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Original Article

Traditional knowledge about medicinal plant in the remote areas of Wari Tehsil, Dir Upper, Pakistan

Conhecimento tradicional sobre plantas medicinais nas áreas remotas de Wari Tehsil, Dir Upper, Paquistão

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Abstract

Traditional medicine is cheaper and easily available to local people, to care for most frequent diseases in the Northern parts of Pakistan. Our study aimed at inventorying medicine from local plants, documenting their uses, and assessing their market value in 2015-2018 during spring, summer, and winter seasons. A total of 15 trips were made, 5 in each season. Semi-structured interviews with 165 inhabitant's age range between 20-80 years were conducted, analyzed the data is analyzed using Relative frequency of citation(RFC), Use Value(UV), Fidelity Level(FL), Informants consensus factor(ICF), and Jaccard index(JI) to find the most frequent and well-known used species in the area. A total of 86 species belonging to 39 vascular plant families, 33 genera were documented as medicinally important. Family Asteraceae was observed as the dominant family among all the families with 10 species, the leaf was the most used parts and decoction 36% was the most preferred preparation type. Herb was the predominant life form (67%). The maximum UV (0.92) was demonstrated by *J. adhatoda* L. species, while *A. sativum* L. shows maximum RFC (0.58), the highest ICF value represented by diarrhea and dermatitis 0.92, and high FL value is recorded 100%. According to our collections, wild species were 45%, invasive species were 38% and cultivated 17% recorded, dicots species were recorded more 81%. Seven 7 medicinal species is being economically important and export to the local and international market of the world, whereas *P. integrima* L. species were the most exported species according to the local dealers. The investigated area is rural and the local people depend on the area's plants for their health needs, and other uses like a vegetable, fuelwood, fodder, etc. The current result of RFC, UV, ICF, FL, and JI shows that medicinal flora needs to be pharmacologically and phytochemically investigated to prove their efficacy. The documentation of medicinal knowledge is important to preserve this precious old knowledge before it is lost forever, due to technological and environmental changes in the world.

Keywords: medicinal plants, economic values, quantitative study, Tehsil Wari, Pakistan.

Resumo

A medicina tradicional é mais barata e facilmente disponível à população local para cuidar das doenças mais frequentes nas áreas do norte do Paquistão. Nosso estudo teve como objetivo inventariar medicamentos de plantas locais, documentar seus usos e avaliar seu valor de mercado em 2015-2018 durante as temporadas de primavera, verão e inverno. Foram feitas 15 viagens, 5 em cada temporada. Foram realizadas entrevistas semiestruturadas com 165 moradores na faixa etária de 20 a 80 anos, com dados analisados por meio de frequência relativa de citação (RFC), valor de uso (UV), nível de fidelidade (FL), fator de consenso de informantes (CIF), e o índice de Jaccard (JI) para encontrar as espécies utilizadas mais frequentes e conhecidas na área. Um total de 86 espécies pertencentes a 39 famílias de plantas vasculares, 33 gêneros foram documentados como medicamente importantes. A família

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Asteraceae foi observada como a família dominante entre todas as famílias com 10 espécies, a folha foi a parte mais utilizada e a decocção 36% foi o tipo de preparação mais preferido. A erva foi a forma de vida predominante (67%). O UV máximo (0,92) foi demonstrado pelas espécies de *J. adhatoda L.*, enquanto *A. sativum L.* mostra RFC máximo (0,58), o maior valor de ICF representado por diarreia e dermatite 0,92, e alto valor de FL é registrado 100%. De acordo com nossas coleções, as espécies selvagens foram 45%, as espécies invasoras 38% e as cultivadas 17% registradas, as espécies dicotiledôneas foram registradas mais 81%. Sete espécies medicinais estão sendo economicamente importantes e exportadas para o mercado local e internacional do mundo, enquanto as espécies de *P. integrima L.* foram as espécies mais exportadas de acordo com os comerciantes locais. A área investigada é rural e a população local depende das plantas da área para suas necessidades de saúde e outros usos como vegetal, lenha, forragem etc. O resultado atual de RFC, UV, ICF, FL e JI mostra que a flora medicinal precisa ser investigada farmacológica e fitoquimicamente para comprovar sua eficácia. A documentação do conhecimento medicinal é importante para preservar esse precioso conhecimento antigo antes que se perca para sempre, devido às mudanças tecnológicas e ambientais do mundo.

Palavras-chave: plantas medicinais, valores econômicos, estudo quantitativo, Tehsil Wari, Paquistão.

1. Introduction

Ethnobotany is a useful relationship between human beings and vegetation within their environment and its medicinal uses. Ethnobotany is the study of a particular culture and region and the uses of plants for various purposes like medicine, food, shelter, and clothing, etc. (Shuaib et al., 2014) uses in the ethnobotanical society. Both highlight the relationship between societies and their environments. The indigenous use of medicinal flora is very important culturally and scientifically as well (Murad et al., 2012).

Traditional medicine was used in most countries of the World for thousands of years (Seifu, 2004). According to the World Health Organization's [WHO] report, 60% of the World's populations depend on herbal and traditional medicine, and 85% of the World's developing countries use traditional medicine in caring for diseases. Traditional medicine is used mostly in rural communities and underdeveloped countries. Plants are the basis for traditional medicine in developing countries all over the World. Plant-based medicine goes back 100,000 years (Razzaq et al., 2013). Throughout the World, herbal medicine has been used for the mitigation, prevention, treatment and management of various ailments since prehistoric times.

Ethnobotany of Pakistan and Khyber Pakhtunkhwa [KPK]: Pakistan occupies a unique position among all the developing countries and it has a great many different varieties of medicinal plants due to various adoption and climatic factors (Shuaib et al., 2019). Pakistan is bestowed with precious biodiversity which is categorized into nine major ecological zones. All these zones contain a lot of precious medicinal flora (Abbasi et al., 2010). It has been reported that about 12% of all the vascular plants in Pakistan are medicinally utilized (Shinwari, 2010; Ali et al., 2019b). There are also varieties of medicinal plants in the Northern and Western parts of Pakistan. Pakistan has diverse flora and about 7000 plant species are present 1, 70,000 plant species are identified. Pakistan has more than 6000 varieties of higher plants (Ali and Qaiser, 2009). Many Pakistani floras are medicinally important and are used in caring for various diseases. In early Pakistan, around 1950, 87% of the population of Pakistan was dependent on traditional medicine (Ali et al., 2019a).

In Pakistan, traditional medicine systems are dominant in rural areas (Ahmad et al., 2003; Ali and Qaiser, 2009). There are 39,800 traditional doctors of medicine and 130,000 homeopaths registered in Pakistan. There are about 501 dispensaries and clinics providing traditional medicine to the people, 300 medicinal companies are working to make preparations of herbal medicine (Ahmad et al., 2003; Hussain et al., 2009). From the Margalla Hills, 160 medicinal plant species were found and their traditional uses and conservation were reported by (Shinwari and Khan, 2000), from the Kahuta district and Rawalpindi, 25 medicinal types of flora were found. Their traditional uses and were listed (Qureshi and Khan, 2001). A total of 124 plant uses were listed from Quetta, Chiltan National Park (Durrani et al., 2010). Seventy-two plant species were reported from Birma, South Waziristan (Farooq et al., 2012). Ninety vascular plant species, belonging to 56 families from the Hazar Nao forest of Malakand were recorded (Murad et al., 2012). Fifty-two plant species and their traditional uses from the Derro Pezo district of Lakki Marwat were noted (Zahoor et al., 2009). A large number of ethnobotanical surveys have been carried out in the Khyber Pakhtunkhwa (KPK) (Begum et al., 2005; Ibrar et al., 2007; Sher and Hussain, 2009; Shinwari et al., 2003).

The whole area of district Dir is covered by forest and is a mostly mountainous area (Shuaib et al., 2018). The research area has diverse flora and is rich in medicinal plants. The local people used these plants as remedies for various ailments. The research area has some unique biodiversity rich in species of fungi, Pteridophytes, Monocots, and Dicots, due to the presence of the Himalayas, and the Karakorum and Hindukush mountain ranges (Hamayun, 2003). Ethnobotanical studies were made in different parts of the districts, Dir Lower and Dir Upper. From Dir Lower, in Tehsil Balambat (Shuaib et al., 2014), they collected 40 medicinal plants belonging to 30 families which were used for various purposes. The same results were had in the Lower Dir Malakand valley. (Habib-Ul-Hassan et al., 2015), from the Jandool valley (Nisar and Ali, 2012), from Barawal Bandi (Hussain et al., 2014), and from the Kohistan valley (Jan et al., 2011). The current research highlights the local medicinal uses of plant in the area, medicinal values, novel uses, economic importance and transport of various medicinal plants to local and international markets, local herbal medicine, for some novel plant uses. The research area Tehsil Wari rich in plant wealth, so this study was undertaken to record the traditional knowledge and to prepare an inventory of traditional medicine for the future.

2. Materials and Methods

2.1. Study area

The study area is called Wari and is situated in the East of District Dir upper. Wari is the name of an administrative division called tehsil which comprises villages and mountains; among the major villages are Matar, Jagam, Cheaper, Nehagdara, Proper Wari, and two mountains Skyland and Karoo. Tehsil Wari is located at 34°59'52.73" N 72°04'22.62"E, with an average altitude of 975m and 3200feets Figure 1. The study area is rural and has no education and health facilities. The district headquarters hospital (DHQ) is about 60 kilometers from the current area of tehsil Wari. The two universities are at a distance of 140 and 200 Kilometers from the local area. Dir upper has a total of 6 tehsils and our work is focused on tehsil Wari. District Dir lies in the Khyber Pakhtunkhwa province KPK, Pakistan. The village of Dir was called the headquarters of former rulers. District Dir was divided into two districts in 1996, Dir Lower and Dir Upper. Districts Dir Upper lies between 35-04 degrees and 35-46 degrees North latitude, and 71-32 to 72-22 degrees East longitude. The total area of Dir Upper is 3,699Km^2 and the total population is about 760,000. Dir Upper has boundaries on its East side with District Swat, Northside, District Chitral, on the Southside, District Dir Lower, and the Westside, Bajaur Agency. Dir Upper has two main subdivisions called Dir and Wari. This variable and unique habitat have diverse geological climatic and ecological conditions, with its traditions and culture. Geographical features of the reported area resulted in its constant dependence on natural resources and indigenous knowledge to fulfill the needs of its people. The current study aims to documents the diverse indigenous knowledge on the medicinal flora of the previously unexplored area of tehsil Wari upper Dir viz, Matar, Jagam, Cheapar, Nehagdara, Proper Wari, and two mountains Skyland and Karoo.

2.2. Socioeconomic background of participants

The inhabitants of the study area are Pathans and speaking Pushto language, and belong to Yousafzai tribes, who come as invaders from Afghanistan in the sixteenth century (Barth, 1981). The inhabitants in plain zones are genuinely educated and the youthful era in specific is outfitting in such manner. The plain zones are similarly more created furnished with better education and hospitals. In the mountains, areas are true without essential facilities like hospitals, education, and transport. By and large, the general populations of the study area are for the most part ranchers and dependent on wild plants as vegetables, fruits significantly as a drug. The most imperative products of the territory are wheat, maize, rice, onion, and some other vegetables. Among the vegetable spinach, mustard, turnip, radish, okra, and gourds are imperative. Peach, plum and persimmon are imperative business products of the range. Occupants of the zone

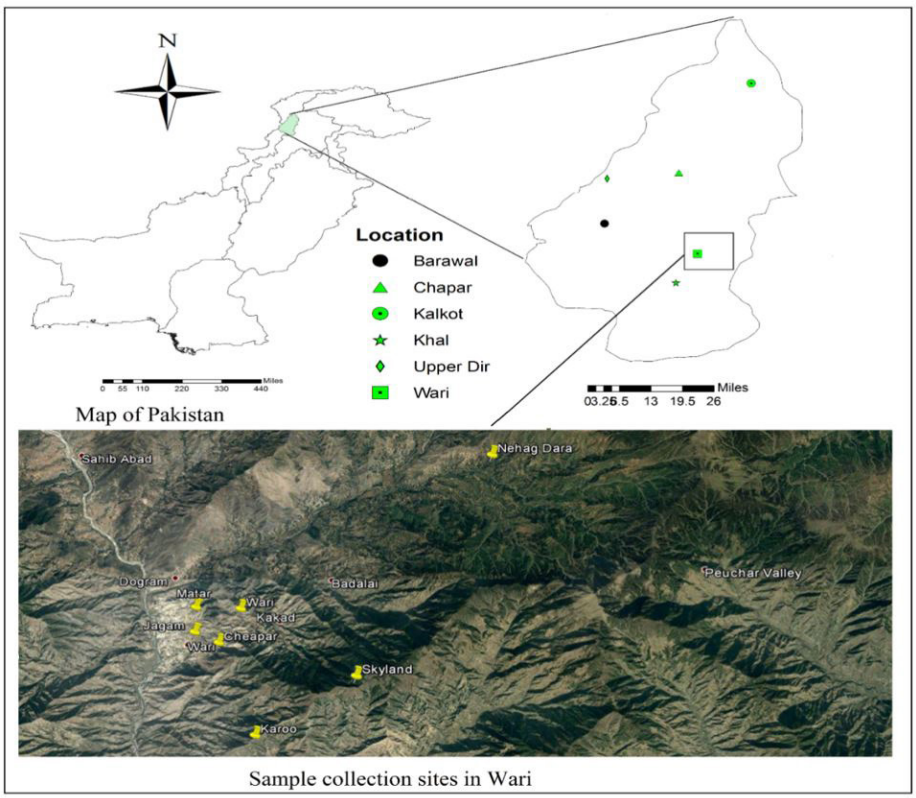

Figure 1. Map of the study area tehsil Wari, and details mentions all the collection areas.

use wild organic products, for example, types of *Pyrus, Rubus, Ficus*, and *Ziziphus* and so forth for neighborhood and business utilize. Additionally, types of numerous genera, for example, *Medicago, Chenopodium, Amaranthus, Nasturtium, Dryopteris, Rumex, Stellaria*, and Malva are to a great extent utilized as wild vegetables and sent out to the nearby market.

2.3. Data collection and identification

Tehsil Wari is repeatedly visited in 2015-2018, for the collection of plant specimens, the collections of medicinal, ethnobotanical, conservation and plant biodiversity data. The research projects were completed in two phases, a) Field and hill trips for plant collection and b) documentation of the data obtained on the trips. During the trips to the fields and hills, random visits were completed to observe the flora, interviews of native people were also conducted with proper questionnaires, and plant biodiversity was observed in Wari, Dir Upper. Muhammad Shuaib author of paper belongs to the local area doing the fields and mountains trips and collected the species. Dr. Fida Hussain (Taxonomist) and Dr. Ikramullah Khan identifies the species. The plant nomenclature is updated using the world checklist of the selected families (Kew Science WCSP, 2021) in the present paper follows the flora of Pakistan (Tropics, 2021). The online database "The Plant List" were used for the validation of accepted and updated Latin names of species and their families (The Plant List, 2013). To understand the plant diversity within the Wari, all the available species i.e. fungi, pteridophytes, gymnosperms, and angiosperms, were collected throughout the field survey. The collected flora was pressed and mounted, while fungi and pteridophytes were preserved in bottles, after thorough washing and cleaning. All the species were identified with the available literature (Ali and Qaiser, 1993; Nasir and Ali, 1971; Stewart, 1967).

2.4. Observation and documentation of the research data

Extensive field trips were made to get insight into the practices of the local community, regarding the uses of local flora. During the field surveys, we observed much about the local flora, plant diversity, conservation, mode of collection, drying techniques, methods of preservation, mode of administration, harvesting times, parts used, medicinal uses, ethnobotanical uses, and how plants were processed. The local men, women, herbalists, marketers, and others who were familiar with the local flora were interviewed during the fieldwork; the data is shown in (Table 1). The participatory and qualitative data were collected through questionnaires, regarding the plant uses and their manner of consumption. The information collected on each plant included botanical name, local name, family, partly used, habit, species habitat, harvesting season, mode of utilization and medicinal uses. Thus the knowledge of the native people regarding their plant assets, the plant uses, religious and cultural aspects, and the conservation status of the flora was documented.

Table 1. Demographic analysis of the participants investigated.

S. No	Variable	Categories	No. of persons	Percentage (%)
1	Experience	Indigenous people	161	97
		Traditional health Practitioner (Herbalists)	4	3
2	Gender	Male	115	70
		Female	60	30
3	Age	Less than 20	10	6
		20-30	38	23
		30-40	50	30
		40-50	35	21
		50-60	22	13
		60-75	10	6
4	Religion	Muslims	165	100
		Hindu	0	0
		Christian	0	0
5	Education	Illiterate	60	36
		Primary	28	17
		Middle	20	12
		Secondary passed	27	16
		Higher secondary	19	12
		Undergraduate	09	06
		Post graduate	02	1.2

2.5. Economic value of Dir Upper Wari

Wari Dir Upper is rich in varieties of flora and has a diverse habitat. The flora is economically very important to the local people, who use it in caring for various diseases. Herbalists make traditional medicines which are the most common way available for caring for the most frequent diseases. The regional plant dealers sell the plants to local markets and export them to the International market as a way of earning money.

2.6. Data analysis

2.6.1. Relative frequency citation (RFC)

The collected ethnobotanical data were quantitatively analyzed using the Relative Frequency Citation (RFC) index. This indicator shows the local importance of each species and is calculated from the frequency of citation (FC, the number of informants mentioning the usage of the species) divided by the total number of informants in the survey (N), without considering the use categories (Kayani et al., 2014).

RFC can be defined by Formula 1

$$\mathbf{RFC} = \frac{\boldsymbol{Fc}}{\boldsymbol{N}} \quad (1)$$

The value ranges from zero (none of the informants cites the plant as useful) to one (every informant report the plant to be useful) (Sadeghi et al., 2014).

2.6.2. Use Value (UV)

The Use Value (UV) demonstrates the relative importance of locally known plants (Ong and Kim, 2014). It is calculated using Formula 2

$$\mathbf{UVi} = \frac{\sum \boldsymbol{UVi}}{\boldsymbol{N}} \quad (2)$$

Where Ui is the number of use mentioned by each informant for a given species and N is the total number of informants

2.6.3. Informants consensus factor (ICF)

ICF is used to measure the homogeneity of information among the informants regarding particular types of ailment categories in Formula 3 (Kadam and Bhalerao, 2010).

$$\mathbf{ICF} = \frac{\boldsymbol{nur} - \boldsymbol{nt}}{\boldsymbol{nur} - 1} \quad (3)$$

Where **"nur"** denotes the number of users report for particular ailment categories. **"nt"** the number of taxa used for a particular use category by all informants. The ICF results range from 0 to 1. The high value close to 1 means that taxa are used by large proportions of the informants for numbers of related broad categories, whereas the low value close to 0 means the plant species is randomly chosen for few or single conditions or the informants did not share information about the use of plants (Sharma et al., 2012).

2.6.4. Fidelity Level (FL)

Since many plant species may be used for some disease, so it is important to find the most frequently used species (Musa et al., 2011) which is calculated through FL formulated by (Friedman et al., 1986) in Formula 4.

$$\mathbf{FL}\ (\%) = \frac{\mathbf{Ip}}{\mathbf{Iu}} \quad (4)$$

Where "I_p" is the number of informants who provided information's about the use of species for particular ailment categories. And "I_u" the number of informants starting the use of the plant for any ailment category. High FL value (near to 100%) obtained from the plant for which almost used report refer to the same category, whereas the low FL value obtained for the plant that is used for different disease category (Musa et al., 2011). Similarly, the high FL value confirms high usage of the plant species for a particular ailment. While low FL value confirms the wide range of medicinal uses but with a low frequency for each ailment.

2.6.5. Jaccard index (JI)

Ethnobotanists calculate the JI for comparison of the documented data with previously published data collected from the adjoining area (Zahoor et al., 2017). Jaccard index (JI) is calculated by using the following Formula 5.

$$JI = \frac{\mathbf{C} \times 100}{(\mathbf{a} + \mathbf{b}) - \mathbf{c}} \quad (5)$$

Where "a" is the number of species of area A (Matar, Jagam, Cheapar, Nehagdara, Proper Wari, and two mountains Skyland and Karoo) and "b" is the number of species in area B, which includes Kohistan valley, Sheringal valley, Chitral, Gilgit Baltistan, Swat valley, Malakand valley, Jandool valley, Lower Dir, Kabal Swat valley, Barawal valley, Bunner valley, Abbottabad, Khyber agency, Mangowal District Gujrat Panjab, Hafizabad, Panjab and "c" the number of species common in both A and B.

2.6.6. Data analysis

The data about medicinal plant collect through a questionnaire from the local peoples and healers, then analyzed through FC, RFC, UV, ICF, FI, and JI. The area map developed through GIS, and the figure developed through RAW GRAPHS (Mauri et al., 2017). Descriptive Statistics use for describing, presenting, summarizing and organizing data, either through numerical calculations or graphs or tables. RAW Graphs is an open-source data visualization framework built to make the visual representation of complex data easy for everyone. Mauri et al. (2017) Alluvial diagrams which allow representation flows and to see correlations between categorical dimensions, visually linking to the number of elements sharing the same categories. It is useful to see the evolution of a cluster (such as the number of people belonging to a specific group). It can also be used to represent bipartite graphs, using each node group as dimensions. Used a scatter plot, it is a type of mathematical diagram using Cartesian coordinates to display values for two variables for a set of data. The data is displayed as a collection of points, each having the value of one variable determining the position on the horizontal axis and the value of the other variable determining the position on the vertical axis. This kind of plot is also called a scatter chart, scattergram, scatter diagram, or scatter graph. Used Dendrograms, they are tree-like diagrams used to represent the distribution of hierarchical clustering. The different depth levels represented by each node are visualized on the horizontal axes and it is useful to visualize a non-weighted hierarchy. Used a bar chart that presents grouped data with rectangular bars with heights proportional to the values that they represent.

3. Results and Discussion

The current investigations are one of the very populated ranges of Tehsil Wari which stayed unexplored in the past investigations. From Tehsil Wari, this is the first comprehensive documentation of medicinal species.

3.1. Demographic data of tehsil Wari

The ethnobotanical research was conducted in Tehsil Wari, Dir Upper in 2013-2015 during spring, Summer, and Winter seasons. A total of 15 fields and mountain trips were made, 5 in each season. In the present study, semi-structured interviews with 165 inhabitant's age range between 20-80 years were conducted in (Table 1). Among the 165 informants mostly were indigenous people, having 97% were local peoples and 3% were traditional health practitioner (herbalist), 70%

male and 30% female represents (Table 1). At the age of 30 to 40 years represents more people having 30%. Due to Lack of educational facilities illiterate ratio was more in the local area having 36%. Many informants had an education with primary education 17%, middle and high secondary education were 12%, secondary education passed 16%, undergraduate education is 6%, and postgraduate education has less ratio 1.2% (Table 1). The local community of people is Muslims 100%, Hindu 0%, and Christian 0%. Majority of people in the local area is speaking Pushto Language. Despite the changing trends towards moderns synthetic medicine, most people like and prefer herbal medicine because to avoid the side effects of modern medicine (Gilani and Atta-ur-Rahman, 2005; Shah et al., 2016; Shinwari, 2010).

3.2. Medicinal plant diversity

The study area falls in the moist temperate climatic region having rich floral diversity. The area represents large numbers of medicinal species. The diversity shows 86 medicinal species out of that Dicots were recorded 81%, followed by Monocots 8%, Gymnosperms 5%, Pteridophytes 4%, and fungi 2% (Figure 2).

3.3. Parts of medicinal plants for curing diseases

In the current medicinal plants survey Whole plants were utilized most frequently for medicinal purpose 31(36%) uses were reported, followed by 25(31%) leave only uses, 14 (16%) fruit uses, 13(15%) uses of wood, 7(8%) uses of seeds, 6(7%) flower uses, 5(6%) uses of roots and shoot each, 4 (5%) uses of bark, 3(4%) each uses of stem and resins, 2(2%) each uses of cones, rhizome, and capsule, while 1(1%) each uses of frond, nuts, sap, achene, and grain Figure 3 and Table 2. A large number of human ailments were treated by the native healers, like dysentery, diarrhea, hepatitis, cough, malaria, stomach ache, constipation, jaundice, cancer, fever, and seizures.

Figure 2. Total diversity of species in the local area with their percentages.

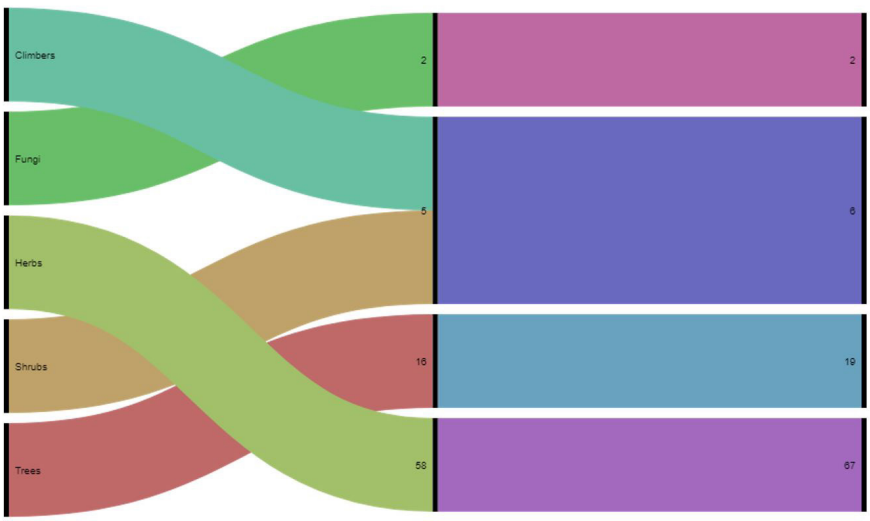

Figure 3. Life form of medicinal plants in the study area.

Table 2. Indigenous medicinal plant species and there use in the Wari (Dir), Pakistan.

SNo	Botanical name +Family name+ Voucher number	Local name	Part used	Habit	Nature of Species	Form of preparation	Harvesting season	Medicinal uses	FCi[B]	RFCi[C]	UV i[D]	Comparison with previous records
1	*Abies pindrow* Royle. Pinaceae H.AUP.WS:101	Acharr	W, Re, L	Tree	Invase	Decoction, maceration	Spring	The plant used as fuel, making wood products and homes. Resins used for backbone pain. **The plant used for a cough, asthma and chronic bronchitis.**	33	0.2	0.41	(Kayani et al., 2014) **(∞), (μ),** (α),(β)
2	*Adiantum inciscum* Forsk. Adiantaceae H.AUP.WS:102	Sumbal	Fr	Herb	Wild	Maceration	Spring/ winter	**Plant help in cough, fever and diabetes.**	28	0.16	0.37	(Sher et al., 2011) **(∞),** (μ), (α),(β)
3	*Adiantum vensutum* D.Done Adiantaceae H.AUP.WS:103	Sumbal	Fr	Herb	Wild	Infusion, Decoction	Spring/ winter	Plants were used as emetic, diuretic, and expectorant. **The plant is also used for a lung disorder.**	14	0.08	0.21	(Kayani et al., 2014) **(∞)**,(μ), (α),(β)
4	*Adiantus capillus veneris* L. Adiantaceae H.AUP.WS:104	Bandakay	L	Herbs	Wild	Decoction, Juice	Spring	Use for fever, **cough and bronchial problems**	16	0.09	0.33	(Kayani et al., 2014) **(∞)**, (μ), (α),(β)
5	*Agaricus compestris* L. Agaricaceae H.AUP.WS:105	Khareray	Wh	Fungi	Wild	Fresh	Spring / Winter	**Cooked as a food**, edible. This economics species peoples collect and sell in the local market.	7	0.04	0.14	(Ahmad et al., 2011) **(∞)**, (μ), (α),(β)
6	*Ailanthus altissima* (Mill) Swingle. Simarubaceae H.AUP.WS:106	Spena Shandai	B, W, L	Tree	Invasive	Cataplasm, Decoction, Juice (From Peel)	Spring	**Honey bees visited for making honey.** Plant leaves are used as cataplasm on swelling after biting a yellow fly. Leaves were used as fodder. Barks was used as anthelmintic, diarrhea and dysentery.	78	0.47	0.58	(Jan et al., 2011) (∞),(μ), (α),**(β)**
7	*Ajuga bracteosa* Wall.ex Benth. Labiatae H.AUP.WS:107	Goote	Wh	Herb	Wild	Decoction, Juice, Syrup	Spring/ Winter	The plant was heated in water and use for blood purification, reduce stomach acidity, headache, and measles. The plant also helps in Blood purification, Killing worms abdominal and intestine. **The plant is bitter in taste used for fever and leaves powder is used for a throat infection.**	45	0.27	0.44	(Ali and Qaiser, 2009) (∞),(μ), (α),**(β)**

Symbol representations'A* W= wood, Re= Resins, L= Leaves, R= Roots, F= Flower, S=Seed, B=Barks, C= Cone, N= Nuts, G= Grain, St=Stem, Wh= Whole plant, Sh= Shoot, Fr= Fruits, Cp= Capsule, Rh=Rhizome, Fd= Frond, Ac=Achene; B* Frequency Citation (Afchangi and Fazli); C* Relative frequency Citation (RFC); D* Use Value (UV) F* Plant species are with bold and dark blue represents (Plant with similar use = (∞), Plant with dissimilar use= (μ), Plant not reported in the previous study= (α), Plant species with new medicinal uses reported in this study= (β)); G* Plant uses bolt represent the uses in old records; * Plant uses with dark blue color represents new medicinal uses.

Table 2. Continued...

SNo	Botanical name +Family name+ Voucher number	Local name	Part used	Habit	Nature of Species	Form of preparation	Harvesting season	Medicinal uses	FCi[B]	RFCi[C]	UV i[D]	Comparison with previous records
8	*Allium cepa* L. Alliaceae H.AUP.WS:108	Peyaz	Wh	Herb	Cultivated	Decoction, juice, Fresh, Cataplasm	Spring	**Use as vegetable and salad**. Use in skin problems. **The bulbs are crushed and paste on boils.** The bulbs layers of the onion are used to dawn the swelling of biting skins by various bees.	89	0.53	0.60	(Hussain et al., 2011) (∞), (μ), (α),**(β)**
9	*Allium sativum* L. Alliaceae. H.AUP.WS:109	Ogaa	Wh	Herb	Cultivated	Fresh, Juice, decoction	Spring	Use as vegetable and medicine, it reduces blood pressure and thinner the blood. Boiled and cooled extract administered against dysentery, diarrhea problem, bulbs stimulant, leaves are aphrodisiac, diuretic, antiseptic, and expectorant.	96	0.58	0.6	(Akhtar et al., 2013) **(∞), (μ),** (α),(β)
10	*Amaranthus viridis* L. Amarantheaceae H.AUP.WS:110	Charlai	Wh	Herb	Wild, cultivated	Decoction, Fresh, Paste	Summer	Digestive and use as vegetables. **Plant helpful in a cough, asthma, constipation, eye vision, snake bite, painful urination, and files.**	24	0.14	0.27	(Umair et al., 2017) **(∞)**, (μ), (α),(β)
11	*Ammi visnaga* (L.) Larn. Apiaceae H.AUP.WS:111	Sparkaii	Fr	Herb	Wild	Infusion, Maceration, Syrup	Spring	Plant fruits help in the treatment of asthma. Also used in condiments. **The plant is Astringent, diuretic, and antispasmodic.**	12	0.07	0.21	(Hazrat et al., 2011) **(∞)**, (μ), (α),(β)
12	*Artemisia scoparia* Waldst. & Kit. Asteraceae H.AUP.WS:112	Tarkhaa	Wh	Herb	Invasive	Decoction,	Autumn	Plant leaves were used for the killing warms. The plant used for the care of an earache and purgative. It also used for the scorpion bites and others. **The plant is helpful in caring of kidney and liver ailments and blood purifier.**	7	0.04	0.07	(Barkatullah et al., 2015) **(∞), (μ)**, (α),(β)
13	*Avena sativa* L. Poaceae H.AUP.WS:113	Jamdaar	G	Herb	Wild	Maceration, Juice	Spring	The seed was used as stimulant, and nerve tonic. The plant used as fodder. **The spike becomes dry and make powders and used for the treatment of fever and diarrhea.**	9	0.05	0.09	(Khan et al., 2015) **(∞), (μ),** (α),(β)
14	*Berberis lyceum* Royle. Berberidaceae H.AUP.WS:114	Kwaray	R, B, Fr	Shrubs	Invasive	Paste, Decoction, Maceration, Infusion, Juice (From Roots)	Spring/ summer	**It considers the most local important medicinal plant. Root is used for blood purification, strengthens sex organs, antiseptic, and pains reliever.** Roots used as carminative, antiseptic and refrigerant. Fruits, stem used as a tonic. Root barks use for an ulcer. Roots powdered use for mouth infections.	68	0.53	0.66	(Shuaib and Khan, 2015) **(∞),(μ),** (α),(β)

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Table 2. Continued...

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15	*Bergenia ciliate* (Haw.) sternb. Saxifragaceae H.AUP.WS:115	KamarPanra	Rh	Herb	Invasive	Maceration, Pill	Spring	Plant rhizome help in teething in children, help in a cough, fever, diarrhea, **burns wounds**. Also, increase sexual power. **Leave is used as a poultice and increases lactation in cattle. Rhizome is used for stomach disorder, backbone, and vertebral column.**	23	0.13	0.25	(Khan et al., 2016) **(∞),(μ),** (α),(β)
16	*Brassica campestris* Linn. Brassicaceae H.AUP.WS:116	Sharshum, Masturd	Wh	Herb	Cultivated, Wild	Decoction, Fresh	Spring	**The plant used as a vegetable. Fodder for animals.** Oil is removed and use as cooking, hairs and body massage. The plant has antibacterial, antiviral and anticancer properties.	65	0.39	0.40	(Ali et al., 2016) **(∞),(μ),** (α),(β)
17	*Carthamus oxycantha* M. bieb Asteraceae H.AUP.WS:117	Pohli	Achene	Herb	Invasive	Decoction	Spring	Seed use in stomach ulcer and jaundice.	12	0.07	0.18	(Shuaib et al., 2014) **(∞),(μ),** (α),(β)
18	*Carum carvi* Linn. Apiaceae H.AUP.WS:118	Xankaii	Wh	Herb	Invasive	Maceration, Infusion, Syrup	Spring	The seed of the plants used in rice, condiments for good smell. Plants were used as fodder. The seed was also used to decrease stomach acidity and help in digestion. **Seed is used as carminative, antispasmodic, diuretic, and expectorant**.	14	0.08	0.16	(Afzal et al., 2009) **(∞),**(μ), (α), (β)
19	*Cedrus deodara* L. Pinaceae H.AUP.WS:119	Diyaar	W	Trees	Invasive	Maceration, Paste	Spring	Wood use as construction materials and also resistance to warms. **Used as dyspepsia, boils, refrigerant, scabies, carbuncles and ringworm infections.**	66	0.4	0.40	(Shah et al., 2016) **(∞), (μ),** (α),(β)
20	*Chenopodium album* Linn. Chenopodiaceae H.AUP.WS:120	Sarmaay	Wh	Herb	Wild	Extract, decoction	Spring	Leaves used as a vegetable. Leaves were dried and use in pain. Leaves and stem are used as diuretic, laxative, and cough.	37	0.22	0.37	(Zahoor et al., 2017) (∞),**(μ)**, (α),(β)
21	*Chenopodium botrys* L. Chenopodiaceae H.AUP.WS:121	Kharawa	Sh	Herb	Wild	Decoction	Spring	The plant used in the healing of wounds. Heating in water and use for killing worms and intestinal pain in infants. **It is used for colic pain in newly born babies.**	27	0.16	0.39	(Khan et al., 2015) (∞),**(μ)**, (α),(β)

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22	*Cichorium intybus* L. Asteraceae H.AUP.WS:122	Kashni	Wh	Herb	Wild	Decoction	Spring	Plants used as emollient and blood purifier. Plant leaves were used for the treatment of enlargement of spleen, liver disorder, fever, and diarrheas. The plant also used as a liver tonic. **Root is used for stomach diseases, the seed is tonic, carminative, helpful in renal stones and chronic fever.**	19	0.11	0.26	(Awan et al., 2011) (∞),**(μ)**, (α),(β)
23	*Calendula arvensis* L. Asteraceae H.AUP.WS:123	Zair gulay	Wh	Herb	Wild	Decoction	Spring	The plant is used as a remedy for skin problems, externally bites, stings, wounds, sprains, varicose veins, and sore eyes. It is used as antiseptic,antispasmodic, aperients, antiphlogistic, vul nerary and stimulant.	23	0.13	0.31	(Shuaib et al., 2014) **(∞),(μ),** (α),(β)
24	*Convolvlus arvensis* L. Convolvulaceae H.AUP.WS:124	Perwataii	L	Climber herb	Wild	Paste, Extract	Spring	Plants were used as fodder. Leaves used in antidandruff shampoo and help in dysentery. Roots were Purgative. **Leave are mostly used in liver disorder and especially in spleen enlargement.**	34	0.20	0.39	(Ali et al., 2016) **(∞)**,(μ), (α),(β)
25	*Conyza Canadensis* L. Asteraceae H.AUP.WS:125	Horse weed	Wh	Herb	Wild	Decoction	Spring	Use as Diuretic, homeostatic and astringent, and stimulant.	27	0.16	0.43	(Khan et al., 2015) (∞), **(μ)**, (α),(β)
26	*Coriandrum sativm* L. Apiaceae H.AUP.WS:126	Danyaa	L, Fr	Herb	Cultivated	Fresh, Infusion, Syrup, Decoction, Maceration	Spring	Leaves are used as salad and vegetable. Leaves were crushed grained and put water and then this water used for breaking to a kidney stone. Seed use in condiments. Also, use in bubbles for which keep mouth taste good. **The plant used for tetanus, hypertension, toothache, brain tonic, vertigo, headache, bitter mouthfeel.**	88	0.53	0.86	(Shah et al., 2016) **(∞)**, (μ), (α),(β)
27	*Cucurbita pepo* L. Cucurbitaceae H.AUP.WS:127	Wagrangaykado	Fr	Climber Herbs	Cultivated	Decoction,	Spring/ summer	Use as a vegetable. **Hardcover of fruit is used for remove dead skin of feet.**	86	0.52	0.77	(Ismail and Nisar, 2010) **(∞)**,(μ), (α),(β)
28	*Cymbopogon distans* (Nees ex Steud.) Watson. Poaceae H.AUP.WS:128	Sargaray	Wh	Herb	Invasive	Decoction	Spring	Plants were used as fodder for animals. Roots were boiled and used for internal body infection. **Leave is used as anxiolytic, antidiabetic, antidiuretic and anticancer.**	65	0.39	0.48	(Shuaib et al., 2014) (∞), (μ), (α),(β)

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29	*Diospyros lotus* Linn. Ebenaceae H.AUP.WS:129	Parseeman	Wh	Tree	Cultivated	Fresh	Spring	The leaves used as fodder. The wood used as fuel. Fruits were edible. Medicinally used as constipation, diarrhea, tonic, and antiflatulent.	88	0.53	0.79	(Shah et al., 2016) (∞), **(μ)**, (α),(β)
30	*Dodonea viscose* (L). Jacq. Sapindaceae H.AUP.WS:130	Ghruskaay	Wh	Shrub	Invasive	Paste, Decoction	Spring	Plant use as ornamental. Leaves use for making a broom. Ash of leaves uses in snuff. Medicinally use as rheumatism, astringent and swelling. The fresh leave is used as bandages in the past. **It is used for vitiligo, fever, wounds, and diarrhea.**	55	0.33	0.49	(Shah et al., 2016) (∞), (μ), (α),**(β)**
31	*Duchesnca indica* Lindl. Ex Lacaita Rosaceae H.AUP.WS:131	Da zamkay strawberry	L, Fr	Herb	Wild	Fresh, Decoction	Spring	Fruit was edible and plants were laxative and fodder for animals. **The plant used as fresh fodders, edible, fruits, and laxative.**	13	0.07	0.12	(Ibrar et al., 2007) **(∞), (μ)**, (α),(β)
32	*Euphorbia prostrate* L. Euphorbiaceae H.AUP.WS:132	Warmag/ sakhabotay	Wh	Herb	Wild	Paste	Spring	Plants were used as fodder for animals. It is also used for skin problems like ringworms and itching. **Latex is used for eruptions of ringworms**	43	0.26	0.38	(Ali and Qaiser, 2009) **(∞),(μ)**, (α),(β)
33	*Fagonia cretica L.* Zygophyllaceae H.AUP.WS:133	Azghakay	Sh	Herb	Invasive	Decoction	Spring	Shoot was boiled in water and used for blood purification, diabetes, and coughing. **Plant stem is used as anti-ringworms and itching.**	11	0.06	0.5	(Barkatullah et al., 2015) **(∞)**, (μ), (α),(β)
34	*Ficus crica* L. Moraceae H.AUP.WS:134	Injeer/ Inzar	L, W saf, Fr	Tree	Invasive	Fresh, Paste	Spring	Wood use as fuel. Sap helps in controlling vitiligo disease. Fruit was helpful in controlling sugar, cancer, emollient, laxative and emulcent. **Fruit is used for thalassemia, carminative, stomachic, constipation. Latex is used for ringworms.**		0.46	0.73	(Shah et al., 2016) (∞),(μ), (α),**(β)**
	Frageria indica Andrew Rosaceae H.AUP.WS:135	Da zamaky toot	Fr	Herb	Wild	Maceration, decoction	Spring	Fruits were edible and use as a laxative. **Plant extract is used for caring for a cough, blood purifier, diabetes, and as a cooling agent.**	34	0.20	0.34	(Ibrar and Hussain, 2009) **(∞)**,(μ), (α),(β)
36	*Fumeria indica* (Hsskn) H. N. Fumariaceae H.AUP.WS:136	Krachay	Fr,L	Herb	Invasive	Decoction, Maceration, Paste	Spring	Use as fodder for animals. Has antipyretic property. Medicinally plant heated in water use in green tea help in flue and coughing. **The plant used in stomach disorder, fever and eye infectio**n.	28	0.16	0.27	(Ali et al., 2016) **(∞),(μ)**, (α),(β)

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37	*Hedera helix* L. Araliaceae H.AUP.WS:137	Prewatai	L	Climber	Wild	Maceration	Spring	**Plants were used as fodder for animals.**	10	0.06	0.11	(Sher et al., 2011) **(∞)**,(μ), (α),(β)
38	*Hedera nepalensis* K. Koch Araliaceaes H.AUP.WS:138	Prewathai	L, Fr	Climber	Wild	Fresh, Decoction, Maceration	Spring	Leaves are ant-diabetic and stimulant, also use as abdominal pains and reduce blood pressure. Fruits were purgative. **Fresh leaves are used for diabetes and used as fodders for sheep and goats.**	24	0.14	0.25	(Awan et al., 2011) **(∞),(μ)**, (α),(β)
39	*Hilianthus annus* L. Asteraceae H.AUP.WS:139	Anawarparas	Wh	Herb	Cultivated	Fresh, Extract, Syrup	Spring	Seed was a good source of making oils polish. Also edible eat by the local peoples. **The seed is eaten with sugar for cold, cough, and heart diseases**.	14	0.08	0.20	(Zaman and Hazrat, 2013) **(∞),(μ)**, (α),(β)
40	*Indigofera heterantha* Wall. Ex Brandis Papilionaceae H.AUP.WS:140	Ghorejan	Sh	Herb	Invasive	Decoction	Spring/ summer	Branches used for making ropes and brooms. **Branches used as fuel and wood ash in snuff. Also use in blackening in hair, hepatitis, and whooping cough.** It is also a honey bee species.	17	0.10	0.22	(Shuaib and Khan, 2015) **(∞),(μ)**, (α),(β)
41	*Iris ensata* Thunb. Iridaceae H.AUP.WS:141	Oogakai	R	Herb	Wild	Decoction, Fresh	Spring	**Plants were used as a blood purifier**. Also used for making local green rice.	18	0.10	0.20	(Sher et al., 2011) (∞),(μ), (α),**(β)**
42	*Isodon rugosus* Labiatae H.AUP.WS:142	GaraKarachay	L/ F	Herb	Invasive	Paste, decoction	Summer	The flower was used in making honey, the most expensive honey is of *Isodon rugosus* which 3000 per Kg. Leaves help in remove the fungal infection of the mouth. Also used as a fuel and urgent Snuff. **Extract spayed in houses to kills fleas and termites. Leave is used for cleaning teeth and fodder for animals. A decoction of the herb is used for curing sore throat, coughing, hepatitis B, and C.**	22	0.13	0.25	(Khan et al., 2016) (∞),(μ), (α),**(β)**
43	*Juglans regia* L. Juglandaceae H.AUP.WS:143	Ghooz	N, L, B	Trees	Cultivated, Invasive	Fresh, Decoction, Juice(From Peel), Maceration	Spring	Roots and barks are used in cleaning teeth and color lips. Fruits are edible and increase sexual power and **brain. Fruit is used as a fat burner, tonic, and brain tonic. The bark is used as gingivitis, haematinic and toothache.**	88	0.53	0.79	(Shah et al., 2016) **(∞)**, (μ), (α),(β)

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44	*Justcia adhatoda* L. Acanthaceae H.AUP.WS:144	Baikaar	L, R	Shrub	Invasive	Decoction	Spring	Leaves used to reduce swelling, also use as antispasmodic, expectorant, antiseptic, skin disorder, Fever, cough, and rheumatism. **Wood is used for fire in the home, and honey bees plant**.	46	0.27	0.92	(Ibrar et al., 2007) **(∞)**, (μ), (α),(β)
45	*Luffa cylindrical* (L.) Room Cucurbetaceae H.AUP.WS:145	Torai	W	Climber herb	Cultivated	Decoction, Fresh	Spring	Plants were used as fodder. Fresh leaves and fruits used as a vegetable. Plants were helped in stomach ulcer.	91	0.55	0.62	(Sher et al., 2011) (∞), **(μ)**, (α),(β)
46	*Medicago denticulate* L. Fabaceae H.AUP.WS:146	Shpashtaray	L	Herb	Wild	Decoction	Spring	The plant used as ornamental in lawn, vegetable, salad, and fodder for animals. Leaves were used in the treatment of kidney disorder, Bladder disease, anemia, appetite, stimulant and digestive problems.	53	0.32	0.47	(Shuaib et al., 2014) (∞), **(μ)**, (α),(β)
47	*Melia azedarach* Linn. Meliaceae H.AUP.WS:147	Torashandai	B, L, W	Tree	Invasive	Cataplasm	Spring	Leaves were used as fodder. Leaves also used for biting place. Barks is heating in water and used for dysentery, emetic and cathartic. Wood is used as fuel and wood products. **The plant is used for burns, gonorrhea, gingivitis, piles, headache, diabetes, pyrexia, and spleen enlargement. Leave is used for swelling after biting of yellow fly biting.**	56	0.33	0.45	(Khan et al., 2013a) (∞), (μ), (α),**(β)**
48	*Morchella esculenta* (L.) pers ex. Fr Halveliaceae H.AUP.WS:148	Khosy/Goochi	Wh	Fungi	Wild	Decoction, maceration, Fresh	Winter/ spring start	It is delicious taste local fried and eats. It has high proteins and uses as a tonic. This species is very expansive and use for earning money and export to local and international markets. **The plant is edible and medicinal.**	47	0.28	0.44	(Sher et al., 2011) (∞), **(μ)**, (α),(β)
49	*Morus alba* L. Moraceae H.AUP.WS:149	Spin toot	F, W	Tree	Invasive	Fresh	Spring	Fruits are **edible**. Wood is used for building home and furniture. **Plant fruit is used as astringent and emollient**.	77	0.46	0.52	(Ahmed et al., 2013) **(∞), (μ),** (α), (β).
50	*Morus nigra* L. Moraceae H.AUP.WS:150	Toor toot	F, W	Tree	Invasive	Fresh	Spring	Fruits are used in different herbal medicine. Help in killing warms. **Wood is used for furniture, fuel, fresh leave for fodder, and leave for silkworms and fruit is edible.**	87	0.52	0.56	(Ibrar et al., 2007) **(∞), (μ)**, (α),(β)

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51	*Narcissus tazzeta* L. Amaryllidaceae H.AUP.WS:151	Gul-e- nargis	F	Herb	Cultivated	Decoction	Spring	**Plants were used as an emetic, purgative. It is a honey bee species.** Also used in ornamental lawn and garden.	43	0.26	0.40	(Sher et al., 2011) **(∞)**, (μ), (α),(β)
52	*Nostortium officinale* R.Br. Brassicaceae H.AUP.WS:152	Tarmeer A	Wh	Herb	Invasive, wild	Decoction, extract	Winter/ Spring	Leaves used as a vegetable, a salad which helps tetanus. Oil extracts from the seed and used (Massage) relaxing Body muscles and increase sexual desire. **Leave is used as antidiabetic, relieve constipation and diaphoretic.**				(Khan et al., 2016) (∞),(μ), (α),**(β)**
53	*Olea feroginia Royle* Oleaceae H.AUP.WS:153	Khona	L, S	Tree	Invasive	Fresh, Paste, Decoction	Spring	The leaves were chewing and also used in green tea for a cough and flow. The wood used as fuel, fodder, ornamental and for making good quality of furniture. The leaves are astringent, bitter, antiseptic and diuretic. The oils were used in constipation and **rheumatism. The leave is used for a sore throat; oil from the fruit is used for a backache.**	11	0.06	0.12	(Ibrar and Hussain, 2009) **(∞)**,(μ), (α),(β)
54	*Oryza sativa* L. Poaceae H.AUP.WS:154	Wreje/chawal	Wh	Herb	Cultivated	Decoction	Summer	Plant seed is used for making soft foods which helpful for dysentery and diarrhea. Plants were used as fodder. Good source of food. The main source of carbohydrates. **Plant root is used as a febrifuge, cooling agent, diuretic, diabetes, and dispsia.**	84	0.50	0.54	(Khan et al., 2013a) **(∞)**,(μ), (α),(β)
55	*Oxalis corniculata* L. Oxalidaceae H.AUP.WS:155	Tarokay	Wh	Herb	Wild	Fresh, decoction	Spring	Leaves used as a vegetable, cooling property, relieve stomach trouble, dyspepsia and dysentery. Also, use as fodder for animals. **Leave is crushed and applied to wounds to stop bleedings. Also helpful in jaundice.**	34	0.20	0.27	(Ahmad et al., 2014) **(∞),**(μ), (α),(β)
56	*Paeonia emodi* Wall ex. Royle Ranunculaceae H.AUP.WS:156	Mamakh	Rh	Herb	Invasive	Infusion, Maceration	Spring	Rhizome used in tonic, dropsy, emetic and **epilepsy** and **bone ache. Plant seed and rhizome is used as purgative, epilepsy, emetic and heart diseases.**	12	0.07	0.11	(Ahmed et al., 2013) **(∞)**, (μ), (α),(β)

Symbol representations'A* W= wood, Re= Resins, L= Leaves, R= Roots, F= Flower, S=Seed, B=Barks, C= Cone, N= Nuts, G= Grain, St=Stem, Wh= Whole plant, Sh= Shoot, Fr= Fruits, Cp= Capsule, Rh=Rhizome, Fd= Frond, Ac=Achene; B* Frequency Citation (Afchangi and Fazli); C* Relative frequency Citation (RFC); D* Use Value (UV) F* Plant species are with bold and dark blue represents (Plant with similar use = (∞), Plant with dissimilar use= (μ), Plant not reported in the previous study= (α), Plant species with new medicinal uses reported in this study= (β)); G* Plant uses bolt represent the uses in old records; * Plant uses with dark blue color represents new medicinal uses.

Table 2. Continued...

SNo	Botanical name +Family name+ Voucher number	Local name	Part used	Habit	Nature of Species	Form of preparation	Harvesting season	Medicinal uses	FCi[B]	RFCi[C]	UV i[D]	Comparison with previous records
57	*Papaver somniferum* L. Papaveraceae H.AUP.WS:157	Apium	Fr, L	Herb	Wild	Maceration, Pill,	Spring	Plant seed was nutritive. Plant capsule cut with blades and opium were removed. The capsule is used in "Tandaii" show pleasant excitement. Also use as a headache, Diarrhea, Sedative, Hypnotic and Dysentery. **Fruit is used as a brain tonic, chest infections, cough suppressant, hemorrhoids, chest infection, diarrhea, constipation, carminative, ringworms, pharyngitis, influenza, and colic.**	67	0.40	0.54	(Shah et al., 2016) **(∞),(μ)**, (α),(β)
58	*Pinus roxburghii Sergent* Pinaceae H.AUP.WS:158	Pahoch/ chalgoza	W, Re, C	Tree	Invasive	Paste, decoction	Spring	Plants wood is used as fuel, wood products and making homes. Also used as stimulant, stomachic and diuretic. **Wood is used for furniture and construction purposes. Resin extract is used in varnishes and Turpin.**	13	0.07	0.11	(Awan et al., 2011) **(∞)**, (μ), (α),(β)
59	*Pinus wallichiana* A.B Jackson. Pinaceae H.AUP.WS:159	Nakhter	W,C, Re	Tree	Invasive	Decoction, Paste	Early spring	Plant latex is used for backbone pain. **Plants were being fuelwood, wood products, and timber. Leave is used for temporary shading**.				(Khan et al., 2011) **(∞)**,(μ), (α),(β)
60	*Pistacea integrima* J. L. Stewart ex Brandis Anacardiaceae H.AUP.WS:160		W, L, Fr	Tree	Invasive	Decoction, maceration, infusion	Spring	Fruit and leaves were Tonic and antiseptic. Leaves used as fodder. The wood used as timber. **Barks boiled extract is used bronchial disorder.**	11	0.06	0.07	(Ahmad et al., 2014) (∞),(μ), (α),**(β)**
61	*Plantago lanceolata* L. Plantiginaceae H.AUP.WS:161	Spighol	Wh	Herb	Cultivated, Wild	Decoction	Autumn	The seed was mostly used for digestion, constipation. It also used in biscuits. Leaves were used as fodder. **The seed is used for caring of diarrhea.**	48	0.29	0.42	(Ibrar and Hussain, 2009) **(∞)**,(μ), (α),(β)
62	*Portulaca oleraceae* L. Portulacaceae H.AUP.WS:162	Warkharea	Wh	Herb	Cultivated, wild	Decoction, Fresh	Autumn	Plants were used as fodder, vegetable. Plants help in cure kidney and liver disorder and diuretic. **It is used for urinary disorders and healing kidney**	33	0.2	0.29	(Ibrar and Hussain, 2009) **(∞)**, (μ), (α),(β)
63	*Quercus baloot* Griffith Fagaceae H.AUP.WS:163	Zagawan	L, W, S	Tree	Invasive	Infusion, Paste, Extract	Spring	The seed powdered take with Dasi Ghee and used for Urinary infection. **Wood is used as fuel, making a home. Leave is used as fodder.**	29	0.17	0.26	(Shuaib et al., 2014) (∞),**(μ)**, (α),(β)

Symbol representations'A* W= wood, Re= Resins, L= Leaves, R= Roots, F= Flower, S=Seed, B=Barks, C= Cone, N= Nuts, G= Grain, St=Stem, Wh= Whole plant, Sh= Shoot, Fr= Fruits, Cp= Capsule, Rh=Rhizome, Fd= Frond, Ac=Achene; B* Frequency Citation (Afchangi and Fazli); C* Relative frequency Citation (RFC); D* Use Value (UV) F* Plant species are with bold and dark blue represents (Plant with similar use = (∞), Plant with dissimilar use= (μ), Plant not reported in the previous study= (α), Plant species with new medicinal uses reported in this study= (β)); G* Plant uses bolt represent the uses in old records; * Plant uses with dark blue color represents new medicinal uses.

Table 2. Continued...

SNo	Botanical name +Family name+ Voucher number	Local name	Part used	Habit	Nature of Species	Form of preparation	Harvesting season	Medicinal uses	FCi[B]	RFCi[C]	UV i[D]	Comparison with previous records
64	*Quercus incana* Griffith Fagaceae H.AUP.WS:164	Saraai	L, S	Tree	Invasive	Infusion, Paste, Extract	Spring	Use as fodder for animals, making homes and ornamental. Leaves were purgatives, and seed were used as Tonic. **Fruit is used for wounds healing and renal disorders. Helpful in male impotency and Schiatic pain.**	16	0.09	0.10	(Khan et al., 2015) **(∞)**,(μ), (α), (β)
65	*Ranunculus aquatalis* Linn. Ranunculaceae H.AUP.WS:165	Jaghagha	Wh	Herb	Invasive	Decoction	Spring	Plant used as asthma and fever. Mostly used in animal's problems.	23	0.13	0.26	
66	*Rheum austral* D. Don Polygonaceae H.AUP.WS:166	Chotyal	Wh	Herb	Invasive	Decoction, maceration	Spring	The plant used for internal infections. It also increases the temperature of the body. Mostly give to cattle.	16	0.09	0.13	(Hazrat et al., 2011) (∞), **(μ)**,(α), (β)
67	*Rubusulmi folius* Schott. Rosaceae H.AUP.WS:167	Kharawaa	Sh	Herb	Wild	Decoction, Pill	Autumn	The shoot was boiled and used for the treatment of internal problems in children and also used for the treatment of sexual problems.	33	0.2	0.29	(∞),**(μ)**, (α),(β)
68	*Rumex crispus* L Polygonaceae. H.AUP.WS:168	Shalkhaay	L, Fr	Herb	Wild	Decoction	Spring	Leaves used as vegetable and fodder for animals. Fruit help in digestion and mostly used in condiments. Spores powder used for the treatment of ear-burning infections. **A decoction prepared and applied to the skin**.	21	0.12	0.23	(Hussain et al., 2011) (∞),(μ), (α),**(β)**
69	*Rumex hastatus* D. Don. Polygonaceae H.AUP.WS:169	Tarokayy	Wh	Herb	Wild	Decoction	Spring	Fodder for animals. Leaves used as a salad. The plant was used as Astringent, Purgative and diuretic. **Plant shoot is stomachic**.	10	0.06	0.18	(Barkatullah et al., 2015) (∞),**(μ)**, (α),(β)
70	*Silene conidia* L. Caryophyllaceae H.AUP.WS:170	Mangotai	Wh	Herb	Wild	Maceration, decoction	Spring	Leaves used as vegetable and fodder for animals. Leaves were used as diuretic, expectorants and Diaphoretic. **Fruit is edible but causing drowsiness and fever.**	11	0.06	0.12	(Khan et al., 2016) **(∞)**,(μ), (α),(β)
71	*Silene moorcroftiana* Wall. Labiatae H.AUP.WS:171	Khargug	L, S, R	Herb	Wild	Maceration	Spring	**Roots were dried and grained and use for external infection. Leaves were used for diarrhea, external body infections and also used in mouthwash, the stem was edible and tasty use as an aphrodisiac agent.**	19	0.09	0.19	(Shuaib et al., 2014) **(∞)**,(μ), (α),(β)

Symbol representations'A* W= wood, Re= Resins, L= Leaves, R= Roots, F= Flower, S=Seed, B=Barks, C= Cone, N= Nuts, G= Grain, St=Stem, Wh= Whole plant, Sh= Shoot, Fr= Fruits, Cp= Capsule, Rh=Rhizome, Fd= Frond, Ac=Achene; B* Frequency Citation (Afchangi and Fazli); C* Relative frequency Citation (RFC); D* Use Value (UV) F* Plant species are with bold and dark blue represents (Plant with similar use = (∞), Plant with dissimilar use= (μ), Plant not reported in the previous study= (α), Plant species with new medicinal uses reported in this study= (β)); G* Plant uses bolt represent the uses in old records; * Plant uses with dark blue color represents new medicinal uses.

Table 2. Continued...

SNo	Botanical name +Family name+ Voucher number	Local name	Part used	Habit	Nature of Species	Form of preparation	Harvesting season	Medicinal uses	FCi[B]	RFCi[C]	UV i[D]	Comparison with previous records
72	*Silybum marianum* (L), Gaertn. Asteraceae H.AUP.WS:172	Ganabotay	Seed	Herb	Wild	Extract	Spring	Seed is used for oil synthesis. Mostly use as biofuels plant. Commonly weed. Plant seed is helping in promotes bile secretion and soothes liver.	65	0.39	0.42	(Shuaib et al., 2014) (∞),**(μ)**, (α),(β)
73	*Solanum nigram* Benth. Ex. Wild. Solanaceae H.AUP.WS:173	Kachmacho	L, Fr	Herb	Cultivated, Wild	Decoction, Fresh	Spring	**Leaves were used as a vegetable. The stem is antispasmodic, and to treat diarrhea.** Leaves were tonic, carminative, diuretic and expectorant.	39	0.23	0.43	(Shuaib and Khan, 2015) **(∞)**,(μ), (α),(β)
74	*Solanum tuberosum* L. Solanaceae H.AUP.WS:174	Aloo	Wh	Herb	Cultivated	Decoction, Fresh	Summer	Plants were used as a vegetable and making different food products. Good source of carbohydrates. Leaves were used as fodder.	77	0.46	0.77	(∞),**(μ)**, (α),(β)
75	*Sonchus asper* L. Asteraceae H.AUP.WS:175	Dodal	Wh	Herb	Invasive	Infusion	Spring	Plant help in the treatment of asthma, cooling, antiseptic and diuretic. Also used for kidney inflammation.	48	0.29	0.43	(Ibrar and Hussain, 2009) (∞),**(μ),** (α),(β)
76	*Taraxacum officinale* Weber. Asteraceae H.AUP.WS:176	Dendelian	R	Herb	Wild	Decoction	Spring	**The root is dried and makes powders and uses in green tea and coffee as diuretic and tonic also helpful in treating kidney and liver disorders.** Roots use as diabetes.	39	0.23	0.0.35	(Shuaib and Khan, 2015) **(∞)**,(μ), (α),(β)
77	*Teucrium stocksianum* Bioiss Lamiaceae H.AUP.WS:177	Sperabotay	Sh	Herb	Wild	Paste, Decoction, Juice	Spring	Plants were used for the treatment of diabetes, blood purification, burning sensations, and hepatitis. It is also used as cooling agents. **A decoction of the plant is used for caring foot burning sensation, diabetes, blood purifier and body cooling.**	66	0.4	0.47	(Ibrar and Hussain, 2009) **(∞)**,(μ), (α),(β)
78	*Trianthema portulacastrum* L. Aizoaceae H.AUP.WS:178	Insat	Wh	Herb	Invasive	Maceration, decoction	Spring	Plants were used for the treatment of jaundice, Pain in the bladder, liver disorders, diuretic, fever, and cough. It also useful in asthma.	11	0.06	0.55	(∞),**(μ)**, (α),(β)
79	*Tribulus terrestris* Linn. Zygophyllaceae H.AUP.WS:179	Markondai	Sh	Herb	Invasive	Maceration	Autumn	Shoots were tonic and used to treat rheumatism. Root is used for urinary disorders. **Leave is used for ringworm infection. Fruit is used against hepatitis, dysuria, and backbone**	10	0.06		(Shah et al., 2016) **(∞)**, (μ), (α),(β)

Symbol representations'A* W= wood, Re= Resins, L= Leaves, R= Roots, F= Flower, S=Seed, B=Barks, C= Cone, N= Nuts, G= Grain, St=Stem, Wh= Whole plant, Sh= Shoot, Fr= Fruits, Cp= Capsule, Rh=Rhizome, Fd= Frond, Ac=Achene; B* Frequency Citation (Afchangi and Fazli); C* Relative frequency Citation (RFC); D* Use Value (UV) F* Plant species are with bold and dark blue represents (Plant with similar use = (∞), Plant with dissimilar use= (μ), Plant not reported in the previous study= (α), Plant species with new medicinal uses reported in this study= (β)); G* Plant uses bolt represent the uses in old records; * Plant uses with dark blue color represents new medicinal uses.

Table 2. Continued...

SNo	Botanical name +Family name+ Voucher number	Local name	Part used	Habit	Nature of Species	Form of preparation	Harvesting season	Medicinal uses	FCi[B]	RFCi[C]	UV i[D]	Comparison with previous records
80	*Verbascum thapsus* L. Scrophulariaceae H.AUP.WS:180	Khardag	L, F	Herb	Wild	Paste, Maceration	Spring	Leaves were used to treat rheumatic, diarrhea and dysentery problems. Flower used in pulmonary diseases and coughing. **Young stem extraction is used as wounds healing, antidiabetic, colic pain.**	37	0.22		(Khan et al., 2016) **(∞)**, (μ), (α),(β)
81	*Viola betonicifolia* Sm. Violaceae H.AUP.WS:181	Banafsha	Wh	Herb	Wild	Fresh, Maceration	Spring	Plants were used as a nervous disorder, diaphoretic, anticancer, astringent and antipyretic.	49	0.29	0.40	(∞),**(μ)**, (α),(β)
82	*Viola canscens* Wall. Ex Roxb Violaceae H.AUP.WS:182	Benfsha/ Benwosha	L, F	Herb	Wild	Maceration	Spring	Plant leaves were used in a cough, cold, asthma, jaundice and headache. Flower was put yogurts and used for a cough and flow.	10	0.06	0.48	(Hazrat et al., 2011) (∞), **(μ)**, (α), (β)
83	*Vitex negundo* Linn. Verbenaceae H.AUP.WS:183	Marvandaii	L, R, St	Shrub	Invasive	Decoction	Spring	Used as fuel. Leaves were diuretic, and anthelmintic. Flowers were a tonic. Root was used to treat antiallergic problems. **Leave is used for digestion and external parasites. It is also used for burning purposes.**	12	0.07		(Khan et al., 2015) **(∞)**, (μ), (α),(β)
84	*Withania somnifera* (L) Dunal Solanaceae H.AUP.WS:184	Kootilaal	S	Shrub	Wild	Syrup, decoction	Spring	The seeds help in controlling body temperature during pregnancy. Also, increase milk production in cattle. **Root is used sexual weakness, urinary disorder, rheumatic pain, and narcotic**.	22	0.13		(Ahmad et al., 2014) **(∞)**, (μ), (α),(β)
85	*Xanthium stumarium* L. Asteraceae H.AUP.WS:185	Gishkay	L	Herb	Wild	Paste	Spring	Leaves use for treatment of malarial fever and asthma. Ash of the stem is used as painkiller. The plant used as fuel and leave is fodder for cattle.	13	0.07		(∞),**(μ)**, (α),(β)
86	*Zanthoxylum armatum* DC Rutaceae H.AUP.WS:186	Dambara	S, W	Tree	Invasive	Maceration, decoction, Pill, Syrup	Spring	Wood is used as fuel. Seed is used in food. Plants were used as stomachic, carminative, stimulant and anthelmintic. **Fruit is antipyretic and used for treating stomachache.**	49	0.29	0.58	(Akhtar et al., 2013) (∞),**(μ)**, (α),(β)

Symbol representations'A* W= wood, Re= Resins, L= Leaves, R= Roots, F= Flower, S=Seed, B=Barks, C= Cone, N= Nuts, G= Grain, St=Stem, Wh= Whole plant, Sh= Shoot, Fr= Fruits, Cp= Capsule, Rh=Rhizome, Fd= Frond, Ac=Achene; B* Frequency Citation (Afchangi and Fazli); C* Relative frequency Citation (RFC); D* Use Value (UV) F* Plant species are with bold and dark blue represents (Plant with similar use = (∞), Plant with dissimilar use= (μ), Plant not reported in the previous study= (α), Plant species with new medicinal uses reported in this study= (β)); G* Plant uses bolt represent the uses in old records; * Plant uses with dark blue color represents new medicinal uses.

3.4. Life form and nature of species

During our ethnobotanical survey, a total of 86 species, belonging to 33 families, and 33 genera were collected from the survey area and explored. Informants reported that 58(67%) herbs were used the most used, followed by 16(19%) trees, 5(6%) climbers, and 5(6%) shrubs, while fungi represented by 2(2%) species (Figure 4). According to our collections, a total of 86 species includes 45% wild species, 38% invasive species, and 17% cultivated species (Figure 5, Table 2).

3.5. Form and mode of utilization

In this review, generally, plants were accounted for inward applications. The crude preparations of herbal medicine, medicinal plant parts were grouped into 10 categories. They were utilized either as decoction (36%), followed by Maceration (16%), Fresh (16%), Paste (9%), Juice and infusion (6%), Extract and syrup (4%), Pill (3%), and Cataplasm (2%) in Figure 6. This type of usage is basic in other parts of Pakistan especially and in the World by and large (Yineger et al., 2007). The decoction was made by heating the plant parts in

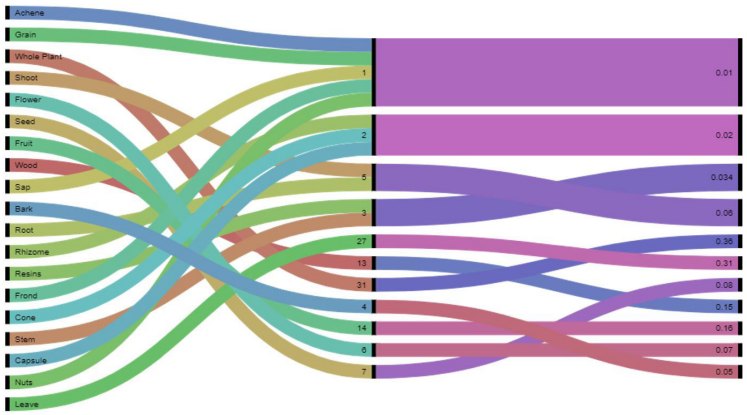

Figure 4. Part used of plant species by local informants and their percentages.

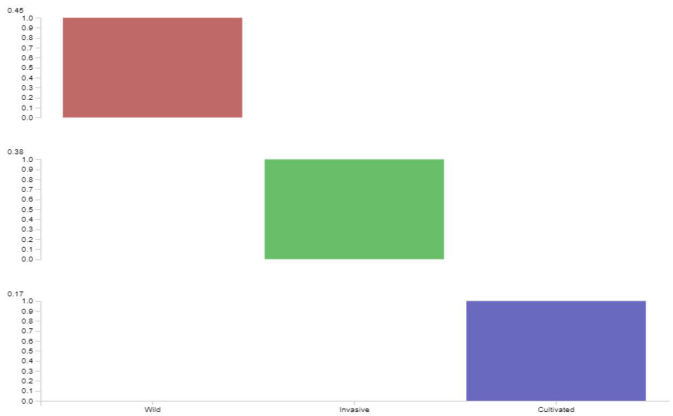

Figure 5 Nature of species in the local area.

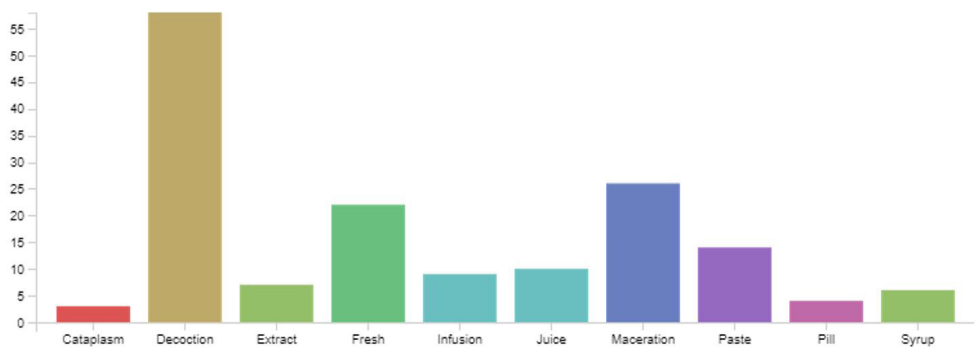

Figure 6 Form of preparation in local area.

water, while (44.44%) were prescribed for outer use as glue. The dominant parts of homegrown medications were set up from crisp plant material as opposed to dried material. The results show that large numbers of medicinal flora have been found to cure more than one disorder. Plant-like *A. altissima, A. bracteosa, B. ciliate, C. intybus, M. azedarach, J. adhatoda, O. feroginia, P. somniferum, S. moorcroftiana, T. portulacastrum* and *Z. armatum* were utilized for more than one disorder i.e. dysentery, diarrhea, cough, malaria, stomach ache, constipation, jaundice, cancer, fever, and seizures, which are very common in the reported area (Table 2). Various medicinal floras are used to treat such ailments by traditional healers (Simbo, 2010).

3.6. New medicinal uses (Novelty)

The current survey, reported 8 species, which were newly documented for their important medicinal uses these species include *A. bracteosa* (Blood purification, killing worms abdominal and intestine), *I. rugosus* (Expansive honey bee species), *P. integrima* Galls (Gas problems and Chest problems), *N. officinale* (Oil for relaxation of Knee Pain, increase sexual desire), *M. azedarach, A. altissima* and *A. cepa* (Inhabit biting swelling of various bees) and *D. viscose* (Wounds healing) Table 2. All these species have new uses in the local area. The plant species with new medicinal uses could be further studies to screen bioactive compounds and their phytochemical and pharmacological activities to introduce novel drugs, thus it provides fresh ethnomedicinal knowledge.

3.7. Market Value in local area

The local people of the area use indigenous medicinal flora for the treatment of many diseases and also sell many of them in the local market to earn their livelihood. About 7 medicinal plants were collected in the study area in Table 3, Figure 7. (Hamayun, 2007) also reported the important value of medicinal flora in National and International markets, corroborating what our report shows. Because many of the nomadic people and a large number of farmers in the mountains of the District Dir live near subsistence level, collection, and potentially cultivation, of these plants could become a more important source of supplementary income. The majority of the families in District Dir, in the area of our collection, are still living in poverty (Khan and Khan, 2011; Sher and Hussain, 2009). Our report showed that the native people of the research area are so poor that they are dependent for their survival on the medicinal flora, to sell in National and International Markets Table 3, Figure 7. Although medicinal flora collection has a huge value in the local market, collectors usually do not know how to market their products, or how much money they could be worth. They are not aware of the importance of their products as shown in (Shinwari and Qaisar, 2011). In the Swat Valley area, this is also true. Findings in (Shuaib et al., 2016) report of the sale and export of medicinal flora from district Dir to local markets and International markets of various countries i.e. India, Europe, Afghanistan, Iran, Arab countries, and Germany.

3.8. Quantitative analysis of ethnobotanical data

3.8.1. Relative frequency citation (RFC)

Relative frequency citation (RFC) was calculated to determine the most common medicinal plants used in the local area for various diseases. The value of RFC is ranged from (0.58) to (0.2) Table 2. The maximum RFC value is presented in *A. sativum* 0.58, while the minimums value present in *P. oleraceae* 0.2. The other maximum value represents in the species *L. cylindrical* (0.55), *A. cepa, B. lyceum* (0.53), *D. lotus, J. regia, C. sativm* (0.53), *M. nigra*, *C. pepo* (0.52), *O. sativa* (0.50), *A. altissima* (0.47), *S. tuberosum, M. alba*, *F. crica* (0.46), *P. somniferum* (0.40), *S. marianum, C. distans, B. campestris* (0.39), *M. azedarach*, *D. viscose* (0.33), and *M. denticulate* (0.32) Table 2, Figure 8. The

Table 3. The important plant used to transport to local and international markets from Wari (Dir) Pakistan.

S.No	Botanical name	Local name	Family	Export locally	Export to international market	Price per kg	Amount transport per season
1	*Pistacia integrrima* .L. Stewart ex Brand	Shanai	Anacardiaceae	Lahore, Peshawar	India	Rs. 1500	20,000kg
2	*Zanthoxylum armatam* DC.	Dambara	Rutaceae	Peshawar, Lahore	India	Rs.600	10,000kg
3	*Valeriana jatamansi* Jones	Mushk-e-bala	Valerianaceae	Peshawar, Lahore	Europe, India	Rs. 2000	20,000kg
4	*Morchella esculenta* Fr.	Khossy. Gochee	Morchellaceae	Peshawar, Lahore, Karachi	India	Rs.19,000	200kg
5	*Rheum austral*	Chootyal	Polygonaceae	Peshawar, Lahore	India, Germany, Iran	Rs.300	1000kg
6	*Paeoniaemodi* Wall.ex Royle	Mamekh	Paeoniaceae	Peshawar, Lahore	India, Europe, Germany	Rs.1800	1500-1800kg
7	*Podophyllum hexandrum* Royle	Kakorra	Podophyllaceae	Peshawar, Lahore	Europe, India	Rs. 300	11,000kg

Figure 7. the important species which transport to local and international market of the world. Species (A) (B) & (C) *P. integrima* (D) *Z. armatum* (E) and (F) *M. esculenta* (G) *P. hexandrum* and (H) *R. austral.*

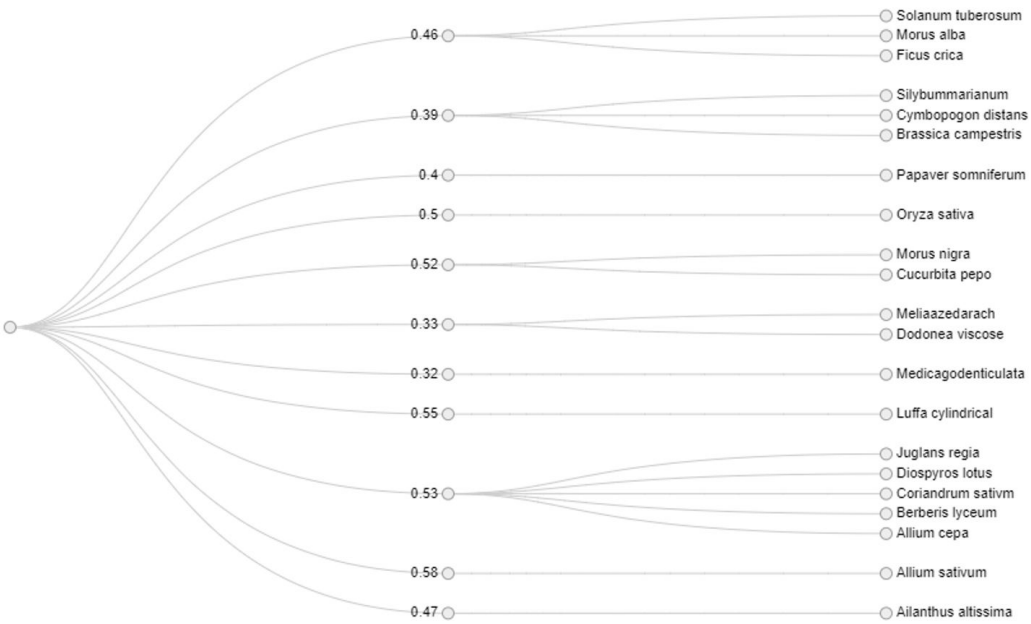

Figure 8. RFC value of medicinal plant using in the local area *A. sativum* L. shows highest values while *M. denticulata* shows the lowest RFC value.

maximum value means the most popular plants species in the community and local people are agreed with their uses. These species are important for daily uses like vegetables, medicinal and economic purposes. In terms of RFC, our values are parallel with (Ahmad et al., 2014; Shah et al., 2016)

3.8.2. Use Value (UV)

In the present study Use Value (UV) is ranged from 0.92 to 0.07. The highest Use Value (UV) is recorded for *J. adhatoda* (0.92) and the lowest UV is recorded for *A. scoparia* and *P. integrima* is 0.07 Table 2. The other highest Used Value (UV) is *C. sativm* (0.86), *J. regia, D. lotus* (0.79), *S. tuberosum, C. pepo* (0.77), *F. crica* (0.73), *B. lyceum* (0.66), *L. cylindrical* (0.62), *A. sativum*, *A. cepa* (0.60), *A. altissima* (0.58), *M. nigra* (0.56), *T. portulacastrum* (0.55), *P. somniferum, O. sativa* (0.54), *M. alba* (0.52) and *F. olivieri* (0.50) Table 2. Plant with high Use Value means that the plant's species is used in other regions of Pakistan. The higher UV of the species also help in developing of drug after phytochemical

screening and pharmacological studies in future, and some species have zero UV i.e. *X. stumarium*, *T. terrestris, P. wallichiana, V. negundo,* and some low-value species, *A. scoparia*, and *P. integrima* 0.07, *A. fatua* 0.09, *Q. incana* 0.10, it means the local informants were not familiar with the plant species and their medicinal uses. Some quantitative results are shown by (Shah et al., 2016) it is impossible to match our current results with the other area because it is the first quantitative ethnomedicinal data from tehsil Wari, Dir upper.

3.8.3. Informant consensus factor (ICF)

ICF was determined for 10 various aliments i.e. Stimulant, Gastrointestinal, Dermatitis, Diarrhea, Tonic, Anathematic, Astringent, Antiseptic, Expectorant, and antibacterial. The ICF value for these ailments is range from 0.71 to 0.92 in Figure 9. ICF value depends on the availability and uses of species in the area Figure 9. The maximum ICF value is recorded for diarrhea and dermatitis 0.92, followed by gastrointestinal 0.90, Stimulant and tonic each 0.88, Anthelmintic 0.83. The ICF value shows that Diarrhea and dermatitis are the most common diseases in the study area and the local peoples have more knowledge about the care of these two diseases. The plant species that uses for these two diseases are *A. sativum*, *A. altissima*, *V. thapsus, S. moorcroftiana, P. lanceolata, R. crispus, P. somniferum,* Q. *incana, O. feroginia, N. officinale, J. adhatoda, E. prostrate, D. viscose, C. deodara, A. sativa,* and *A. cepa.* These 16 plant species is not only used in local area for diarrhea and dermatitis but also used in other regions of Pakistan like Swat (Akhtar et al., 2013), Lower Dir (Shuaib et al., 2014), Malakand (Barkatullah et al., 2015) Chitral and Khyber agency Peshawar (Ali et al., 2016). The minimum lowest ICF value is recorded for Biting (Astringent) and antibacterial (antiseptic) may this due to lack of communications and availability of species among the informants (Rajakumar and Shivanna, 2009).

3.8.4. Fidelity level (FL)

In our current study for Fidelity Level, we determined 10 Species that are used more by the local people. Generally FL of 100% for specific plants that all of the use reports mentions the same disease category (Srithi et al., 2009) In this study we have two species that have 100% FL value *A. bracteosa* and *B. lyceum*. The Fidelity Level FL value is ranged from (68% to 100%) in Figure 10. Maximum the value of FL more will the use of plant (Farnsworth, 1988). The maximum FL Value recorded for *A. bracteosa* and *B. lyceum* both each (100%) followed by *F. cretica* (92%), *C. intybus* (90.5%), *O. feroginia* (86.36%), *P. emodi* (76.93%), and *M. azedarach* (75%) in Figure 10. These plants are used by the informants for various diseases cure, the choice of informants dealing with the specific ailments that indicate a high FL value (Islam et al., 2014; Rajakumar and Shivanna, 2009).

3.8.5. Jaccard index (JI) and comparison

Jaccard index JI is used for comparison of our documented medicinal plant species of Tehsil Wari with the Allied near areas i.e. Kohistan valley, Sheringal valley,

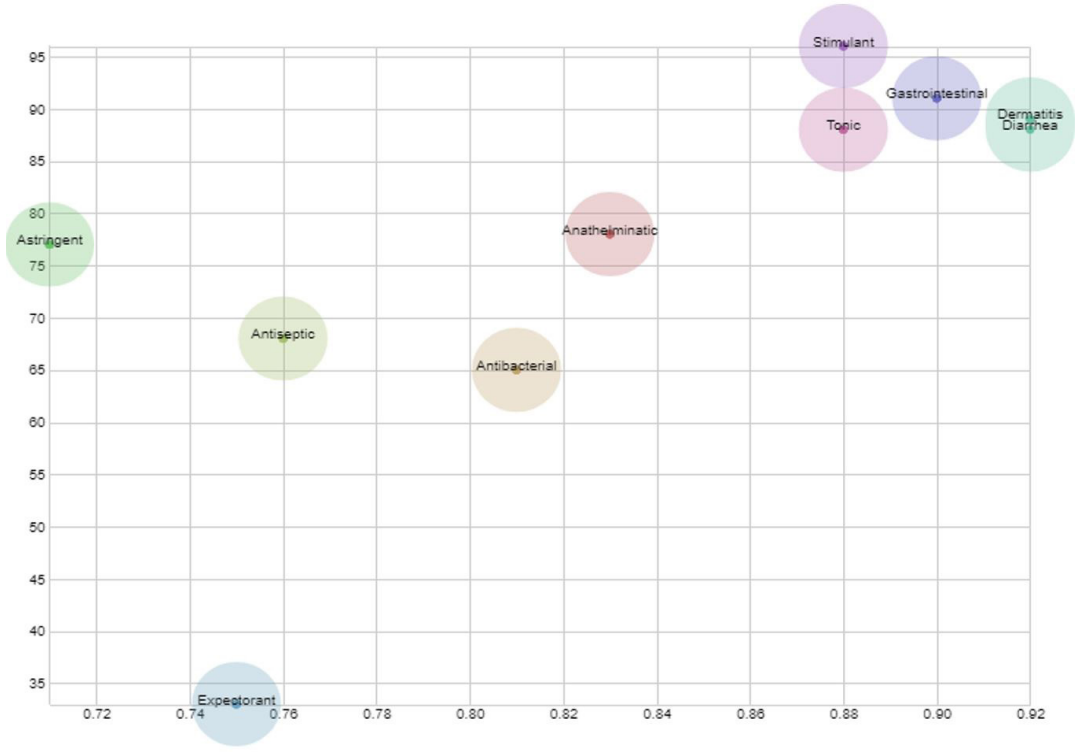

Figure 9. ICF values of traditional medicinal plants in local area.

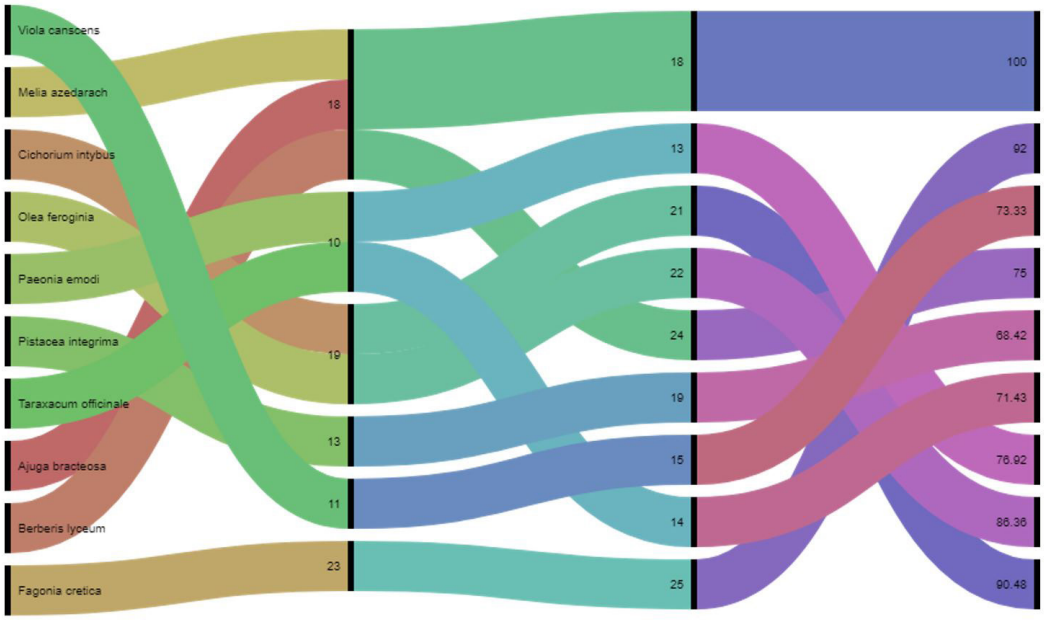

Figure 10. Fidelity level (FL) value of medicinal plants in local area highly used.

Chitral valley, Gilgit Baltistan, Swat valley, Malakand valley, Jandool valley, Lower Dir, Kabal Swat valley, Barawal valley, Bunner valley, Abbottabad, Khyber agency Peshawar, Mangowal, District Gujrat Panjab, and Hafizabad, Panjab. The highest Jaccard index JI value is recorded 29.8 and the lowest data is recorded is 4.72 Table 4. The highest similarity is shown in 55 and the lowest is shown in 6 in Table 4.

The highest JI value is recorded 29.8, common species 55, and similarly used species were 37 and dissimilar uses were 18 shown with our current results, from Buner valley (Sher et al., 2011) documented total 216 medicinal plants Table 4, the common species shown with our current results are *A. pindrow, A. inciscum, A. vensutum, A. altissima, A. bracteosa, A. cepa, A. sativum*, *A. viridis, A. visnaga, A. scoparia, B. lyceum, B. ciliate, B. campestris*, *C. album, C. botrys, C. arvensis, C. sativm, C. distans, D. lotus, D. viscose, E. prostrate, F. crica, F. indica, F. indica, I. heterantha*, *J. regia, J. adhatoda, L. cylindrical, M. azedarach, M. esculenta, M. alba, M. nigra, N. tazzeta, N. officinale, O. feroginia, O. corniculata, P. emodi, P. roxburghii, P. wallichiana, P. integrima, P. lanceolata, P. oleraceae, Q. incana, R. hastatus, S. conidia, S. nigram, S. asper, T. officinale*, *T. terrestris, V. Thapsus, V. betonicifolia, V. negundo, W. somnifera, X. stumarium,* and *Z. armatum*.

The lowest JI value is 4.72 recorded with (Hussain et al., 2011) Gilgit Baltistan. Total 47 records, 6 species are common, 2 species show similar uses and 4 species show dissimilar uses as shown in Table 4. To compare the reported medicinal flora uses with the previous research work in allied areas of Pakistan, almost 75 species were found that have been mentions as herbal medicine but in the present research new medicinal uses of 11 plant species were reported for the first time. These 11 species belong to 10 different families that are Simarubaceae, Labiatae, Alliaceae, Moraceae, Meliaceae, Sapindaceae, Iridaceae, Anacardiaceae, Polygonaceae, Brassicaceae. All the families present 1 species each except Labiatae which presented 2 species. The species were included *A. Altissima* which were reported for the honey bees visited for making honey which showed similar with (Jan et al., 2011). But the new medicinal uses which are reported for the first time of this species is Plant leave is used as cataplasm on swelling after biting a yellow fly.

A. bracteosa were heated in water and use for blood purification, reduce stomach acidity, headache and measles which were same with (Hazrat et al., 2011) for the first time it used for blood purification, Killing worms abdominal and intestine.

A. cepa is used as a vegetable, salad and also in skin problems. The bulbs are crushed and paste on boils (Hussain et al., 2011). The new significant medicinal uses of its bulbs layers of an onion for the swelling of biting skins by various bees.

D. viscose plant used for ornamental, making broom ash of leaves used in snuff. But for the medicinally use as rheumatism, astringent and swelling (Shah et al., 2016). The fresh leave is used as bandages in the past which is reported for the first time.

F. crica were helped in controlling sugar, cancer, emollient, laxative and demulcent while also is used for thalassemia, carminative, stomachic, constipation (Shah et al., 2016). While the wood used as fuel, Sap also helps in controlling vitiligo disease which was not reported by the other researcher.

I. rugosus Extract sprayed in houses to kills fleas and termites. Leave is used for cleaning teeth and fodder for animals. A decoction of the herb is used for curing sore throat; coughing, hepatitis B, and C. Leaves help in remove fungal infection of the mouth. Also used as a fuel and

Table 4. Comparison of medicinal plant species of Tehsil Wari with the Allied near areas using Jacord Index.

S.No	References	Area	Year of study	Number of spp. Recorded	Common species in Both	Similar use of species	Plant having dissimilarity	Jaccard index (JI)
1	(Jan et al., 2011)	Kohistan valley, KP, Pakistan	2011	65	25	9	16	19.8
2	(Hazrat et al., 2011)	Sheringal valley KP, Pakistan	2011	62	24	16	8	19.5
3	(Ali and Qaiser, 2009)	Chitral valley, Pakistan	2009	83	9	03	06	5.62
4	(Hussain et al., 2011)	Gailgit Baltistan, Pakistan	2011	47	6	02	04	4.72
5	(Akhtar et al., 2013)	Swat valley KP, Pakistan	2013	96	33	19	14	22.1
6	(Barkatullah et al., 2015)	Malakand valley KP, Pakistan	2015	92	33	24	09	22.7
7	(Nisar and Ali, 2012)	Jandool valley KP, Pakistan	2012	67	31	18	13	25.4
8	(Shuaib et al., 2014)	Lower Dir KP, Pakistan	2014	40	29	21	08	29.8
9	(Ahmad et al., 2011)	Kabal, Swat valley KP, Pakistan	2011	140	38	20	18	20.2
10	(Khan et al., 2016)	Barawal valley Upper Dir KP, Pakistan	2016	64	19	16	03	14.5
11	(Sher et al., 2011)	Bunner valley KP, Pakistan	2011	216	55	37	18	22.2
12	(Kayani et al., 2014)	Abbatabad, KP, Pakistan KP, Pakistan	2014	120	20	08	12	10.76
13	(Ali et al., 2016)	Khyber agency Peshawar, Pakistan	2016	31	09	05	04	8.333
14	(Parvaiz, 2014)	Mangowal, District Gujrat Panjab, Pakistan	2014	40	06	02	04	5
15	(Umair et al., 2017)	Hafizabad, Panjab, Pakistan	2017	85	13	06	07	8.2

urgent Snuff (Khan et al., 2016). The new medicinal is The flower was used in making honey, the most expensive honey is of *I. rugosus* which 3000 per Kg. Leaves help in to remove the fungal infection of the mouth. Also used as a fuel and urgent Snuff.

I. ensata plants were used as a blood purifier (Khan et al., 2016). While the first time it is reported for the making local green rice

M. azedarach leaves were used as fodder. Leaves are also used for biting place. A bark is heating in water and used for dysentery, emetic and cathartic. Wood is used as fuel and wood products. The plant is used for burns, gonorrhea, gingivitis, piles, headache, diabetes, pyrexia, and spleen enlargement (Rehman et al., 2013). The first time its leave is used for swelling after biting of yellow fly biting.

N. officinale leaves are used as a vegetable, a salad which helps tetanus (Khan et al., 2016; Khan et al., 2009). The new medicinal uses of this plant for the first time that oil is extracted from the seed and used (Massage) relaxing Body muscles and increase sexual desire.

P. integrima barks are boiled and its extract is used for the bronchial disorder (Ahmad et al., 2014) while its unknown medicinal uses are introducing is its gall is used for gas and chest problem.

R. crispus leaves are used as vegetable and fodder for animals. Fruit help in digestion and is mostly used in condiments (Hussain et al., 2011) while it is introduced in the treatment of ear-burning infection special its spore powder.

The people of that research area mostly utilized herbs and trees for ethnological purposes and the result is in line with our research (Habib-Ul-Hassan et al., 2015). The majority of plants utilized for medicinal purposes in the research area are herbaceous plants. The informants

felt it takes more time and effort to harvest plants from woody medicinal flora. This could also relate to the fact that herbaceous plants are more easily accessible in the nearby areas, than trees and shrubs. The dominant use of herbaceous material as medicinal flora in our research agrees with other ethnobotanical research into medicinal flora inventories, done in Pakistan, and in the entire world (Adnan et al., 2012; Giday et al., 2010; Ibrar and Hussain, 2009; Murad et al., 2011; Yineger et al., 2007) reported on ethnobotanical studies of medicinal flora of Batkhela district which were in line with the research. This study examined what parts of the medicinal flora were utilized for various purposes. The local people mostly harvest the whole plant for ethnobotanical purposes. Harvesting the whole plant greatly reduces the number of plants in existence, and causes a great threat of extinction to these medicinal floras. Harvesting the medicinal flora in excess may destroy the sustainable utilization of this highly valued plant biodiversity. Our research is in line with an ethnobotanical survey of Naran Valley, Pakistan (Khan et al., 2013b). Leaves are used more frequently in the research area. The huge utilization of the leaves may be due to the easy availability. The excessive utilization of leaves might also be due to great medicinal value but more research is required to explore their medicinal properties (Barkatullah and Ibrar, 2011). **T**he uses of leaves for medicinal value (Habib-Ul-Hassan et al., 2015) have been reported on as being a greater source of medicine than the present research shows. The frequent utilization of leaves is also reported on by various other ethnobotanists (Barkatullah and Ibrar, 2011).

This may be because some medicinal flora contains large numbers of secondary metabolites (Tolossa et al., 2013) and (Habib-Ul-Hassan et al., 2015) also report the same single species being used for various disorders in the same way as our present findings. The majority of medicinal recipes are taken orally in the research area. That may be because of the ease of utilization of additives like honey, milk, etc. as a carrier for administration of the remedies. This was also reported in (Lulekal et al., 2013) that oral ingestion was the preferred mode of administration of plant remedies. (Murad et al., 2013; Ullah et al., 2006) also reported the same result. The medicinal flora of the study area is facing many threats of over-exploitation, like overgrazing, use as construction material, and the use for fuel and food. The native people of the area are very poor and the majority of these people are involved in collecting and exploiting plants for their needs, and the needs of their cattle. The grazing of their cattle is causing great damage to the medicinal flora of the research area. (Lulekal et al., 2013) also, many medicinal floras are shown to be over-exploited in our report. The most common fuel and fodder plants are *A. altissima, C. deodara, D. viscose, F. crica, I. heterantha, M. azedarach, O. feroginia, P. roxburghii, Q. baloot, Q. incana.* Due to the shortage of modern sources of fuel, the native people are over-harvesting the woody species to fulfill their basic heating requirements, without any awareness of their role in pushing the woody plants towards extinction. It was noticed that pressure on fuel woods increased greatly in winter because of cold weather. This finding is also reported in (Ahmed et al., 2013) Woody species from New Murree was used as fuel, as shown in the present report. Our survey shows that a huge number of medicinal floras are over-harvested for ethnobotanical purposes. Agriculture and livestock rearing in the research area is also a very common practice. This supports the lives of rural people. Another pressure on the medicinal flora of the survey area is overgrazing, with animals trampling the ground and causing soil compaction. Compacted soil retards germination, and slows seed growth and development. (Nogués-Bravo et al., 2008) reports the same result. Moreover, the rearing of goats is very common in the survey area, which causes huge damage to the flora through browsing. (Murad et al., 2013) reports the same effect of the animals as shown in our findings.

3.9. Future impact of the study

We hope this study will be valuable to develop a sense in the local communities, of the value economically and social of the local medicinal plants, and encourage them to care for them, for future generations. This valuable information hopefully will also encourage the local inhabitants to preserve the beauty of their valley. This can lead to increased tourism, which could have a positive effect on the local economy. With tourism could come to a greater awareness of the value and importance of the local medicinal plants, and lead to their marketing and export to the different countries of the world? That would also improve the local economy.

4. Conclusion

There is a great relationship between plants and humans. Plants play a vital role in the life of humans. Human life is impossible without plants. Plants are necessary to balance ecosystems. Plants trap the sunlight and create energy and then transfer it to animals and humans. All life forms on Earth depend on plant energy. The Wari Valley in Northern Pakistan is rich in plants with economic, commercial, pharmaceutical, medicinal and ethnobotanical uses. We hope our research work will generate widespread interest in the local communities to protect and conserve the medicinal flora for future generations. The native people of Dir Upper Wari have been dependent on medicinal plants to fulfill their day-to-day health care needs. The traditional healers and herbalists have centuries-old knowledge, about the uses of plants. The local inhabitants know some of the uses for plants, but they don't know the proper ways of the collection, collection time, parts used preservation and proper storage. The local area has an illiterate population, with poor ways of plant collection, unscientific ways of storage of medicinal plants, corrupt forest officials, with the smuggling of timber wood. These were big factors that could lead to the extinction of many medicinal plants. Many plant species are at risk due to over-collection in the local area. The important and high-value plants are decreasing in number and could become extinct. Education in proper ways of collection and conservation could lead to the preservation of these valuable plants for future generations. Medicinal plants are an important component in the agriculture sector and contribute a great share in the economic development of a country.

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