

Medicinal Plants Used for Treatment of Prevalent Diseases in Northern Pakistan of Western Himalayas

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Abstract

In this research study, we have scientifically assessed medicinal species and herbal preparations used by inhabitants of Northern Pakistan to treat joint pain, hypertension, skin diseases and glottis infections. The aim of the study is to document and highlight the ethnopharmacological significance and compare the uses of medicinal herbs for curing prevalent ailments in Northern Pakistan. Ethnomedicinal data were collected from 180 informants using semi-structured interviews and group meetings. A total of 80 plant species in 54 families were reported for the treatment of various health conditions. *Heliotropium lasiocarpum*, *Geranium wallichianum*, *Parkinsonia aculeata*, *Rubia cordifolia* and *Salvadora persica* were the favored plants for curing these diseases. Highest RFC was recorded for *Neolitsea chinensis* (0.956), *Rubia cordifolia* (0.928). The similarity of the informer's knowledge about used medicines was found in *Aesculus indica* and *Abies pindrow* with high UV. *Cuscuta reflexa* and *Lawsonia inermis* had 98–99% fidelity level for management of joint pain, skin diseases, glottis infection and hypertension respectively. In Northern Pakistan, a rich diversity of medicinal plants was used in curing various diseases. The results of this study help us in screening of herbal plants for further phytochemical and pharmacological study which leads to discovery of natural drug and development with global interest for cure of various ailments.

Keywords: herbaceous diversity, ethnomedicinal, diseases, Northern Pakistan, herbal preparation, frequency of citation

1. Introduction

1.1 Ethnobotany: concept and significance

Ethnomedicinal literature put emphasis on the relation between the indigenous communities and the usage of plants [1]. Plants are important for all biomes and the working of all social societies [2]. Traditional herbal drugs have been effective as a remedy for wide variety of diseases [3]. Traditional medicinal species and plant derivative treatments are extensively utilized in old medicinal systems worldwide,

and the therapeutic use of plant species is becoming gradually popular in modern society as natural alternatives to synthetic medications [4]. Ethnomedicinal assessment of medicinal species is essential for preserving security and valuable for incipient plant medicines [5]. Many people of the rural areas retain indigenous knowledge of therapeutic plant species [6] and such plant material still exists because it is transferred from generation to generation [7]. Thus, the race of human generally relies on plant species and their needs are increasing with passage of time [8].

1.2 Medicinal plants used at global level

The usage of medicinal plant species is common, as they have little side effects, less price, easily accessible, consistent by numerous beliefs and traditional performs [9]. Native utilization of medicinal species becomes unavoidable in giving as a source of food and drugs for health care for the rural communities and low income class. The ethnic system of old herbal drugs rely on the utilization of medicinal flora by the people of native populations and has been experienced for spans [10]. These medicinal plants were commonly used by local inhabitants and were of great value so that lot of people was engaged in the trade of essential medicinal species throughout the world [11]. Medicinal herbs gained attention due to elevation in prices of allopathic drugs for the wellbeing, biomedical benefits and accessibility and maintenance of personal health, [12]. So, conservation and sustainability of traditional medicinal system is needed [13].

World Health Organization (WHO) stated that, in developing nations around 80% of the population of the world dependent on indigenous herbal drugs (THD) for treating various diseases. Internationally, 422,000 flowering species are stated [10]. Out of these, around 50,000 plant species are used as medicinal plants and only 5000 species have separated phytochemically to examine their active chemical compounds [14]. In developed nations, 25% of medications are based on plant species and their derivatives [14]. Consequently pharmaceutical companies have made a huge amount of clinical agents, still traditional knowledge of herbal medications and phytotherapies are running in different areas of the globe. The importance of the indigenous traditional medicinal system was highlighted by the WHO that the most of population the rural communities of the emerging states is still relies on the medications for healthcare [15].

Pakistan has about 6000 medicinal plant species out of which 600 are considered to be significant from medicinal point of view [16]. These medicinal herbs are recommended by the local healers, akhuns and hakims who give health care tips within the rural areas. Around 80% of the rural people of Pakistan depend on Unani medicinal system, derived from medicinal species directly or their products [17]. The rich biodiversity of Pakistan has nine major ecological amplitudes in which the areas of Northern Pakistan are blessed with a unique biodiversity [4]. Variety of economically essential medicinal plant species for indigenous communities is fairly rich in Northern Pakistan [18]. Therapeutic species have remained utilized as a base of herbal medicinal treatment since human civilization in these areas [19]. Because of diverse climatic conditions and unique phytogeography, the area has a high variety of aromatic and medicinal plant species [20]. People living in hilly areas of Pakistan utilized medicinal species for numerous diseases and they also reliant on herbal products for their shelter, fuel, food, health, and further needs [21]. Field of ethnobotany has been presented currently in Pakistan in comparison to other nations however in the recent era much effort was performed in this research study by several scientists in various regions of country [17, 19, 22–33]. Although, a lot of work has been done on medicinal species in several areas in Pakistan, yet, no study

has been carried out on areas of Northern Pakistan in relation to special emphasis on hypertension diseases, skin infections, glottis problems and musculoskeletal disorders. Further, this is the first ever report on these prevalent disorders from Northern Pakistan.

1.3 Objectives

This study has been planned with the objective to document the folkloric knowledge of commonly used therapeutic species from different regions of Northern Pakistan, to save the medicinal knowledge. The current work focused to quantitatively calculate consensus of plants usage for treatment of diseases. This study also aims to form a baseline data for future comprehensive research on bioactive constituents.

2. Methodology

2.1 Study sites

The Northern part of Pakistan in Western Himalayas is situated among world's largest peaks and high heaps i.e., Himalaya ranges, Alai Ranges, Karakorum, Kunlun, Tien Shan and Hindu Kush [34]. The Himalaya ranges have of world largest peak i.e. Mount Everest and K2 present in this range and the lesser Himalayas Mountains are located on 2000–3000 m elevation. Its topography diverges from desiccated rocky areas in north to forest and green plains in the south. Northern part of Pakistan has rich floral variety particularly of therapeutic plant species [35]. The areas included in the research work were Bannu, Swat, Mahnshera, Dir, Abbottabad, Naran, Khaghan, Hazara division, and other tribal areas of northern parts (**Figure 1**). It is located at 72°35'- to 73°31'- east longitude and 33°50'- to 34°23'- north latitudes. It shares border with FATA (Federal Administered Tribal Areas) in the Western South part, in Northern side Azad Jammu and Kashmir, Gilgit Baltistan in north east while the Punjab in south east. Northern areas of Pakistan are home of the largest peaks these covers 72,496 km². Mean lowest temperature in January was documented to be 1.7°C, while average highest temperature to be 32.41°C in June. These Northern areas have also very severe winter with heavy rainfall [33]. The chief tribes of the area are Marwat, Shinwari, Afridi, Mohmand, Abbassies, Tareen, Khattak, Mashwani, Jadoon, Tanolis, Awans, Yusufzai, Sardars, Qureshis and

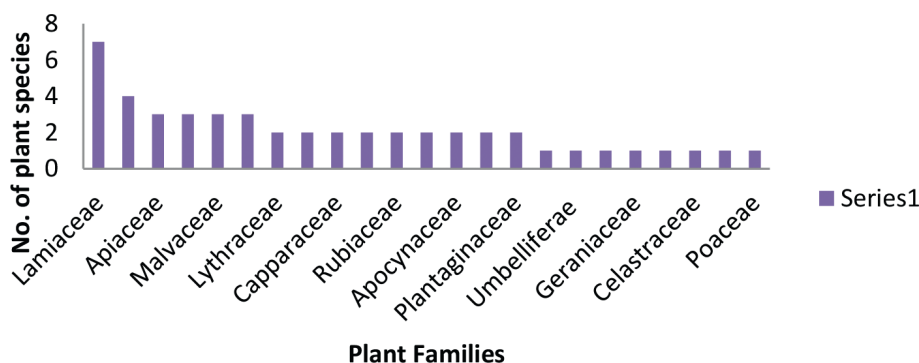


Figure 1.
Dominant families of medicinal plants.

Orakzai [30]. Majority of people speaks Pushto other local languages are Potohari, Gujrati and Hindko.

2.2 Ethnobotanical data collection

This work was mainly focused on communities exploiting conventional plant resources for treatment of hypertension, glottis disorders, skin infection, joint pain and throat diseases. The people living in Northern Pakistan have information on the usage of natural resources. The field work was performed for 6 months (from March to September, 2016). Semi-structured interviews were taken from 180 informants having traditional curing methods against variety of ailments after receiving their prior consent. The data about medicinal uses of these plants was collected from local informers and healers and medicinal practionists. Questionnaire forms was comprised of two sections; first section involves the demographic information of participants and the other section contains data about plants vernacular name, part used and mode of administration used against these diseases. Further evaluation of data obtained during field study was done by using quantitative indices.

2.3 Plant collection and preservation

The medicinal plants exploited for different ailments in the Northern Pakistan were first collected and vouchers were constituted for identification at Herbarium of Quaid -i- Azam University Islamabad Pakistan (ISL). Correct scientific families and names were confirmed by database of KEW medicinal plant name services (mpns: <http://www.kew.org/mpns>) and flora of Pakistan [36]. Each plant sample contains vital parts such as stems, seeds, roots, bark, fruits, flowers and leaves, whole plants was generally collected for small herbaceous plant specimen.

2.4 Quantitative analysis of ethnobotanical data

2.4.1 Use value citations (UV)

UV was assessed by means of standard procedure of [24].

$$UV = u/n \quad (1)$$

“u” denoted the total respondent citing different usages of a medicinal species. Use value is usually larger at close to (1) incase numeral of usage is higher and UV of plant noticeably lowers if it is close to (0). Use values do not deliver data for only one or numerous uses of plants.

2.4.2 Relative frequency of citation (RFC)

The computation of RFC was done by using formula:

$$RFC = Fc/N \quad (2)$$

The number of respondents stated by “Fc” that specified about therapeutic use related to herbal medicinal plants whereas “N” stands for numeral total value related to the respondents [37–39].

2.4.3 Family importance value (FIV)

FIV of the plant species being evaluated by using formula as under [40].

$$FIV = FC/N \times 100 \quad (3)$$

where “Fc” is the numeral value of respondents stating the use of the family and N denotes to the total numeral value of respondents contributing in the research work.

2.4.4 Fidelity level (FL)

FL is measured by following formula:

$$FL (\%) = N_p/N \times 100 \quad (4)$$

where “Np” is the numeral value of participants who defined medicinal plants as a remedy for particular ailments while “N” is the total number of informants [41].

3. Results and discussion

3.1 Socio-demographic profile of informants

Demographic information of the participants was taken from semi structured questionnaires. A total of 180 respondents were questioned in this field survey. Of the 180 informants, 113 were Indigenous people and the rest (67) were local health practitioners, rest of all information is stated in (**Table 1**).

3.2 Medicinal plant diversity

Present research stated 80 medicinal plants used to treat some prevalent diseases in Northern Pakistan (**Table 2**). These medicinal plants were distributed in 54 families. They show diversity in growth and presented by all growth forms with high proportion of herbs (54%), shrubs (30%) and trees (16%) (**Table 3**). The main cause for herbs dominance in the research area may be the easily accessibility resultant from bulk growing in wild area. The native respondent described that most of the hakims and healers commonly use herbs for treatment of ailments because of their easy attainability and availability.

The recorded medicinal species and medicinal uses along with local name, part used, preparations and mode of utilization had been documented in **Table 2**. The plant family that have higher number of medicinal species was *Lamiaceae* (7 species) followed by (4 species) of *Papaveraceae*, (3 species) of *Malvaceae*, *Apiaceae*, *Asteraceae* and *Brassicaceae*, (2 species) *Acanthaceae*, *Pinaceae*, *Myrtaceae*, *Rubiaceae*, *Lythraceae*, *Plantaginaceae*, *Cactaceae* and *Capparaceae*, (1 species) *Ranunculaceae*, *Berberidaceae*, *Saxifragaceae*, *Umbelliferae*, *Moraceae*, *Papilionaceae*, *Poaceae*, *Oleaceae*, *Fabaceae*, *Salvadoraceae*, *Solanaceae*, *Rutaceae*, *Meliaceae* and rest of the families presented one medicinal plant (**Figure 1**). *Lamiaceae* documented higher diversity of medicinal species followed by *Asteraceae* and *Solanaceae*; *Lamiaceae* also indicated greater diversity of medicinal flora plants [42]. *Lamiaceae* a diverse family with mostly herbaceous plants producing volatile aroma over all aerial parts, has been described as dominant plant family by [43]. In ethnobotanical studies of lesser Himalayas the high percentage of medicinal

Serial number	Variables	Categories	No of person	Percentages
1.	Gender	Female	84	47
		Male	96	53
2.	Age group	37–47	12	7
		47–57	36	20
		57–67	49	27
		67–77	53	29
		77>	30	17
3.	Occupation	Retired	48	27
		Unemployed	24	13
		Employed	38	21
		Housewife's	50	28
		Others	20	11
4.	Education	Primary level	52	29
		Secondary level	31	17
		Tertiary level	20	11
		Others	19	10
		Uneducated	58	33
5.	Informant category	Indigenous people	113	63
		Local health practitioners	67	37
6.	Residence	Rural	41	23
		Urban	139	77
7.	Marital status	Married	83	46
		Un-married	97	54

Table 1.
Demographic data of informants of Western Himalayas.

plants in the families' Papaveraceae, Moraceae and Fabaceae has previously been stated by [44].

3.3 Plant parts used as a medicine

In this ethnobotanical study, the part of plant most frequently utilized is was leaves (41%), and seeds and roots (10%) (**Table 4**). Leaves were used as main part of plant, it has been stated within different ethnomedicinal research of Thailand, India, Bangladesh, Colombia, Pakistan, and China [45–51]. Leaves are the dominantly used plant part because it is easily attainable plant part and requires small effort to collect as compared to other plant parts [43]. Moreover, other important fact of leave utilization is important for conservation and maintenances of plant because collection of other plant parts and roots may kill the plant or endangered the specie [52]. Bulk use of whole plant, fruits, seeds, roots and bark in herbal medicinal preparations may results in decreasing population of plants in nature [53].

While fruits (9%), whole plant (7%), stem and aerial part (6%), bark (4%), flower (3%), shoots and rhizomes (2%) were also frequently used (**Table 4**). Fruits,

Sr. no	Taxonomic names/voucher no/families	Local name	Life form	Part used	Mode of utilization	Diseases category	Recipes	FC	RFC	UR	UV	FL
1.	<i>Abelmoschus esculentus</i> (L.) Moench KN 1011/Malvaceae	Bhindi	Herbs	Seed	Teas	pimple	Plants seeds are boil in water and make tea which is usage in treatment of pimples for 2 weeks	25	0.139	1	0.040	80.00
2.	<i>Abies pindrow</i> (Royle ex D. Don) Royle KN 1015/Pinaceae	Kachal/Achal	Trees	Leave and shoot	Decoctions	Throat and cough infection	Leave decoction of are given for 3–4 weeks for treatment of throat diseases	28	0.156	2	0.071	78.57
3.	<i>Achyranthes aspera</i> L. KN 1017/ Amaranthaceae	Put kandha	Herbs	Leave	Juices	Rheumatism	The 20 g fresh leave juice is used for treatment of rheumatism after every meal for month	18	0.100	1	0.056	55.56
4.	<i>Aconitum chasmanthum</i> Stapf ex Holmes KN 1019/ Ranunculaceae	Mori, Bishmoulo	Herbs	Rhizome	Decoctions	Measles and mumps	The rhizomes of the plant is boiled in water and decoction is made, are given for weeks to cure diseases	42	0.233	2	0.048	76.19
5.	<i>Acorus calamus</i> Linn KN 1010/ Acoraceae	Wajh	Herbs	Root	Infusions	Hypertension	20-30 g of root infusion are given to relief hypertension until it is controlled	110	0.611	1	0.009	92.73
6.	<i>Adiantum venustum</i> D. Don KN 1013/Pteridaceae	Pata, kakwa	Herbs	Leave	Paste	Healing of wound	The 50 g of leaves are dried and make paste for healing wounds	144	0.800	1	0.007	84.72
7.	<i>Aesculus indica</i> (Wall. Cambess.) Hook. OP KN 1014/ Hippocastanaceae	Bankh khore	Trees	Leave	Extracts	Whooping and cough	Leaves extract are used to treat whooping and cough	22	0.122	2	0.091	81.82
8.	<i>Ajuga bracteosa</i> Benth. AK KN 1017/Lamiaceae	Kahri bhooti	Herbs	Whole plants	Decoction and infusion	Rheumatism and body pain	20 g of whole plant is boiled in water and decoction is made this is given to treat body pain	10	0.056	2	0.200	80.00
9.	<i>Argemone mexicana</i> Linn KN 1019/Papaveraceae	Kandiarhi	Herbs	Aerial part	Decoction and infusion	Dislocate pain and joint pain	Infusion and decoction of aerial part of plant is suggested for 5 days	48	0.267	2	0.042	70.83
10.	<i>Barleria cristata</i> L. KN 1020/ Acanthaceae	Janglhi pool	Shrubs	Roots and stem	Poultices	Rheumatic pain	25 g of stem and roots are powdered and mix with water and make paste that is used as poultice to treat rheumatism	62	0.344	1	0.016	85.48

Sr. no	Taxonomic names/voucher no/families	Local name	Life form	Part used	Mode of utilization	Diseases category	Recipes	FC	RFC	UR	UV	FL
11.	<i>Begonia reniformis</i> Bedd. KN 1021/Begoniaceae		Shrubs	Flower	Infusions	Hypertension	Infusion of dry flower is taken to relieve hypertension	20	0.111	1	0.050	65.00
12.	<i>Berberis lycium</i> Royle KN 1024/ Berberidaceae	ZiarLargay	Shrubs	Leave	Decoction s	Sore throat and throat infection &	2 cups of decoction is taken twice a day for week for curing throat infections	36	0.200	2	0.056	69.44
13.	<i>Bergenia ciliata</i> (Haw.) Sternb KN 1026/Saxifragaceae	Batweyaha	Herbs	Bark	Pastes	Wound healing	Paste of Bark is used to heal up wounds	16	0.089	1	0.063	75.00
14.	<i>Bryophyllum pinnatum</i> (Lam.) Oken KN 1027/Crassulaceae	Zakam e Hayhat	Herbs	Leave	Decoction s	Hypertension	15 g of leaves are boiled in water and decoction is made, 1 cup of decoction is used once a day for hypertension	33	0.183	1	0.030	90.91
15.	<i>Buxus papillosa</i> KN 1028/ Buxaceae	Angaroo	Shrubs	Leave	Oils	Skin problem	Oil of leaves are applied on skin to treat skin problem	22	0.122	1	0.045	86.36
16.	<i>Camellia sinensis</i> (L.) Kuntze KN 1029/Camelliaceae	Chaieh	Shrubs	Leave	Teas	Throat infection and Cough	50 g of leaves are boiled in water to make tea which is used for 2 weeks for cough and throat infections	32	0.178	2	0.063	90.63
17.	<i>Capparis decidua</i> (Forssk.) Edgew. KN 1030/Capparaceae	Keehra	Trees	Seed	Decoctions	Healing of wound	Seeds decoction used 3 cups daily for treatment of disease	21	0.117	1	0.048	71.43
18.	<i>Capparis spinosa</i> L. KN 1032/ Capparaceae	Kabhar	Shrubs	Seed	Powders	Hypertension	Powder of the seeds is taken with water 3 times a day to cure hypertension	56	0.311	1	0.018	60.71
19.	<i>Commelina diffusa</i> Burm. f KN 1034/Commelinaceae		Herbs	Whole plants	Juices	Hypertension	30-35 g of whole plants are crushed to attain juice which is better for hypertension for 3 weeks	62	0.344	1	0.016	79.03
20.	<i>Commiphora stocksi</i> ana (Engl.). KN 1036/Burseraceae	Chandru	Shrubs	Leave and root	Paste and Poultice	Backache Joint pain and bone fracture	Leaves paste and poultice are applied on joints for treatment of rheumatic disorders until its cure	76	0.422	3	0.039	88.16
21.	<i>Cuminum cyminum</i> L. KN 1038/ Apiaceae	Zhira	Herbs	Fruit	Infusions	Cough	80 g of fruits of the plants are dipped whole night in water and make in fusion given twice a day for 2 weeks	40	0.222	1	0.025	55.00

Sr. no	Taxonomic names/voucher no/families	Local name	Life form	Part used	Mode of utilization	Diseases category	Recipes	FC	RFC	UR	UV	FL
22.	<i>Cuscuta reflexa</i> Roxb KN 1040/ Convolvulaceae	Aftinmoon	Herbs	Leave	Decoctions	Hypertension	10-20 g of leave decoction is used for hypertension for 3 weeks	111	0.617	1	0.009	99.10
23.	<i>Daphne macronata</i> Royle. KN 1042/Thymelaeaceae	Daphnee plants	Shrubs	Leave bark & aerial part	Decoctions cooked and Powders	Rheumatism	Powder of aerial parts and bark is taken after each meal for treatment of rheumatic disorders. Leaves are dried mix with water and taken for 4-5 days. Aerial parts are cooked and used for cure of diseases	83	0.461	1	0.012	96.39
24.	<i>Descurainia sophia</i> (L.) Webb ex Prantl KN 1043/Brassicaceae	Burriborhy	Herbs	Whole plants	Decoctions	Cough and throat infection	30 g of leave decoctions is used for a 2 week to cure throat infection	12	0.067	2	0.167	83.33
25.	<i>Equisetum arvense</i> L. KN 1045/ Equisetaceae		Herbs	Aerial parts	Extracts	Hypertension	70 g of aerial parts are required for extraction that is used for hypertension for 20 days	102	0.567	1	0.010	89.22
26.	<i>Eruca sativa</i> (L.) Cav. KN 1048/ Brassicaceae	Jambhoo	Herbs	Shoot & seed	Pastes and decoctions	Rheumatic disorders	2 cups of hot water is taken and add 2 teaspoons of grinded plant mixed well and used thrice a day for treatment. Seeds paste is used for Rheumatism	109	0.606	1	0.009	90.83
27.	<i>Eucalyptus globulus</i> Labill. KN 1049/Myrtaceae	Lachi, Sufaida	Trees	Leave & Stem	Decoctions	Sore throat	25 g of eaves decoction is used twice a day after every meal	28	0.156	1	0.036	71.43
28.	<i>Euphorbia helioscopia</i> L. KN 1051/Euphorbiaceae	Catt milk	Herbs	Leave	powder	Healing of wounds	Dried 40 g of leaves are powdered and mix with water and taken orally for 4-5 days	21	0.117	1	0.048	66.67
29.	<i>Ferula asafoetida</i> L. KN 1053/ Umbelliferae	Hinhg	Herbs	Rhizomes	Decoction s	Coughs	A rhizomes of the plant is boiled in water and decoction is made taken 2 cups daily for cough	18	0.100	1	0.056	66.67
30.	<i>Ficus virgata</i> Reinw. ex Blume KN 1055/Moraceae	Anjheer Zardh	Trees	Fruit	Raw	Hypertension	Fruits are eaten orally for treatment of diseases	100	0.556	1	0.010	89.00
31.	<i>Fumaria officinalis</i> L. KN 1057/ Papaveraceae	Shaharaha	Herbs	Aerial part	Juices and Extracts	Hypertension	45 g of dried leaves are used for making decoction and juice. 1 cup is used for hypertension	48	0.267	1	0.021	60.42

Sr. no	Taxonomic names/voucher no/families	Local name	Life form	Part used	Mode of utilization	Diseases category	Recipes	FC	RFC	UR	UV	FL
32.	<i>Galium abaijense</i> Borbás KN 1058/Rubiaceae	Khrhratanii	Herbs	Leave	Poultices	Wound healing and skin problem	Poultice of leaves is applied on wounds	17	0.094	4	0.235	52.94
33.	<i>Geranium wallichianum</i> D. Don ex sweet KN 1059/Geraniaceae		Herbs	Root	Extracts	Hypertension	50 ml of extract of 80 g of dried roots is use for hypertension	150	0.833	1	0.007	92.00
34.	<i>Glycyrrhiza glabra</i> L. KN 1060/Papilionaceae	Malhathii	Herbs	Root	Decoction s	Sore throats	Roots of plants are boil in water then used as decoction for treating sore throat infections	23	0.128	1	0.043	78.26
35.	<i>Grewia optiva</i> J. R. Drumm. ex Burret KN 1062/Malvaceae	Tamhar	Shrubs	Leave and bark	Decoctions and powders	Rheumatism and bone dislocation	Paste of leaves are apply on bones & plant decoction are used for treatment of diseases	99	0.550	2	0.020	76.77
36.	<i>Gymnosporia senegalensis</i> (Lam.) Loes.KN 1064/Celastraceae		Shrubs	Leave and root	Decoctions	Hypertension	Decoctions of roots and leaves are used for cure of hypertension	73	0.406	1	0.014	93.15
37.	<i>Heliotropium lasiocarpum</i> Fisch KN 1067/Boraginaceae	Chulai	Herbs	Whole plants	Decoction s	Hypertension	35 g of whole plant is boiled in water and decoction is made that is used for hypertension	135	0.750	1	0.007	89.63
38.	<i>Hippophae rhamnoides</i> L. KN 1069/Elaeagnaceae		Trees	Fruit and seed	Decoctions	Skin problem	Fruits decoction are used for skin problems	132	0.733	1	0.008	95.45
39.	<i>Hordeum vulgare</i> L. KN 1070/Poaceae	Jahoo	Herbs	Seed	Decoctions	Whooping cough	Seeds decoction are used to cure cough, 2 cups of decoctions taken daily twice a day	28	0.156	1	0.036	67.86
40.	<i>Heracleum candicans</i> Wall. ex DC. KN 1072/Apiaceae	Kadupanhra	Herbs	Whole plants	Juices	Rheumatic pain	Whole plant is grinded to make juice and this juice is taken 2 glasses a day	76	0.422	1	0.013	85.53
41.	<i>Impatiens edgeworthii</i> Hook. f KN 1074/Balsaminaceae	Buntilh	Herbs	Whole plants	Pastes	Skin burns	Paste of the plant is applied externally for burns	30	0.167	1	0.033	93.33
42.	<i>Isodon rigosus</i> (Wall. ex Benth.) KN 1075/Lamiaceae	Sperkaye	Shrubs	Leave	Powders	Wound healings and skin problem	15 g of leaves powder is used 2 times a day after each meal	122	0.678	2	0.016	93.44

Sr. no	Taxonomic names/voucher no/families	Local name	Life form	Part used	Mode of utilization	Diseases category	Recipes	FC	RFC	UR	UV	FL
43.	<i>Juglans regia</i> L. KN 1076/Juglandaceae	Akhroot	Trees	Aerial part, leave and stem	Decoction s	Hypertension	40 g of dried leaves and roots extract and decoction are used in hypertension for 1 month thrice a day	52	0.289	1	0.019	92.31
44.	<i>Justicia adhatoda</i> L. KN 1079/Acanthaceae	Behkare	Shrubs	Leave	Raw	Wound healing	Leaves are directly applied on wounds for healing	25	0.139	1	0.040	72.00
45.	<i>Legenaria siceraria</i> (Molin) KN 1082/Cucurbitaceae		Herb	Fruit,	Raw	Muscle and rheumatic pain	Fruit is eaten directly for curing a diseases	19	0.106	2	0.105	68.42
46.	<i>Lavandula angustifolia</i> Mill KN 1084/Lamiaceae	Khushbudhar	Shrub	Leave	Infusions & decoction	Hypertension	20 g of leaves are taken and dipped in water for 2 days, its infusion is antihypertensive	62	0.344	1	0.016	69.35
47.	<i>Lawsonia inermis</i> KN 1085/Lythraceae	Mehndi	Shrubs	Leaves	Infusions	Boils and skin burn	Dried and crushed leaves are dissolved in water and are applied for 5–6 days	140	0.778	2	0.014	98.57
48.	<i>Laphangium affine</i> (D.Don) Tzvelev KN 1086/Asteraceae	Janglii dodhal	Herbs	Leaves	Decoctions	Throat and cough infection	10-20 g of leaves decoction is use for throat infection twice a day for 2 weeks	49	0.272	2	0.041	59.18
49.	<i>Malvastrum coromandelianum</i> (L.) Garcke KN 1087/Malvaceae	Dhammii bhooti	Herbs	Leave and rhizomes	Powders	Muscular pain	3-5 rhizomes of the plants are taken, powder them tea can be made by addition of 2–6 g of powder in 3 cups of water. This is used for cure of muscular diseases	52	0.289	1	0.019	88.46
50.	<i>Mentha longifolia</i> (L.) Huds. KN 1089/Lamiaceae	Jangli Podhina	Herbs	Flower and leave	Extracts	Hypertension	50 g of leaves extract o is used to cure hypertension	75	0.417	1	0.013	81.33
51.	<i>Musa acuminata</i> Colla KN 1090/Musaceae	Kelha	Trees	Fruits and stem	Decoctions	Hypertension	Stems, fruits and flowers decoctions are effective in relieving from hypertension	51	0.283	1	0.020	90.20
52.	<i>Myrsine africana</i> L. KN 1092/Myrsinaceae	Gughal	Shrubs	Leave	Decoctions	Skin problems	Leaves were especially used against cough, cold, flue and skin diseases	39	0.217	1	0.026	76.92
53.	<i>Myrtus communis</i> L. KN 1094/Myrtaceae	Manrhoo	Trees	Fruit	Decoctions and boils	Muscle pain	25 g of fruit decoction is taken for muscle disorder for 2 weeks, twice a day	67	0.372	1	0.015	70.15

Sr. no	Taxonomic names/voucher no/families	Local name	Life form	Part used	Mode of utilization	Diseases category	Recipes	FC	RFC	UR	UV	FL
54.	<i>Nolitsea chinensis</i> Chun KN 1096/Lauraceae	Maiddasak	Trees	Shoot & bark	Powders and pastes	Muscular problem	Paste of the 39 g of bark and shoot are apply over muscles for several days until pain is cure	172	0.956	1	0.006	97.09
55.	<i>Nepeta praterensis</i> Rech. f. KN 1098/Lamiaceae	Simsok	Herbs	Leave	Teas	Cough and throat infection	Leaves are boil in water, make tea which is used for throat infection	32	0.178	2	0.063	53.13
56.	<i>Nerium oleander</i> L. KN 1099/ Apocynaceae	Kaneer	Shrubs	Leave	Extracts	Hypertension	30 g of leave extracts are mixed with oil are used for hypertension	54	0.300	1	0.019	75.93
57.	<i>Ocimum basilicum</i> L. KN 1100/ Lamiaceae	JangliTulsi	Herb	Leave	Infusions	Hypertension	Leaves infusion in 1 l water is prepared and taken two times/day as needed until improvement occurs	81	0.450	1	0.012	81.48
58.	<i>Oenothera rosea</i> L'Hér. ex Aiton KN 1101/Onagraceae	Jungligulahb	Herbs	Whole plants	Infusions	Whooping Cough	Leaves are dipped in water for 2 days than infusion is used for cough for a week	20	0.111	1	0.050	50.00
59.	<i>Olea europaea subsp. cuspidata</i> (Wall. & G. Don) Cif KN 1104/ Oleaceae	Ghawarejha	Shrubs	Seed and leave	Teas	Skin problem	70 g of dried leaves of plants are boiled and tea is used orally for mouth ulcer and skin diseases for 1 month	32	0.178	1	0.031	84.38
60.	<i>Opuntia dillenii</i> (Ker Gawl.) Haw. KN 1106/Cactaceae	Zuqham	Shrubs	Fruit	Juices	Cough and throat infection	Juice of 90 g of fruit is good in throat infection	32	0.178	2	0.063	56.25
61.	<i>Opuntia ficus-indica</i> (L.) Mill KN 1107/Cactaceae	Zahqam	Shrubs	Fruit	Raw	Muscular pain	Raw fruits are taken daily to treat muscle pain	117	0.650	1	0.009	96.58
62.	<i>Pinus sylvestris</i> L. KN 1108/ Pinaceae	Snobher	Trees	Leave	Extracts	Hypertension	Few grams of leaves extract is good for curing disease for 3 weeks	56	0.311	1	0.018	76.79
63.	<i>Papaver somniferum</i> L. KN 1110/ Papaveraceae	Post	Herbs	Fruit	Teas	Whooping, cough	Fruits are boil in water to make tea and 2 cups of tea are taken thrice a day for cough	43	0.239	1	0.023	65.12
64.	<i>Parkinsonia aculeata</i> L. KN 1112/Fabaceae	Janglii baabar	Shrubs	Leave, seed and root	Oils	Joint pain and body swelling	Seeds oil of plants are used for joints pain	163	0.906	2	0.012	85.28
65.	<i>Picrorhiza kurroo</i> Royle. ex Benth KN 1114/Plantaginaceae	Kutakhi safed	Herbs	Root	Raw	Skin burns	It is beneficial in the treatment of burning sensation	40	0.222	1	0.025	50.00

Sr. no	Taxonomic names/voucher no/families	Local name	Life form	Part used	Mode of utilization	Diseases category	Recipes	FC	RFC	UR	UV	FL
66.	<i>Plantago major</i> L. KN 1117/ Plantaginaceae	Barthange	Herbs	Leave	Decoctions	Hypertension	Leaves decoction is taken for 3 week to cure hypertension	97	0.539	1	0.010	81.44
67.	<i>Prunus persica</i> (L.) Batch KN 1118/Rosaceae	Arnu	Trees	Leave and fruit	Decoctions	Skin problem	20 g of dry leaves are taken boiled in water, decoction is made that is given for week for skin problems	18	0.100	1	0.056	50.00
68.	<i>Rhazya stricta</i> Decne. KN 1120/ Apocynaceae	Harnaal, venna	Shrubs	Leave	Infusions	Sore throats	65 g of leaves are dipped in water whole night and infusion is made that is used to cure sore throat	28	0.156	1	0.036	64.29
69.	<i>Rhododendron arboreum</i> Sm. KN 1122/Ericaceae	Rantool	Trees	Leave	Powders	Rheumatic disorder	13 g of leaves are dried and powder are taken against chronic rheumatic disorders for 2 weeks	124	0.689	1	0.008	95.16
70.	<i>Rubia cordifolia</i> L. KN 1124/ Rubiaceae	Majithe	Herbs	Whole plants and root	Decoction s and Pastes	Joint pains	40 g of roots are powdered and make paste that are applied at joints for 2 weeks	167	0.928	1	0.006	79.64
71.	<i>Rydingia limbata</i> (Benth.) Scheen & V. A. Albert KN 1127/ Lamiaceae	Ghawarejha	Shrubs	Leave	Extracts	Skin problems	30 ml of extracts of leaves are taken orally against mouth ulcers and skin diseases	117	0.650	1	0.009	86.32
72.	<i>Salvadora persica</i> L. KN 1128// Salvadoraceae	Pilu	Shrubs	Stems and leave	Poultices	Rheumatic diseases	Leaves of plants are heated and tied in cloth and applied over pain areas	138	0.767	1	0.007	72.46
73.	<i>Senecio chrysanthemoides</i> DC KN 1129/Asteraceae		Herbs	Leave	Oils	Skin problems	Oil of 60 g of leaves are used for treatment	102	0.567	1	0.010	87.25
74.	<i>Sisymbrium irio</i> L.KN 1131/ Brassicaceae	Janglii sarso	Herbs	Leave	Infusions	Throat infection & cough	50 ml of infusion of leaves is effective against throat and cough ailment	30	0.167	2	0.067	76.67
75.	<i>Tagete serecta</i> L. KN 1134/ Asteraceae	Satveerga	Herbs	Leave	Poultices	Muscular pain & swelling of body	Hot oil is mixed in leaves and applied on used on swelling body parts	153	0.850	2	0.013	95.42
76.	<i>Trachyspermum ammi</i> (L.) Sprague KN 1136/Apiaceae	Ajwaain	Herbs	Seed	Decoctions	Throat infection and cough	50 g of seed decoction is used for 3 weeks for throat infections	139	0.772	2	0.014	88.49

Sr. no	Taxonomic names/voucher no/families	Local name	Life form	Part used	Mode of utilization	Diseases category	Recipes	FC	RFC	UR	UV	FL
77.	<i>Urtica dioica</i> L. KN 1137/ Urticaceae	Bichoo bhooti	Herbs	Root	Decoctions	Cough and throat infection	30-40 g of root are boiled in water and make decoction that is used for throat infection	129	0.717	2	0.016	86.05
78.	<i>Verbascum thapsus</i> L. KN 1138/ Scrophulariaceae	Gadikhanda	Herbs	Aerial part	Infusions	Pimples and skin problems	Aerial plants are grinded and dissolved in water and make infusion that is taken for 3-4 days	109	0.606	2	0.018	96.33
79.	<i>Withania somnifera</i> (L.) Dunal KN 1139/Solanaceae	Aksaan	Herbs	Leave & root	Pastes and powders	Joint pains	Root of plant are taken, rinse with water, dried and crushed to make powder then it is given in lessen amount for joint disorders. Paste of leaves is used to cure pain	112	0.622	1	0.009	87.50
80.	<i>Zanthoxylum armatum</i> DC. KN 1142/Rutaceae		Trees	Seed	Decoctions	Sore throat	18 g of seeds decoction are given for 3 week to treat sore throat	132	0.733	1	0.008	75.00

Table 2.
Medicinal plants use for some prevalent diseases in Northern Pakistan.

S/No	Life form	Percentage (%)
1.	Herbs	54
2.	Shrubs	30
3.	Trees	16

Table 3.
Life form of medicinal plant.

S/No	Part used	Percentage (%)
1.	Leaves	41
2.	Seeds	10
3.	Roots	10
4.	Fruits	9
5.	Whole plant	7
6.	Stem	6
7.	Aerial parts	6
8.	Bark	4
9.	Flowers	3
10.	Rhizomes	2
11.	Shoots	2

Table 4.
Plant part used as medicines.

leaves and stem were the key source of herbal medicines in the research study area. In earlier described studies from various parts of the Pakistan whole plant, flower and fruit therapy is very common and it is present among the top of the plant parts usage [54]. Rhizomes, roots and fleshy parts of the plant species have a high amount of bio-active compounds [55].

3.4 Types of herbal preparations

Medicinal species utilized and administrated in herbal medicines in numerous forms in the area. The common preparation methods were categorized into decoction (33%), powder (14%), paste and extracts (11%), infusion (10%). Juice (5%), tea (7%), poultice (3%), raw (2%) and Oil and cooked (2%) (**Table 5**). There are several routes of administration, such as, topical use and oral ingestion for the treatment of different diseases (**Table 2**). Local traditional healers use ingestion to cure most diseases, but topical use is an important route of intake to cure diseases such as skin disorders, glottis diseases, joint pain, hypertension, wounds, and body pain, weakness and poisonous bites [54]. The particular parts of plants and definite quantity of dosages taken for ailments control mainly depends on patients physical health [35]. Some individuals use, orange peel, sugar, lemon, banana pulp, tobacco leaf, black pepper and camphor, as adjuvant with various diluents.

Large number of the plant drugs (74%) was made from fresh part of plants neither the dry parts of plants. In this study it was observed that there are ambiguities in taking exact quantities of medicines between the respondents due to

S/No	Mode of preparation	Percentage (%)
1.	Poultice	3
2.	Decoction	33
3.	Infusion	10
4.	Powder	14
5.	Paste	11
6.	Extract	11
7.	Juice	5
8.	Tea	7
9.	Oil	2
10.	Raw	2
11.	Cooked	2

Table 5.
Mode of utilization of medicinal plant.

variation of person's experiences and difference in ethnical information of the respondents.

3.5 Use of phototherapies

This ethnobotanical survey showed indigenous people utilized therapeutic plant species most often for the cure of hypertension (20 reports) followed by cough (14 reports), skin problem (11 reports), rheumatism (10 reports). This survey specified fact that indigenous communities used medicinal plants frequently exploited in skin diseases, respiratory disorders, cough, throat infections, joint pain and hypertension specified that the plant of this zone have versatile medicinal usages against disease [56]. The other noticeable diseases were throat infections (10 reports), wound healing (7 reports), Sore throat (5 reports), joint pain (4 reports), skin burn (3 reports). Though, skin problems were followed by pimples and swelling of body (2 reports) and boils and body pain (1 report) (**Tables 2 and 6**). Recent studies shown that maximum of local populations were dependent on a diversity of native plant species to treat several diseases as the modern health services were out of reached. It was noticed in throughout the field study that old information of indigenous therapeutic species is about to vanishing upcoming age groups belonging to research region. This is because of absence of attention by modern cultures, as they thought herbal medicines are less useful in comparison to allopathic medicines. Despite the fact when these elder persons die than these conventional medicinal practices might be quickly disappeared [57].

3.6 Quantitative analysis

3.6.1 Relative frequency of citation

For examining the ethnobotanical knowledge quantitative analysis was recorded in this study. Most stated plant species identified by a large number of respondents for medicinal purposes. Maximum RFC was documented for *Neolitsea chinensis* (0.956), *Rubia cordifolia* (0.928), *Parkinsonia aculeate* (0.906) and *Tagetes erecta* (0.850) (**Table 2**). These findings are related to the fact that a large number of respondents cited the plant species and RFC directly related to the number of

S/No	Mode of preparation	Percentage (%)
1.	Hypertension	22
2.	Cough	15
3.	Throat infection	11
4.	Sore throat	6
5.	Wound healing	8
6.	Rheumatism	11
7.	Joint pain	4
8.	Swelling of body	2
9.	Muscular pain	2
10.	Body pain	1
11.	Skin problem	12
12.	Skin burn	3
13.	Boils	1
14.	Pimples	2

Table 6.
Categories of disease.

respondents describing the usage of this medicinal species [19]. It was followed by *Lawsonia inermis* (0.778), *Zanthoxylum armatum* (0.733), *Utica dioica* (0.717), *Opuntia ficus-indica* (0.65), *Rhododendron arboretum* (0.689), *Geranium wallichianum* (0.833), *Hippophae rhamnoides* (0.73), *Cuscuta reflexa* (0.617) and *Ficus virgate* (0.556). Another cause of why medicinal plant stated repeatedly because of; (1) the trust of people on medicinal plant and old age relationship of the easily accessible medicinal species with people and (2) the comparatively high price of synthetic drugs and non-approach to the systems of medicine [41].

3.6.2 Use value of medicinal plants

Mostly local health practitioners in study area used these species to cure diseases from other communities. The current research showed that the use value varies from 0.094 to 0.006 (**Table 2**). Plant species recorded with high use values were *Aesculus indica*, *Abies pindrow*, *Opuntia dillenii*, *Nepeta praetervisa*, *Begonia reniformis* and *Berberis lyceum*. These plants were commonly found in people's homes, the decoction, tea, extract made from leaves was found very effective in hypertension, joint pain and glottis infection. Thus it should be recommended that medicinal plants have maximum UV values, would be further studied for phytochemical and pharmacological evaluation for developing medicinal system of herbal drugs [58]. *Neolitsea chinensis* (Use value 0.006) revealed least UVs because they were not abundant in the research area. Used value was less in some conditions due to the lower information of the informants about the medicinal plants, that may be of exotic source [59].

3.6.3 Fidelity level (FL)

To find the plant that is most chosen by the respondents for the cure of specific disease is fidelity level. FL in the present study varied from 50 to 99%. *Cuscutareflexa* (99%), *Lawsonia inermis* (98%), *Daphne mucronata* (96%),

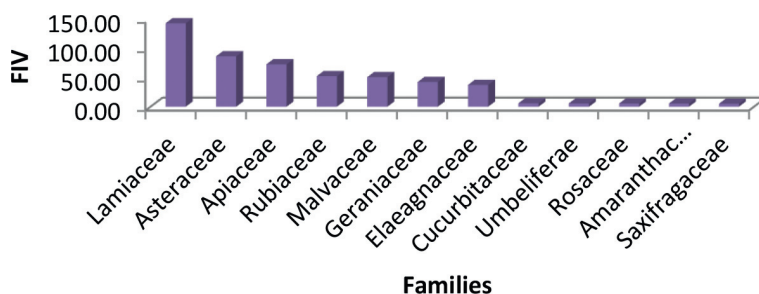


Figure 2.
Family importance value of medicinal plants.

Hippophae rhamnoides (95%), *Impatiens edgeworthii*, *Isodon rugosus* and *Gymnosporia senegalensis* (93%), *Geranium wallichianum* and *Acorus calamus* (92%) *Bryophyllum pinnatum*, *Camellia sinensis* and *Eruca sativa* (90%), *Heliotropium lasiocarpum*, *Equisetum arvense* and *Ficus virgata* (89%), *Commiphora stocksiana* and *Malvastrum coromandelianum* (88%), *Withania somnifera* (87%), *Buxus papillosa* (86%), *Heracleum candicans* and *Barleria cristata* (85%), *Adiantum venustum* (84%), *Descurainia sophia* (83%), *Mentha longifolia* and *Aesculus indica* (81%), *Abelmoschus esculentus* and *Ajuga bracteosa* (80%) had high fidelity levels for the treatment of muscular pain, skin infections, dermatological diseases and hypertension (**Table 2**). High FL values of medicinal plant shows the selection of plant by respondents to cure particular disease [60, 61]. These plants might be confirmed as significant medicinal species by further evaluation and assessment by pharmaceutical, phytochemical and biological actions [62]. The species with least FL cannot be ignored as it causes the next generation to control the risk of gradually decreasing medicinal knowledge [63].

3.6.4 Family importance value (FIV) of medicinal flora

The evaluation of family importance value of plant species revealed that *Lamiaceae* was most prevailing group of plants having FIV of (142.50) then *Asteraceae* (86.1), *Apiaceae* (72.50), *Rubiaceae* (52.22), *Malvaceae* (50.56), *Geraniaceae* (42.22) and *Elaeagnaceae* (37.22) etc. Lower values of FIV were calculated for *Saxifragaceae* (5.00), *Amaranthaceae*, *Rosaceae* and *Umbelliferae* (5.56), *Cucurbitaceae* (5.83), *Euphorbiaceae* (6.39), *Hippocastanaceae* and *Buxaceae* (6.67), *Fabaceae* (6.94) and *Poaceae* (8.33) (**Figure 2**). The ethnobotanical study revealed by [35] showed that maximum FIV was observed by family *Asclepiadaceae* (FIV 18.5) then *Punicaceae* (FIV 17.9) whereas minimum value was observed by *Myrtaceae* (FIV 2.3). All these findings are dissimilar from current research as the numerical ethnomedicinal facts varies because of change in geo-climate and vegetation of the region [19].

4. Conclusion

The ethnobotanical data revealed that the conventional knowledge of therapeutic plants in the Northern Pakistan is mostly sustained by elders, and this knowledge was transferred from their forefathers. This study revealed that the most frequently exploited plants were present in *Lamiaceae* and *Papaveraceae*, The common method of utilization was decoction. Numerical indices of FC, UV, RFC, FL, and FIV reveal that a greater variety of medicinal species is still utilized between the native inhabitants as treatment of various ailments in the study site. Particularly,

this ethnobotanical study suggested that the studied species of far-off valley should be further assessed for appropriate research and pharmacological activities to validate their present traditional usage that may help as the primary means to produce plant-derived prescriptions. Future study on the security and usefulness of medicinal herbs, along with ecological and traditional management works, which are required intended for the maintainable development of herbal drugs in the Northern Pakistan.

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Abbreviations

WHO	World Health Organization
THD	traditional herbal drugs
FATA	federal administered tribal areas
ISL	Islamabad
UV	used value
FC	frequency of citation
RFC	relative frequency of citation
FIV	family importance value
FL	fidelity level

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References

- [1] Pereira JA, Oliveira I, Sousa A, Ferreira IC, Bento A, Estevinho L. Bioactive properties and chemical composition of six walnut (*Juglans regia* L.) cultivars. *Food and Chemical Toxicology*. 2008;**46**(6):2103-2111
- [2] Smita R, Sangeeta R, Kumar SS, Soumya S, Deepak P. An ethnobotanical survey of medicinal plants in Semiliguda of Koraput District, Odisha, India. *Research Journal of Recent Sciences*. 2012;**2277**:2502
- [3] Malik K, Ahmad M, Bussmann R, Tariq A, Alqahtani A, Shahat A, et al. Ethnobotany of anti-hypertensive plants used in northern Pakistan. *Frontiers in Pharmacology*. 2018;**9**:789
- [4] Malik K, Ahmad M, Zhang G, Rashid N, Zafar M, Sultana S, et al. Traditional plant based medicines used to treat musculoskeletal disorders in northern Pakistan. *European Journal of Integrative Medicine*. 2018;**19**:17-64
- [5] Rashid N, Gbedomon RC, Ahmad M, Salako VK, Zafar M, Malik K. Traditional knowledge on herbal drinks among indigenous communities in Azad Jammu and Kashmir, Pakistan. *Journal of Ethnobiology and Ethnomedicine*. 2018;**14**(1):16
- [6] Ahmad M, Malik K, Tariq A, Zhang G, Yaseen G, Rashid N, et al. Botany, ethnomedicines, phytochemistry and pharmacology of Himalayan paeony (*Paeonia emodi* Royle.). *Journal of Ethnopharmacology*. 2018;**220**:197-219
- [7] Sadia S, Tariq A, Shaheen S, Malik K, Ahmad M, Qureshi H, et al. Ethnopharmacological profile of anti-arthritic plants of Asia-a systematic review. *Journal of Herbal Medicine*. 2018;**13**:8-25
- [8] Sher H, Hussain F. Ethnobotanical evaluation of some plant resources in northern part of Pakistan. *African Journal of Biotechnology*. 2009;**8**(17): 4066-4076
- [9] Gradé JT, Tabuti JR, Van Damme P. Ethnoveterinary knowledge in pastoral Karamoja, Uganda. *Journal of Ethnopharmacology*. 2009;**122**(2):273-293
- [10] Ahmad M, Sultana S, Fazl-i-Hadi S, Ben Hadda T, Rashid S, Zafar M, et al. An Ethnobotanical study of medicinal plants in high mountainous region of Chail valley (district swat-Pakistan). *Journal of Ethnobiology and Ethnomedicine*. 2014;**10**(1):36
- [11] Sher H, Elyemeni M, Sher H, Hussain K. Ethnobotanical and economic observations of some plant resources from the northern parts of Pakistan. *Ethnobotany Research and Applications*. 2011;**9**:027-041
- [12] Yabesh JM, Prabhu S, Vijayakumar S. An ethnobotanical study of medicinal plants used by traditional healers in silent valley of Kerala, India. *Journal of Ethnopharmacology*. 2014;**154**(3):774-789
- [13] Shah NA, Khan MR, Nadhman A. Antileishmanial, toxicity, and phytochemical evaluation of medicinal plants collected from Pakistan. *BioMed Research International*. 2014:1-7
- [14] Ali H, Sannai J, Sher H, Rashid A. Ethnobotanical profile of some plant resources in Malam Jabba valley of swat, Pakistan. *Journal of Medicinal Plants Research*. 2011;**5**(18):4676-4687
- [15] Murad W, Azizullah A, Adnan M, Tariq A, Khan KU, Waheed S, et al. Ethnobotanical assessment of plant resources of Banda Daud Shah, district Karak, Pakistan. *Journal of*

- Ethnobiology and Ethnomedicine. 2013; **9**(1):77
- [16] Jan G, Khan MA, Farhatullah JF, Ahmad M, Jan M, Zafar M. Ethnobotanical studies on some useful plants of Dir Kohistan valleys, KPK. Pakistan. Pak J Bot. 2011;**43**(4): 1849-1852
- [17] Ali H, Qaiser M. The ethnobotany of Chitral valley, Pakistan with particular reference to medicinal plants. Pakistan Journal of Botany. 2009;**41**(4): 2009-2041
- [18] Alam N, Shinwari Z, Ilyas M, Ullah Z. Indigenous knowledge of medicinal plants of Chagharzai valley, district Buner. Pakistan. Pak J Bot. 2011; **43**(2):773-780
- [19] Bibi T, Ahmad M, Tareen RB, Tareen NM, Jabeen R, Rehman S-U, et al. Ethnobotany of medicinal plants in district Mastung of Balochistan province-Pakistan. Journal of Ethnopharmacology. 2014;**157**:79-89
- [20] Bano A, Ahmad M, Zafar M, Sultana S, Rashid S, Khan MA. Ethnomedicinal knowledge of the most commonly used plants from Deosai plateau, Western Himalayas, Gilgit Baltistan, Pakistan. Journal of Ethnopharmacology. 2014;**155**(2): 1046-1052
- [21] Ahmad S, Islam M, Bano G, Aslam S, Koukab S. Seasonal variation in current season and dead biomass of chrysopogon aucheri (boiss) stapf. And cymbopogon jwarancusa (jones) schult. in highland Balochistan, Pakistan. Pakistan Journal of Botany. 2009;**41**(2): 519-527
- [22] Ahmad F, Khan MA, Ahmad M, Zafar M, Mahmood T, Jabeen A, et al. Ethnomedicinal uses of grasses in the salt range region of northern Pakistan. Journal of Medicinal Plant Research. 2010;**4**(5):362-369
- [23] Hazrat A, Nisar M, Shah J, Ahmad S. Ethnobotanical study of some elite plants belonging to Dir, Kohistan valley, Khyber Pukhtunkhwa, Pakistan. Pakistan Journal of Botany. 2011;**43**(2): 787-795
- [24] Rashid S, Ahmad M, Zafar M, Sultana S, Ayub M, Khan MA, et al. Ethnobotanical survey of medicinally important shrubs and trees of Himalayan region of Azad Jammu and Kashmir, Pakistan. Journal of Ethnopharmacology. 2015;**166**:340-351
- [25] Gilani SA, Qureshi RA, Gilani SJ. Indigenous uses of some important ethnomedicinal herbs of Ayubia National Park, Abbottabad, Pakistan. Ethnobotanical Leaflets. 2006; **2006**(1):32
- [26] Hussain K, Shahazad A, Zia-ul-Hussnain S. An ethnobotanical survey of important wild medicinal plants of Hattar district Haripur, Pakistan. Ethnobotanical Leaflets. 2008;**2008**(1):5
- [27] Afzal S, Afzal N, Awan MR, Khan TS, Gilani A, Khanum R, et al. Ethno-botanical studies from northern Pakistan. Journal of Ayub Medical College, Abbottabad. 2009;**21**(1):52-57
- [28] Ahmad M, Qureshi R, Arshad M, Khan MA, Zafar M. Traditional herbal remedies used for the treatment of diabetes from district Attock (Pakistan). Pakistan Journal of Botany. 2009;**41**(6): 2777-2782
- [29] Qureshi RA, Ghufuran MA, Gilani SA, Yousaf Z, Abbas G, Batool A. Indigenous medicinal plants used by local women in southern Himalayan regions of Pakistan. Pakistan Journal of Botany. 2009;**41**(1):19-25
- [30] Abbasi AM, Khan M, Ahmad M, Zafar M, Jahan S, Sultana S. Ethnopharmacological application of medicinal plants to cure skin diseases and in folk cosmetics among the tribal

communities of North-West Frontier Province, Pakistan. *Journal of Ethnopharmacology*. 2010;**128**(2): 322-335

[31] Ishtiaq M, Mumtaz AS, Hussain T, Ghani A. Medicinal plant diversity in the flora of Leepa Valley, Muzaffarabad (AJK), Pakistan. *African Journal of Biotechnology*. 2012;**11**(13): 3087-3098

[32] Butt MA, Ahmad M, Fatima A, Sultana S, Zafar M, Yaseen G, et al. Ethnomedicinal uses of plants for the treatment of snake and scorpion bite in northern Pakistan. *Journal of Ethnopharmacology*. 2015;**168**:164-181

[33] Khan MPZ, Ahmad M. Traditional preference of wild edible fruits (WEFs) for digestive disorders (DDs) among the indigenous communities of Swat Valley-Pakistan. *Journal of Ethnopharmacology*. 2015;**174**:339-354

[34] Abbas Z, Khan SM, Abbasi AM, Pieroni A, Ullah Z, Iqbal M, et al. Ethnobotany of the Balti community, Tormik valley, Karakorum range, Baltistan, Pakistan. *Journal of Ethnobiology and Ethnomedicine*. 2016;**12**(1):38

[35] Kayani S, Ahmad M, Zafar M, Sultana S, Khan MPZ, Ashraf MA, et al. Ethnobotanical uses of medicinal plants for respiratory disorders among the inhabitants of Gallies–Abbottabad, northern Pakistan. *Journal of Ethnopharmacology*. 2014;**156**:47-60

[36] Ahmad M, Khan MPZ, Mukhtar A, Zafar M, Sultana S, Jahan S. Ethnopharmacological survey on medicinal plants used in herbal drinks among the traditional communities of Pakistan. *Journal of Ethnopharmacology*. 2016;**184**:154-186

[37] Shah G, Ahmad M, Arshad M, Khan M, Zafar M, Sultana S. Ethno-phyto-veterinary medicines in northern

Pakistan. *Journal of Animal and Plant Sciences*. 2012;**22**:791-797

[38] Kayani S, Ahmad M, Sultana S, Shinwari ZK, Zafar M, Yaseen G, et al. Ethnobotany of medicinal plants among the communities of alpine and sub-alpine regions of Pakistan. *Journal of Ethnopharmacology*. 2015;**164**:186-202

[39] Fatima A, Ahmad M, Zafar M, Yaseen G, Khan MPZ, Butt MA, et al. Ethnopharmacological relevance of medicinal plants used for the treatment of oral diseases in Central Punjab-Pakistan. *Journal of Herbal Medicine*. 2017;**166**:340-351

[40] Bibi T, Ahmad M, Tareen NM, Jabeen R, Sultana S, Zafar M, et al. The endemic medicinal plants of northern Balochistan, Pakistan and their uses in traditional medicine. *Journal of Ethnopharmacology*. 2015;**173**:1-10

[41] Yaseen G, Ahmad M, Sultana S, Alharrasi AS, Hussain J, Zafar M. Ethnobotany of medicinal plants in the Thar Desert (Sindh) of Pakistan. *Journal of Ethnopharmacology*. 2015;**163**:43-59

[42] Saqib Z, Mahmood A, Malik RN, Mahmood A, Syed JH, Ahmad T. Indigenous knowledge of medicinal plants in Kotli Sattian, Rawalpindi district, Pakistan. *Journal of Ethnopharmacology*. 2014;**151**(2): 820-828

[43] Mardani-Nejhad S, Vazirpour M. Ethno-botany of medicinal plants by Mobarakeh's people (Isfahan). *Journal of Herbal Drugs (An International Journal on Medicinal Herbs)*. 2012;**3**(2): 111-126

[44] Ai AM, Khan MA, Shah MH, Shah MM, Pervez A, Ahmad M. Ethnobotanical appraisal and cultural values of medicinally important wild edible vegetables of lesser Himalayas-Pakistan. *Journal of Ethnobiology and Ethnomedicine*. 2013;**9**(1):66

- [45] Singh H, Husain T, Agnihotri P, Pande P, Khatoon S. An ethnobotanical study of medicinal plants used in sacred groves of Kumaon Himalaya, Uttarakhand, India. *Journal of Ethnopharmacology*. 2014;**154**(1): 98-108
- [46] Kadir MF, Sayeed MSB, Setu NI, Mostafa A, Mia M. Ethnopharmacological survey of medicinal plants used by traditional health practitioners in Thanchi, Bandarban Hill tracts, Bangladesh. *Journal of Ethnopharmacology*. 2014;**155**(1):495-508
- [47] Ismail M, Ibrar M, Iqbal Z, Hussain J, Hussain H, Ahmed M, et al. Chemical constituents and antioxidant activity of *Geranium wallichianum*. *Records of Natural Products*. 2009;**3**(4):193
- [48] Ibrar M, Hussain F. Ethnobotanical studies of plants of Charkotli hills, Batkhela district, Malakand, Pakistan. *Frontiers of Biology in China*. 2009;**4**(4):539
- [49] Teklehaymanot T. Ethnobotanical study of knowledge and medicinal plants use by the people in Dek Island in Ethiopia. *Journal of Ethnopharmacology*. 2009;**124**(1):69-78
- [50] Tabuti JR, Kukunda CB, Waako PJ. Medicinal plants used by traditional medicine practitioners in the treatment of tuberculosis and related ailments in Uganda. *Journal of Ethnopharmacology*. 2010;**127**(1):130-136
- [51] Upadhyay B, Dhaker AK, Kumar A. Ethnomedicinal and ethnopharmacological studies of eastern Rajasthan, India. *Journal of Ethnopharmacology*. 2010;**129**(1):64-86
- [52] Kadir MF, Sayeed MSB, Mia M. Ethnopharmacological survey of medicinal plants used by indigenous and tribal people in Rangamati, Bangladesh. *Journal of Ethnopharmacology*. 2012;**144**(3):627-637
- [53] Ghimire SK, Gimenez O, Pradel R, McKey D, Aumeeruddy-Thomas Y. Demographic variation and population viability in a threatened Himalayan medicinal and aromatic herb *Nardostachys grandiflora*: Matrix modelling of harvesting effects in two contrasting habitats. *Journal of Applied Ecology*. 2008;**45**(1): 41-51
- [54] Mahmood A, Mahmood A, Tabassum A. Ethnomedicinal survey of plants from district Sialkot, Pakistan. *Journal of Applied Pharmacology*. 2011;**3**:212-220
- [55] Munir M, Khan MA, Ahmed M, Seema N, Ahmed SN, Tariq K, et al. Foliar epidermal anatomy of some ethnobotanically important species of wild edible fruits of northern Pakistan. *Journal of Medicinal Plant Research*. 2011;**5**(24):5873-5880
- [56] Akhtar N, Rashid A, Murad W, Bergmeier E. Diversity and use of ethno-medicinal plants in the region of swat, North Pakistan. *Journal of Ethnobiology and Ethnomedicine*. 2013;**9**(1):25
- [57] Khan SW, Khatoon S. Ethnobotanical studies on some useful herbs of Haramosh and Bugrote valleys in Gilgit, northern areas of Pakistan. *Pakistan. Journal of Botany*. 2008;**40**(1):43
- [58] Qureshi R, Bhatti GR, Memon RA. Ethnomedicinal uses of herbs from northern part of Nara desert. *Pakistan. Pak J Bot*. 2010;**42**(2):839-851
- [59] Rokaya MB, Münzbergová Z, Timsina B. Ethnobotanical study of medicinal plants from the Humla district of western Nepal. *Journal of*

Ethnopharmacology. 2010;**130**(3):
485-504

[60] Rajakumar N, Shivanna M. Ethno-medicinal application of plants in the eastern region of Shimoga district, Karnataka, India. Journal of Ethnopharmacology. 2009;**126**(1):64-73

[61] Islam MK, Saha S, Mahmud I, Mohamad K, Awang K, Uddin SJ, et al. An ethnobotanical study of medicinal plants used by tribal and native people of Madhupur forest area, Bangladesh. Journal of Ethnopharmacology. 2014; **151**(2):921-930

[62] Ugulu I, Baslar S, Yorek N, Dogan Y. The investigation and quantitative ethnobotanical evaluation of medicinal plants used around Izmir province, Turkey. Journal of Medicinal Plants Research. 2009;**3**(5):345-367

[63] Shinwari S, Qureshi R, Baydoun E. Ethnobotanical study of Kohat pass (Pakistan). Pakistan Journal of Botany. 2011;**43**(SI):135-139