedicines for treatment of various diseases in DI Khan district. Sarhad Journal of Agriculture 24(2): 305-315.

McCorkle CM, Green EC. 1998. Intersectoral healthcare delivery. Agriculture and Human values, 15(2): 105-114.

Mussarat, S, Amber R, Tariq A, Adnan M, Abd el Salam NM, Ullah R, Bibi R. 2014.

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

Ethnopharmacological assessment of medicinal plants used against livestock infections by the people living around Indus river. BioMed Research International, 2014.

Nfi AN, Mbanya JN, Ndi C, Kameni A, Vabi M, Pingpoh D, Yonkeu S, Moussa C. 2001. Ethnoveterinary medicine in the northern provinces of Cameroon. Veterinary Research Communications25 (1): 71-76.

Njoroge GN, Bussmann RW. 2006. Herbal usage and informant consensus in ethnoveterinary management of cattle diseases among the Kikuyus (Central Kenya). Journal of Ethnopharmacology, 108(3): 332-339.

Phillips O, Gentry AH. 1993. The useful plants of Tambopata, Peru: I. Statistical hypotheses tests with a new quantitative technique. Economic Botany, 47(1): 15-32.

Pica-Ciamarra U, Baker D, Morgan N, Zezza A, Azzarri C, Ly C, Sserugga J. 2014. Investing in the Livestock Sector: Why Good Numbers Matter, A Sourcebook for Decision Makers on How to Improve Livestock Data. World Bank.

Salgotra RK, Zargar SM, Sharma M, Sood M. 2018. Traditional Knowledge: A Therapeutic Potential in the Scenario of Climate Change for Sustainable Development. Development 1-9.

Saltan FZ, Ozaydin O. 2013. Ethnobotany of Eskisehir and its environs. Pakistan Journal of Botany 45(1): 207-214.

Sindhu ZU D, Iqbal Z, Khan M N, Jonsson N N and Siddique M. 2010. Documentation of ethnoveterinary practices used for treatment of different ailments in a selected hilly area of Pakistan. International Journal of Agriculture and Biology 12(3): 353-358.

Tariq A, Mussarat S, Adnan M, Abd el Salam NM, Ullah R, Khan AL. 2014. Ethnoveterinary study of medicinal plants in a tribal society of Sulaiman range. The Scientific World Journal, 2014.

Tolossa K, Debela E, Athanasiadou S, Tolera A, Ganga G, Houdijk JG. 2013. Ethno-medicinal study of plants used for treatment of human and livestock ailments by traditional healers in South Omo, Southern Ethiopia. Journal of Ethnobiology and Ethnomedicines 9 (1): 32.

Tongco MDC. 2007. Purposive sampling as a tool for informant selection. Ethnobotany Research and Applications 5: 147-158.

ul Hassan H, Murad W, Tariq A, Ahmad A. 2014. Ethnoveterinary study of medicinal plants in Malakand Valley, District Dir (Lower), Khyber Pakhtunkhwa, Pakistan. Irish Veterinary Journal, 67(1): 6.

Ullah M, Mehmood S, Ali M, Bussmann RW, Aldosari A, Khan RA, Ullah R, Hussain W, Shah MAR. 2019. An ethnopharmacological study of plants used for treatment of diabetes in the Southern and Tribal regions of Khyber Pakhtunkhwa province, Pakistan. Ethnobotany Research and Applications 18: 1-20.

Ullah M, Khan MU, Mahmood A, Malik RN, Hussain M, Wazir SM, Daud M, Shinwari ZK. 2013. An ethnobotanical survey of indigenous medicinal plants in Wana district south Waziristan agency, Pakistan. Journal of Ethnopharmacology 150(3): 918-924.

Uncini Manganelli RE, Camangi F, Tomei PE. 2001. Curing animals with plants: traditional usage in Tuscany (Italy). Journal of Ethnopharmacology 78: 171-191.

Zia-ud-Din S, Zafar I, Khan MN, Jonsson NN, Muhammad S. 2010. Documentation of ethnoveterinary practices used for treatment of different ailments in a selected hilly area of Pakistan. International Journal of Agriculture and Biology, 12(3): 353-358.

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19

Annex 1

Questionnaire for documentation Veterinary Practices at Kurram District, Pakistan

Informant's Consent for Participation in Study

I……. (Name of Informants) thus give my full agree and cognizant to take an interest in the study and proclaim that to the best of my insight the data I have given are valid, exact and finish.

Date……

(Signature……..)

A: Informant' Details

● Name……

●Gender…….

●Age……..

●Occupation…….

●Education……...

●Location/Residence……..

●Description of locality/GPS……..

B; Information about medicinal plants

Local plant name……

Habit of plant (tree/Herb/Shrub/Climber)……

Plant Value (Medicinal/Food/ Fuelwood)/miscellaneous……

Name of diseases(s) treated……..

Method of crude drug preparation…….

Folk recipes of plants and dosage…….

Published: 10 July 2019

http://dx.doi.org/10.32859/era.18.24.1-19