Ethnomedicinal survey of medicinal plants traditionally used in Sakhra Valley district Swat, Pakistan

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Research

Abstract

Background: In Pakistan, out of 6000 species of higher plants only 600-700 are being used for medicinal purposes. It demands further exploration of more species having medicinal properties. The current study aims to document the traditional medicinal knowledge among the local communities residing in Sakhra Valley, district of Swat, Pakistan

Methods: The ethnomedicinal surveys were done from April 2021 to September 2022, and data was collected by organizing semi-structured interviews. For this purpose, 222 local informants with different age groups, genders, and professions were randomly selected to share their traditional wisdom. The data was evaluated by ethnobotanical indices like Informants Consensus Factor (ICF), Relative Frequency of Citation (FRC), Fidelity Level (FL), Relative Popularity Level (RPL) and Informants Consensus Factor (ICF).

Results: A total of 153 plant species belonging to 63 families and 100 genera were reported. Lamiaceae was reported as the dominant family followed by Asteraceae, Rosaceae, Brassicaceae, and Polygonaceae. Whole plant with 60 species was the leading group used in various formulations followed by leaves (30 species) and fruit (28 species). The most commonly used form was powder (55 species) succeeded by extract and decoction with 29 and 17 species respectively. Among the 24 commonly reported ailments categories, the gastrointestinal problem was the common ailment for which 81 species were cited, followed by excretory problems (36 species), and respiratory problems (28 species), while for skin and hepatic problems 23 and 19 species respectively.

Conclusions: The ethnobotanical study in Sakhra Valley unveiled some novel uses of ethnomedicinal plants. The traditional healers and local community members participated in the survey and provided vital information about the medicinal plants which will help in future research and new drug discovery.

Keywords: Ethnobotany, Traditional knowledge, Indigenous communities, Use Reports, Fidelity level,

Background

Worldwide above 70% of the rural population depends on plant-based medicines because of low prices and lack of availability of modern health facilities (Shin *et al.* 2018). According to the World Health Organization (WHO), about 80% population of the developing world depends on traditional herbal medicines for curing various diseases (Tangjitman *et al.* 2015). Almost 50,000 plant species (18.9 %) of worldwide flora have been reported for their global use in traditional medicines (Bhat *et al*. 2013; Baydoun *et al*. 2015). In developing countries, a large section of the population is dependent on traditional medicines for basic medical needs (Pandey 2021; Rehman *et al.* 2023a). The utilization of wild plants by many rural communities is an integral part of their cultural heritage (Abdullah & Andrabi 2021; Kidane & Kejela 2021). Different plant species have been used as an ancient source of traditional medicine by mankind since the emergence of civilizations (Abbasi *et al.* 2013). The relationship of human communities with the use of plant resources has been considered as an ecological balance system and an iconic factor of ecosystem in the developed countries (Koellner *et al.* 2019; Rehman *et al.* 2023b).

Numbers of ethnobotanical research have proven the importance of plant species for the local communities especially in emergencies like war, famine, and drought throughout the world (Addis *et al.* 2005).The medicinal plants are collected by local communities from the surrounding environment and utilized as medicine and in various food recipes (Ju *et al.* 2013; Rehman *et al*. 2023c). Along with medicinal uses, these plants also provide healthy food for the local communities (Pieroni & Quave 2006; Pieroni *et al.* 2018). Besides the pharmacological properties, such plants have also been investigated for nutritive properties to cope with problems of malnutrition (Shin *et al.* 2018; Punchay *et al.* 2020). The presence of many bioactive compounds like fatty acids, complex sugars, vitamins, and proteins makes the medicinal plants can also be used to control the problems of malnutrition (Cornara *et al*. 2009; Pieroni *et al.* 2018; Garcia-Herrera *et al.* 2020). According to Singh *et al*. (2023), many wild plants have richer nutrient and mineral contents than their cultivated counterparts. The medicinal plants are satisfying the health security issues by providing alternative sources of medicines to the traditional communities (Beyene & Deribe 2016; Rehman *et al.* 2023d). In this respect, the phytochemicals in many plants have already been investigated based on medicinal and nutritional aspects (Pei & Sajise 1995).

Pakistan stands in 6th position among the populous most countries in the world (Sunderland 2013). Out of 6000 species of higher plants found in Pakistan, about 600-700 (11-12%) are being used against various ailments (Jan *et al.* 2020; Sharif *et al.* 2018). About 84% populations in Pakistan depended on herbal medicines till the 1990s (Alam *et al*. 2011). The country has rich plant diversity and the people living in remote areas depend on traditional medicines to cure their ailments (Hussain *et al.* 2024). Besides therapeutic uses, the collection of medicinal plants on a commercial level is a means of earning their livelihoods (Hussain *et al.* 2024; Rehman *et al.* 2024). Collection on a mass level and its unsustainable use are some of the continuous threats to medicinal plant diversity (Ali *et al.* 2020). To minimize such problems, conventional cultivation of wild plants should be carried out through agro-forestry and afforestation programs to ensure the conservation of the resource (Paul *et al.* 2020). It will overcome the food security issues and provide sources of income generation for local communities (Golait *et al.* 2021). Many of the medicinal plant species could also be used to compete with the problems of malnutrition if properly managed (Abdullah *et a*l. 2021).

In Pakistan, the ethnobotanical studies conducted for the documentation of the locally used medicinal plants are insufficient and for a better understanding the importance of ethnobotanical knowledge, qualitative as well as quantitative evaluation of the plant species is necessary (Sher *et al.* 2010; Tareen *et al.* 2016; Rehman *et al.* 2023e). It needed to make further efforts to document, integrate, and compile the indigenous knowledge about Plant utilization practices (Sleet 2019). The ethnobotanical culture can only be conserved if its importance is publicly addressed and understood properly among the local communities. Sustainable harvesting, involvement of community members, their folk traditions, and maintaining the natural habitats of plants are some other ways of conservation (Cao *et al*. 2020). The scientific evidence shows that traditional knowledge in collaboration with novel scientific understandings can provide cultural and environment-friendly approaches vital for the sustainable development of a community (Ayeni & Basiri 2018).

The status of traditional knowledge is very dynamic, it changes from time to time, generation and culture, its proper and timely documentation is utmost necessary (Alam *et al*. 2011). Most of the previous studies show that oral communication has remained the only means of transfer of traditional ethnomedicinal knowledge which is still being practiced in the families of traditional healers (Nadembega *et al*. 2011).This knowledge is largely confined to elderly people of communities residing in the remote regions of the country(Alam *et al*. 2011). These people have rich ethnobotanical knowledge which is being transmitted from generation to generation (Mattalia *et al*. 2020; Mahwasane *et al*. 2013). Old people in community possess reliable knowledge while the young members often remain unaware of the use of this wealth (Rahman *et al*. 2020; Rehman

et al. 2022a). The young members mostly stay out of the community for employment so remain unaware of traditional knowledge, such discontinuity of traditional knowledge may lead to complete loss if not properly documented (Tamang *et al*. 2021; Rehman *et al.* 2022b).The decline of ethnomedicinal knowledge goes parallel with the disappearance of medicinal plants. The indigenous knowledge accumulated in the communities is vulnerable and it declines with the extinction of species (Singh *et al*. 2013; Khadim *et al.* 2023). Proper documentation of such knowledge not only ensures its safety but also directs the global communities for the conservation of plant resources (Ijaz *et al*. 2016; Singh *et al*. 2014; Rehman *et al.* 2022c). It is also necessary to bring medicinal plants under cultivation to reduce pressure on their natural population and ensure their conservation (Singh et al. 2021).The ethnobotanical studies conducted for the documentation of the locally used medicinal plants are insufficient and require further explorations (Sher *et al.* 2010; Tareen *et al.* 2016).It is crucial to investigate and document the plants being used by ethnic groups for medicinal, nutritional and economic proposes (Heinrich *et al*. 2006).

Due to lack of modern health facilities in the study area, the rural communities of Sakhra Valley, district Swat mostly rely on and prefer the medicinal plants to cure their ailments. Preference given to traditional healthcare system is due to its easy accessibility and cost-effectiveness (Khan *et al*. 2015; Ahmad *et al*. 2014; Aftab *et al.* 2023). The current study was an attempt to document the traditional medicinal knowledge for the first time from Sakhra valley, district Swat, Pakistan. The study aimed:

i. To explore the médicinal Flora of the Valley
ii. To document the traditional knowledge about use of médicinal plants, used parts, drugs formulation and mode of administration
iii. Quantitative évaluation of the acquired data to know about the reliance of communities and authenticity of traditional ethnomedicinal knowledge.

Materials and Methods

Study area

Sakhra Valley is located in the North-West region of Pakistan about 60 kilometers from the district headquarter Saidu Sharif Swat (Figure 1). The area lies in the complex Hindu-kush mountain range. The annual temperature ranges from -5°C in January- February to 30°C in July- August with altitude ranges from 1449 to 3920m above mean sea level (Ahmad & Ahmad 2004) (Table 1). Due to varied geographical and climatic conditions, the area possesses a surprising biodiversity and is phyto-geographically considered in the Sino-Japanese region (Haq *et al.* 2022). The study area being in the Hindu-kush mountain range possesses moist temperate forests with *Pinus, Abies, Piecea,* and *Taxus* as the dominant plant genera along with rich herbal flora and fauna. The herbaceous plant species mostly used for medicinal purposes are found in open patches in forests and alpine pastures. Some species are specifically found at high altitudes which are mostly covered with snow and the local people collect them at specific times. Maximum snowfall occurs in January and April while heavy rainfall of Monsoon in July-August. The area lacks a proper irrigation system however, 'Bawrai stream' is the only source used for watering the agricultural lands and running water mills and electric generators. Orchards of Peaches and Apples are the main sources of revenue and wood-fuel for the local people. There are also numerous permanent springs that fulfill the need for drinking water and other domestic uses. On the other hand, Maize, Wheat, Potato, Pea, and Tomato are the most cultivable crops. In remote areas, mostly traditional agriculture is practiced due lack of access to advanced machinery.

Like other parts of district Swat the local inhabitants of the study area are divided into five ethnic groups including Sayed, Yousafzai, Sahibzada, Mulakheil, and Gujjar (Ali *et al*. 2017; Yousafzai *et al*. 2010). The majority of the locals are poor, some of them collect medicinal plants to generate revenue after selling them in the local market. Mingora bazar is the main market for the whole sellers of medicinal plants called 'Pansars'. The shepherds used to graze openly the herds of sheep and goats in the forests. The over-grazing and uncontrolled collection of medicinal plant species is seriously causing the loss of diversity in the area.

Data collection

The ethnobotanical data was carefully collected through face- to- face interviews among 222 informants. The data obtained was entitled by local names of the plant species, family, growth form, used parts, season of collection, methods of use, and purpose of use. The acquired data from the informants was analyzed by calculating the number of Use Reports (UR), Relative Frequency of Citation (RFC), Fidelity level (FL), and Relative popularity level (RPL) to know about the importance of reported MPs among the local inhabitants following (Ahmad *et al.* 2017; Ishtiaq *et al* . 2021) (table 3). Special measures were taken during the documentation of local names of each plant species in various localities in the research area. For confirmation of the MPs, used parts/ products as medicine were organoleptically tested in the field where necessary. The taste and smell

are important organoleptic properties used to determine a crude drug (Barras *et al.* 2013; Zaid 2020). The characteristics and properties of medicinal plant species are presented in Table 3.

During the survey, 153 medicinal plants (MPs) species were reported from different localities of the area belonging to 63 families and 100 genera which are traditionally used in various drug formulations (Table 3). The taxonomic identification of plant species was performed through different sources like the flora of Pakistan and consulting expert taxonomists. Some specimens were identified using references of botanical data reported from the area in various botanical researches. Besides this, acceptance of taxonomic names of plant species was done with the help of 'The Plant List' (www.theplantlist.org) following (Vitalini *et al.* 2013). The Voucher specimens preserved and mounted on standard herbarium sheets were deposited in the herbarium of the Botany Department at Hazara University Mansehra (HUP), Pakistan.

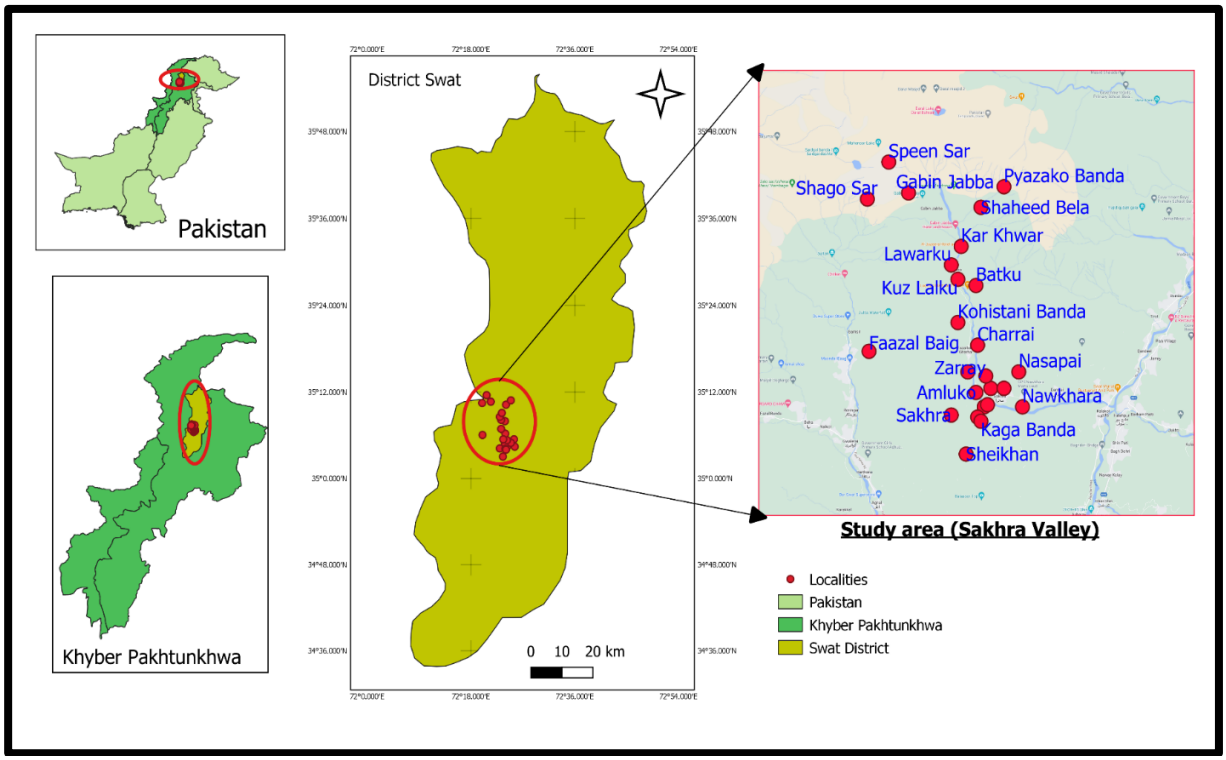

Figure 1. Map of Pakistan, Khyber Pakhtunkhwa and district Swat highlighting the study area

Table 1. Sampling sites of the study area with geographical coordinates

Name of Locality	Altitude (m)	Latitude	Longitude	Name of Locality	Altitude (meters)	Latitude	Longitude
Amluk	1544	72°23′55″E	35°04′49″N	Landai Garhai	1620	72°23′27″E	35°05′24″N
Bara ghat	1490	72°24′28″E	35°04′59″N	Lawarku	2025	72°22′59″E	35°08′37″N
Baru	1493	72°24′11″E	35°04′29″N	Nasapai	1712	72°25′28″E	35°05′28″N
Batku	2019	72°23′56″E	35°08′02″N	Nawkhara	1449	72°23′52″E	35°03′57″N
Charrai	1700	72°23′58″E	35°06′15″N	Penday	1671	72°24′19″E	35°04′33″N
Faazal Baig	2064	72°19′48″E	35°06′03″N	Pyazako Banda	2995	72°24′57″E	35°10′52″N
Gabin Jabba	2760	72°21′28″E	35°10′43″N	Sabzal	1511	72°24′57″E	35°04′59″N
Kaga Banda	1783	72°24′07″E	35°04′02″N	Sakhra	1560	72°22′59″E	35°04′13″N
Kar Khwar	2135	72°23′21″E	35°09′09″N	Shago Sar	3920	72°19′56″E	35°10′31″N
Kharkai	1617	72°23′57″E	35°04′10″N	Shaheed Bela	2880	72°24′01″E	35°10′19″N
Kohistani Banda	2130	72°23′16″E	35°06′57″N	Sheikhan	2060	72°23′26″E	35°03′01″N
Kolatay Chum	1588	72°24′56″E	35°04′60″N	Speen Sar	3680	72°20′45″E	35°11′29″N
Kuz Lalku	2011	72°23′15″E	35°08′11″N	Zarray	1735	72°24′17″E	35°05′22″N

Statistical indices

The data obtained was analyzed by the following commonly used statistical indices.

Relative Frequency of Citation (RFC)

The Relative Frequency of Citation (RFC) was calculated in order to highlight the popularity of a species among the local communities following (Aziz *et al.* 2018).

RFC = FC/N (0 < RFC < 1)

FC= Number of informants citing a plant species and
N= Total number of informants interviewed during the survey.

Fidelity Level (FL)

Fidelity Level (FL) shows how a plant species is ideal for a particular disease treatment. The FL was calculated by following (Musa *et al*. 2011).
FL= Np/N×100

Np= The number of informants claiming the use of a particular species for a particular disease and
N= The total informants claiming the species for any disease.

Relative popularity level (RPL)

The RPL shows a ratio between the number of ailments treated by a particular species and the whole number of informants for any ailment category (Abdullah *et al.* 2021).

Informants Consensus Factor (ICF)

The Informants Consensus Factor **(ICF)** indicates the level of homogeneity in information provided by different informants about the mode and purpose of use of plant species (Abbas *et al.* 2020).

ICF= Nur- Nt /Nur-1

Nur= Total number of use reports for each disease category and
Nt= Number of species used in said category.
To get the ICF values, we divided the reported ailments into 24 categories.

Results and Discussion

The participants of interviews were divided into 5 categories on the basis of age, gender and profession groups following (Jahn *et al*. 2007; Umair *et al.* 2017). Among them 24 persons were between the age of (15-25 years) (10.81%), 46 people from (25-35) (20.72%), 54 people from (35-45) (24.32%), 56 from (45-55) (25.22%) and 42 individuals with 55-65 years or above (18.91%). Based on gender 178 (80.18%) of the total informants were male while 44 (19.81%) were female. The dominance of male informants in the study area was higher than females. Our findings agreed with (Amjad *et al.* 2020; Rehman *et al.* 2024). There was a distinct cultural border due to which female participants could not talk with male interviewers outside of their families. Due to the location of the study area in the far-out skirts from cities and towns, most of the informants interviewed were illiterates (40.50%), followed by high school (27.90%), intermediate (23.40%), and graduates (8.10%), and were also preferably asked for sharing their valuable knowledge about the plants commonly used as medicines. Based on profession, the majority of the informants were farmers (35.13%), followed by shepherds (24.32%), housewives (19.81%), herbal practitioners (10.81%), and teachers (9.90%) (Table 2).

Phytodiversity of the medicinal plants

The informants reported 153 plant species belonging to 63 families and 100 genera. Taxonomically, Lamiaceae was found as the dominant family with 12 species (7.84%), followed by Asteraceae with 10 species (6.53%), Rosaceae with 9 species (5.88%), Brassicaceae and Polygonaceae with 5 species (3.26 % each). Families Ranunculaceae, Pinaceae, and Amaranthaceae had 4 species each (2.61%). Similar findings were reported by (Rahman *et al.* 2018; Rehman *et al.* 2023). In some related studies carried out in Himalayan and Hindukush regions, Singh *et al.* (2021); Mir *et al.* (2020); Thakur *et al.* (2020); Abdullah and Andrabi (2021) found Rosaceae as a dominant family for traditional uses. The remaining families represented less than 4 species (Table 3). Mesfin *et al.* (2014), & Monigatti *et al* (2013) have reported the importance of local

names as very essential and helpful in selection of the appropriate plant species for preparation of a remedy. It was observed that the local people of the area name and classify the MPs by the local names. They are able to differentiate the plant species with closely similar morphological characters. They are also aware about the habitats and seasons of availability of specific species. In most cases, the plant species and their use parts are known with the same names. It has been reported that the local people almost use no specific names for their formulations against various ailments however; they are named after the name of source plants. For instance, the name '**kwaray**' is used for all useable parts of *Berberis* species including the bark and fruits.

Table 2. Demographic features of informants selected from the study area

Factors	Categories	Number of participants	Percentage (%)
Age	15-25	24	10.81
	25-35	46	20.72
	35-45	54	24.32
	45-55	56	25.22
	55-65 and Above	42	18.91
Gender	Male	178	80.18
	Female	44	19.81
Education	Illiterates	90	40.5
	High School	62	27.9
	Intermediate	52	23.4
	Graduates	18	8.10
Profession	Farmers	78	35.13
	Shepherds	54	24.32
	Housewives	44	19.81
	Herbal practitioners	24	10.81
	Teachers	22	9.90

Growth Forms of the Medicinal Plants

The majority of the reported medicinal plants were herbs (61%) followed by Shrubs (24%), trees (14%), and climbers (1%) (Fig. 2). Herb as the most commonly used form has also been reported by many researchers because of convenience in its collection and processing (Shuaib *et al*. 2021, Umair *et al*. 2019; Rehman *et al.* 2022a). The herbaceous plants are used either as a whole for medicinal purposes or their parts especially leaves (Meragiaw *et al*. 2016; Shinwari *et al.* 2011.), because herbaceous plants contain bioactive compounds (Abbasi et al. 2013).

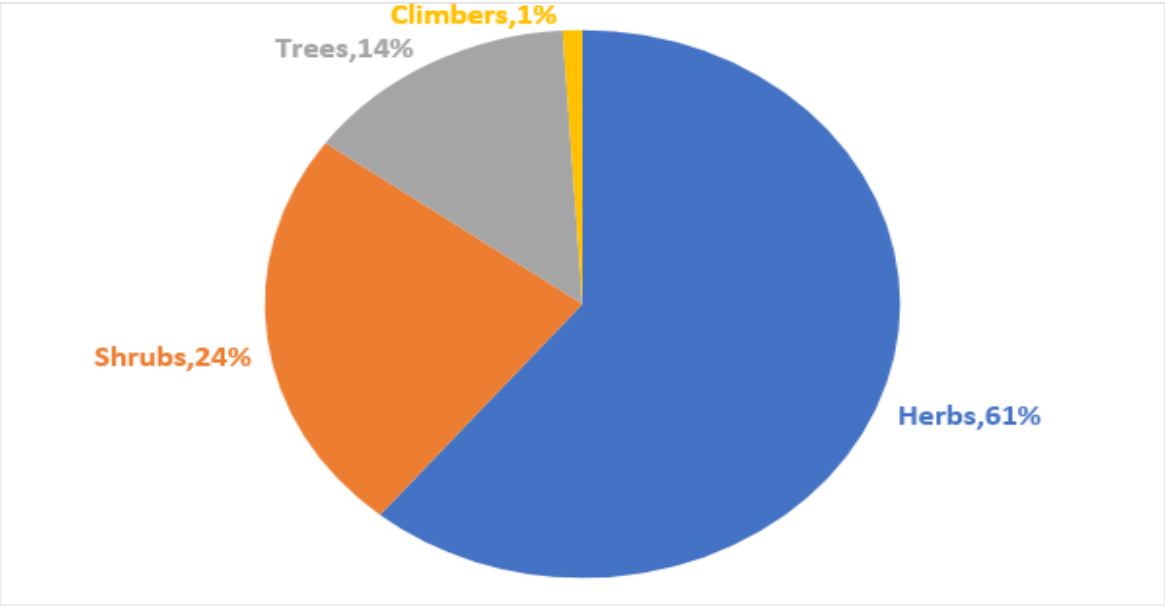

Figure 2. Life form of the reported medicinal plant species

Table 3. Botanical names of plant species, local names, family names, habit, medicinal uses, crude drugs and route of administration, RFC, UV, FL and RPL (%) of the medicinal plants being used in Sakhra valley, district Swat.

Botanical Name/ voucher number	Local Name	Family	Habit	Part used	Medicinal Uses	Crude Drug	RFC	FL	RPL
Achillea millifolium L. HUP0004551	Jarrai	Aceraceae	H	Leaf, root	For removal of stones from kidney and urinary bladder, Respiratory problems, Relieve fever	Tea/ oral	0.081	65.5	0.75
Achyranthes aspera L. HUP0004568	Buchkanda	Amaranthaceae	H	Whole	For relieving toothache and sparkling of teeth, Antidote for snake and scorpion sting, and dog bites	Paste/ Top	0.045	53.7	0.45
Aconitum chasmanthum Stapf ex Holmes HUP000429	Da ghra zahar	Ranunculaceae	H	Rhizome	General body pain, Aphrodisiac, strengthening of weak body	Tablet/ Oral	0.140	84.2	0.91
Adiantum capillus-veneris L. HUP0004511	Parsusha	Polypodiaceae	H		Constipation, Cough and fever	Powder/ Oral	0.135	75	0.54
Aesculus indica (Wall. ex Camb.) Hook. HUP0004609	jawaz	Hippocastanaceae	T	Fruit, bark	As vermifuge, anti-diabetic , healing of wounds	Powder/ Oral	0.081	69.3	0.92
Ajuga bracteosa Wall. ex Benth. HUP0004562	Spina butti	Lamiaceae	H	Whole	Anti-diabetic, Tonsillitis, healing of wounds	Powder/ Oral	0.171	99	1
Ajuga parviflora Benth. HUP0004561	Sra butti	Lamiaceae	H	Whole	Anti-diabetic, Tonsillitis, healing of wounds, skin allergy	Powder/ Oral	0.135	99	1
Ailanthus altissima (Mill.) Swingle HUP0004570	Spina shandai	Simaroubaceae	T	Fruit, bark	Gastro-intestinal problems, ophthalmic	Powder/ Oral	0.063	52.3	0.31
Alliaria petiolata (M.Bieb.) Cavara & Grande HUP004539	Shnapana	Brassicaceae	H	Whole	Cough and flu, healing of wounds	Powder/ Oral	0.027	50.5	0.35
Allium humile Kunth HUP0004609	Ogakai	Alliaceae	H	Whole	Aphrodisiac, Anti-diarrheal, Asthma and short breathing	Powder/ Oral	0.180	97.2	1
Allium griffithianum Boiss. HUP0004627	Zangali piaz	Alliaceae	H	Whole	Asthma and short breathing, Anti-hypertensive, removal of kidney stones	Powder/ Oral	0.180	97.2	1

Alnus nitida (Spach) Endl. HUP0004620		Betulaceae	T	Leaf, bark	Whooping cough	Powder/ Oral	0.018	53.3	0.33
Althaea officinalis L. HUP0004535	Gul-e- khaira	Malvaceae	H	Flower, leaf	Laxative, renal diseases, constipation, cough	Macerat/ Oral	0.063	77.1	0.67
Althaea rosea (L.) Cav. HUP0004618	Gul-e- khaira	Malvaceae	H	Flower, leaf	Laxative to treat constipation, Fever	Macerat/ Oral	0.054	77.5	0.68
Amaranthus caudatus L. HUP0004557	Gandhar	Amaranthaceae	H	Young shoot and leaf	Blood purifier, anti-hypertensive, Diuretic, Asthma	Macerat/ Oral	0.090	51.4	0.73
Amaranthus spinosus L. HUP0004541 HUP0004574	Asli Chalwai	Amaranthaceae	H	Young shoot and leaf	Emollient, Abnormal menstruation	Macerat/ Oral	0.036	61	0.8
Amaranthus viridis L. HUP0004567	Chalwai	Amaranthaceae	H	Young shoot and leaf	Urinary tract infection, improvement of renal system	Macerat/ Oral	0.027	60.3	0.8
Arisaema flavum (Forsk.) Schott. HUP0004565	Mar jarrai	Araceae	H	Rhizome	Toothache, strengthening of gums, weight gainer	Paste/ Top	0.027	80.2	0.66
Arisaema jacqumontii Blume. HUP0004573	Mar jarrai	Araceae	H	Rhizome	Toothache, strengthening of gums, weight gainer	Paste/ Top	0.027	87.1	0.65
Arisaema utile Hook. f. eSchott HUP0004544	Mar jarrai	Araceae	H	Rhizome	Treatment of piles	Paste/ Top	0.036	83	0.73
Artemisia dubia L. ex B.D.Jacks. HUP0004633	Tarkha	Asteraceae	H	Shoot, leaf	Gynecological problems, relieve fever	Powder/ Oral	0.036	56.7	0.33
Artemisia scoparia Waldst. & Kitam. HUP0000197	Jawkay	Asteraceae	H	Shoot, leaf	Abdominal discomfort/pain, gas-troubles	Powder/ Oral	0.036	79	0.9
Artemisia vulgaris L. HUP0000215	Tarkha	Asteraceae	H	Leaf, flower	Relieve fever, gas-troubles and healing of wounds	Extract/ Oral	0.045	61.5	0.35
Asparagus gracilis Salisb. HUP0000191	Tendoray	Asparagaceae	S	Young shoot	Aphrodisiac, diuretic	Decoction/ Oral	0.081	88.6	1

Avena sativa L. HUP0000142	mastakay	Poaceae	H	Whole	Lower the cholesterol level, constipation, and improve digestion	Powder/ Oral	0.036	50	0.4
Berberis calliobotrys Bien. ex Koehne HUP0004537	Kwaray	Berberidaceae	S	Fruit, bark	Hepatitis, blood purifier, urinary tract infection, stops bleeding	Powder/ Oral	0.315	96.2	1
Berberis C.K. jaeschkeana Schneid. HUP0004575	Kwaray	Berberidaceae	S	Fruit, bark	Hepatitis, blood purifier, urinary tract infection, stops bleeding, coolant	Powder/ oral	0.324	95	1
Berberis lyceum Royle HUP0004576	Kwaray	Berberidaceae	S	Fruit, bark	Hepatitis, blood purifier, urinary tract infection, stops bleeding, coolant	Powder/ Oral	0.333	97	1
Bergenia cilliata (Haw.) Sternb. HUP0004582	Gatpanra	Saxifragaceae	H	Rhizome	Increase urination, remove kidney stone, stops bleeding in minor injuries	Powder/ Oral	0.110	79	0.65
Bergenia stracheyi (Hook.f. & Thomson) Engl. HUP0004579	Gatpanra	Saxifragaceae	H	Rhizome	Increase urination, remove kidney stone, stops bleeding in minor injuries	Powder/ Oral	0.081	75	0.6
Bistorta amplixicaulis (D.Don) Greene HUP0000176	Anjabar	Polygonaceae	H	Rhizome	Stops bleeding in abnormal menses, controls diarrhea and vomiting, improve digestion	Powder/ Oral	0.189	90	1
Brassica campestris (Linn.) Clapham HUP0003018	Sharsham	Brassicaceae	H	Whole	The oil is used for massage to relieve fatigue, strengthen hair, abolish the irritation in dry skin	Extract/ Top	0.234	91	0.95
Buxus wallichiana Baill. HUP0004584	Shamshad	Buxacae	S	Bark	To treat Constipation, cause excessive sweating and so relieve fever, turn back the white hairs into black	Decoction/ Oral	0.054	63	0.77
Caltha alba Cambess. HUP0004581	Makhan pat	Ranunculaceae	H	Flower, leaf	Laxative, improve digestion, treat constipation, increase urination, headache.	Macerat/ Oral	0.144	98	1
Cannabis sativa L. HUP0004530	Bhang	Cannabinaceae	H	Flower, leaf	Appetizer, anti-diarrheal, aphrodisiac, induce sleep, relieve pain	Tablet/ Oral	0.270	50	0.33
Capsella bursa pastoris (L.) Medik HUP0004563	Bambessa	Brassicaceae	H	Whole	Lowers blood pressure, stops bleeding and induce appetite	Powder/ Oral	0.027	67	0.5
Carbeni benedicta (L.) Benth. & Hk. HUP0004611	Sharai	Asteraceae	H	Leaf, seed	Stimulate hunger (Appetizer)	Powder/ Oral	0.054	50	0.69

Cedrus deodara (Roxb. ex D.Don) G.Don HUP0004534	Ranzra	Pinaceae	T	Resins	Treatment of skin irritation and allergies	Extract/ Oral	0.063	78	0.86
Cedrela serrata Royle. HUP0004521	Barabru	Meliaceae	T	Bark	Stops bleeding, cure of ulcer	Powder/ Top	0.027	60.5	0.76
Celtis causcasica Willd. HUP0004523	Tagha	Ulmaceae	T	Fruit, bark	Blood purifier, anti-allergic	Powder/ Oral	0.036	71.3	0.8
Chenopodium album L. HUP000454566	Sarmay	Chenopodiaceae	H	Whole	Improve digestion, treatment of hepatitis, healing of throat and adjust the sensation of thrust	Macerat/ Oral	0.072	57.4	0.63
Chenopodium botrys L. HUP0004580	Skha kharawa	Chenopodiaceae	H	Whole	Urinary tract infection	Powder/ Oral	0.054	91	0.92
Cichorium intybus L. HUP0000315	Hunn	Asteraceae	H	Whole	Blood purifier, treatment of hepatitis, typhoid, remove intestinal worms, improve eye sight	Macerat/ Oral	0.117	94	1
Colchicum luteum Baker HUP0000323	Qeematgulay	Colchicaceae	H	Corm	Arthritis and rheumatism, laxative, carminative and aphrodisiac	Powder/ Oral	0.072	89	0.9
Conyza canadense (L.) Cronquist. HUP0000369	Mrach bootay	Asteraceae	H	Whole	Increase urination, controls diarrhea and stops bleeding	Powder/ Oral	0.027	50.1	0.39
Corydalis diphylla Wall. HUP0000311	Shamdana	Fumeriaceae	H	Whole	Increase urination, inflammation of eyes	Powder/ Oral	0.036	61.5	0.6
Cotoneaster nummularia Fisch. & C.M. Mey. HUP000307	Mamanay	Rosaceae	S	Fruit	Hepatitis C, stops bleeding	Fresh/ Oral	0.036	77	0.55
Daphne mucronata Royle HUP0004613	Leghunay	Thymelaeaceae	S	Whole	Laxative but over doze cause diarrhea, healing of skin acnes, joints pain	Fresh/ Oral	0.072	69	0.6
Debregeasia salicifolia (D.Don) Rendle HUP0004527	Ajlai	Urticaceae	S	Leaf, bark	Hepatitis, skin diseases	Extract/ Oral	0.018	50.6	0.3
Delphinium denundatum Wall. ex Hook. f. & Thomson HUP0004649	Lajward	Ranunculaceae	H	Seeds	Acute body pain, skin care	Extract/ Top	0.038	59.2	0.45

Delphinium roylei Munz HUP0004577	Lajward	Ranunculaceae	H	Seeds	Joint pain, skin care	Extract/ Top	0.045	59.1	0.4
Desmodium elegance f. *albiflorum* (P. Li) H. Ohashi HUP0000190	Tablai	Papilionaceae	S	Root	Increase urination, improve digestion	Powder/ Oral	0.027	54.5	0.3
Diospyros lotus L. HUP0004590	Toor amluk	Ebenaceae	T	Fruit	As anti-diarrheal, induce constipation in case of taking over doze	Direct/ Oral	0.105	95	0.95
Elaeagnus umbellata Thunb. HUP0004581	Ghanamranga	Eleagnaceae	S	Fruit	Relieving whooping cough, as astringent to stop bleeding	Decoction/ Oral	0.045	72	0.9
Eucalyptus lanceolata L. HUP0004612	Laachi	Myrtinaceae	T	Dried exudates	As astringent to stop bleeding in minor injuries	Extract/ Top	0.009	58	0.4
Euphorbia helioscopa L. HUP0000169	Mandanu	Euphorbiaceae	H	Whole	Expel intestinal worms, laxative to improve digestion and relieve constipation	Powder/ Oral	0.036	62.5	0.57
Euphorbia wallichii Hook. f. HUP0004589	Arghamalay	Euphorbiaceae	H	Whole	As Emitic cause vomiting, used for washing the stomach	Decoction/ Oral	0.027	63	0.55
Euphrasia himalaica Wettst. HUP0004601	Stargai	Scrophulariaceae	H	Whole	To relieve cough and treatment of ophthalmia	Juice/ Oral, Drops for eyes	0.027	69	0.49
Ficus palmata Forssk. HUP0000119	Enzar	Moraceae	T	Fruit, latex	Being a laxative, Improve digestion, improve respiratory system by removing from respiratory tract, weight gainer, aphrodisiac, to cure cough and fever	Direct/ Oral	0.207	98	0.9
Fragaria nubicola (Lindle. ex. Hook. f.) Lacaita HUP000462	Sarckai	Rosaceae	H	Fruit	In treatment of diabetes, stops bleeding in minor hemorrhages, anti-diarrheal	Maceration/ Oral	0.081	82	0.55
Galium tricornutum Dandy HUP0000113	March butay	Rubiaceae	H	Leaves	Increase urination, improvement of renal system	Powder/ Oral	0.018	55	0.36
Geranium wallichianum D.Don ex Sweet HUP0004622	Bhanda	Geraniaceae	H	Rhizome	To stop bleeding, cure of mouth ulcers, and anti-diarrheal	Extract/ Oral	0.027	53	0.3
Geranium nepalense Sweet. HUP0004541	Bhanda	Geraniaceae	H	Rhizome	Stops bleeding, improvement of renal functioning	Powder/ Oral	0.063	50	0.33

Gratiola officinalis L. HUP0004525	Ghutyalay	Scrophulariaceae	H	Whole	Increase urination, relieve constipation and strengthen the cardiac tissues	Extract/ Oral	0.018	66.5	0.77
Gymnosporia royleana Wall. ex M.A Lawson HUP0004601	Surazghay	Celastraceae	S	Seeds	For the treatment of toothache and sparkling of teeth	Paste/ Top	0.028	52	0.58
Hypericum oblongifolium Choisy HUP0004613	Balsanay	Hypericaceae	S	Flower	Anti-diarrheal, to treat piles of the large intestine	Decoction/ Oral	0.073	53	0.6
Hypericum perforatum L. HUP0004605	Balsanay	Hypericaceae	H	Whole	Used as diuretic, anti-diarrheal, healing of wounds and piles, improve the uterine health	Decoction/ Oral	0.117	89	0.88
Indigofera heterantha Wall. ex Brandis HUP0004604	Ghjwareja	Papilionaceae	S	Oil extracts	Used to treat ringworms of skin, blackening of hair, cough	Extract/ Top	0.045	52	0.4
Ipomoea hederacea (L.) Jacq. HUP0004538	Zeelai	Convulvulaceae	C	Seeds	To treat constipation, increase urination and to expel the intestinal worms	Powder/ Oral	0.054	52	0.4
Ipomoea purpurea (L.) Roth HUP0000118	Zeelai	Convulvulaceae	C	Seeds, root	To treat constipation, increase urination, also causes vomiting and diarrhea	Powder/ Oral	0.108	79	0.61
Iris hookeriana Foster HUP0004570	Turai	Iridaceae	H	Rhizome, bulb	Used to improve the respiratory system by curing cough and removal of sputum from the respiratory tract, hepatitis, diuretic, headache, causes sneezing	Powder/ Smelled	0.036	77	0.69
Jasminum humile L. HUP0004592	Champa	Ebenaceae	S	Flower	Used to stop bleeding, and expel intestinal worms	Powder/ Oral	0.019	85	0.85
Jasminum officinale L. HUP0004593	Chambelli	Ebenaceae	S	Root	Used to expel intestinal worms	Decoction/ Oral	0.180	83	82
Juglans regia L. HUP0004646	Ghuzz	Juglandaceae	T	Fruit, bark, leaf	The bark is used to strengthen gums, remove bad smell in mouth, while fruit as nerve tonic, general body pain especially back pain	Direct/ Oral	0.180	99	1

Justicia adhatoda L. HUP0004561	Bekarr	Acanthaceae	S	Leaf, root, bark	The powdered leaves are used as blood purifier, cough, control diarrhea, fever, flower as laxative to relieve constipation, controls leprosy, tuberculosis, kills intestinal worms, remove sputum from the respiratory tract.	Extract/ Oral	0.243	89	0.95
Malva neglecta Wallr. HUP0004617	Panerak	Malvaceae	H	Whole	The soup prepared from leaves are used as laxative and improvement of gastro-intestinal system	Maceration/ Oral	0.081	84.5	0.9
Malva sylvestris L. HUP0004616	Samchal	Malvaceae	H	Whole	The leaves are used as laxative and improvement of gastro-intestinal system	Maceration/ Oral	0.090	85	0.85
Melia azedarechta L. HUP0004615	Tora shandai	Meliaceae	T	Leaf, bark	The leaf extract is used as blood purifier, to cue skin irritation and intestinal piles, leprosy, as pain killer and to expel abdominal worms	Juice/ Oral	0.108	55	0.6
Mentha arvensis L. HUP0004606	Pudeena	Lamiaceae	H	Whole	The extract after boiling the plant is used as appetizer by improving the digestive system, anti-venomous for snake and scorpion poisons, to treat hepatitis, expel abdominal worms	Fresh, Powder/ Oral	0.210	99	1
Mentha longifolia (L.) Huds HUP0003982	Weelanay	Lamiaceae	H	Whole	The powdered plant is used to relieve abdominal pain, appetizer and improvement the digestive system	Fresh, Powder/ Oral	0.170	99	1
Micromeria biflora Benth. HUP0004621	shamakay	Lamiaceae	H	Whole	The plant is crushed and the extract is used to cure typhoid and gynecological problems	Juice/ Oral	0.053	88	0.7
Mirabilis jalapa L. HUP0004683	Gul e bada	Nyctaginaceae	H	Leaf, root	The roots are used as aphrodisiac, blood purifier, flowers are used to treat piles and the leaves for healing of wounds	Decoction, Bandage/ Oral, top	0.100	96	1
Morus alba L. HUP0004602	Spin tut	Moraceae	T	Fruit, leaf, bark	The fruit is used to treat constipation and improvement of digestive system	Direct/ Oral	0.090	57	0.85
Morus nigra L. HUP0004621	Tor tut	Moraceae	T	Fruit, leaf, bark	The fruit is used to treat constipation and improvement of digestive system, removal of sputum, irritation of throat and to treat cough	Direct, Juice/ Oral	0.216	64	0.9

Nasturtium officinale R. Br. HUP0004650	Talmeera	Brassicaceae	H	Whole	Regulation of metabolic activities, gastro-intestinal system, hepatitis	Maceration/ Oral	0.125	91	0.75
Nepeta erecta Benth. HUP0000129	Jalbang	Lamiaceae	H	Whole	Headache, cough and cold, stomach pain	Powder/ Oral	0.039	60	0.5
Nerium oleander L. HUP0000115	Ganderay	Apocynaceae	S	Whole	Diuretic, insect repellent	Extract/ Top	0.029	57	0.63
Ocimum basilicum L. HUP0004537	Kashmalay	Lamiaceae	H	Whole	Cardiac diseases, anti-diarrheal, anti-malarial, appetizer, constipation	Fresh/ smell Powder/ Oral	0.181	99	1
Oenothera rosea L. Her. ex Aiton. HUP0004611	Gulabi	Onagraceae	H	Seeds	Gynecological problems	Powder/ Oral	0.018	50.9	0.31
Olea ferruginia Wall. Ex. Aitch HUP0004610	Khoona	Oleaceae	T	Fruit Leaf, bark	Hyper tension, diabetes, cholesterol regulator, laxative, analgesic, healing of wounds, emollient	Tea/ Oral Direct/ Oral	0.279	93	0.9
Onopordum acanthium L. HUP0004617	Ghana	Asteraceae	H	Seeds	Detoxify liver, lower cholesterol level, hyper tension, diuretic, appetizer, kidney problems, gastro-intestinal problems	Powder/ Oral	0.093	54	0.33
Oxalis acetosella L. HUP0004659	Manzakin tarukay	Oxalidaceae	H	Whole	Ophthalmic, bleeding of gums, dry skin	Paste, Top	0.045	70.5	0.7
Oxalis corniculata Lourteig HUP0004596	Manzakin tarukay	Oxalidaceae	H	Whole	Ophthalmic, bleeding of gums, dry skin	Paste, Top	0.045	80.9	0.7
Paeonia emodi Royle HUP0004564	Mameekh	Paeoniaceae	H	Flower, seeds, tuber	Analgesic, arthritis and rheumatism, anti-diarrheal	Tablet/ Oral	0.234	90.2	93
Papaver dubium L. HUP0004571	Reday	Papaveraceae	H	Flower	Fever, anti-diuretic	Decoction/ Oral	0.009	58	0.41
Papaver somniferum L. HUP0004555	Qashqash	Papaveraceae	H	Fruit, seeds, latex	Analgesic, astringent, flu and cough, tonic for brain, diarrhea	Tea/ Oral	0.191	93	1
Phytolacca acinosa Roxb. HUP0004584	Tamaku saag	Phytolaccaceae	H	Whole	Laxative, analgesic	Maceration/ Oral	0.054	82.2	0.8
Pimpinella diversifolia DC. HUP0004577	Tarpakhii	Apiaceae	H	Whole	Diuretic, anti-hyper tension,	Powder/ Oral	0.036	54.6	0.45
Pinus roxburghii Sarg. HUP0004501	Nakhtar	Pinaceae	T	Resin, seeds	Hepatitis C, removal of stones from kidney and urinary bladder, acnes on skin	Resins/ Oral	0.047	66.6	0.49

Piesea ssmithiana Sarg. HUP0004500	Mangazai	Pinaceae	T	Resin, seeds	Anti-allergic, facial acnes, removal of stones from kidney and urinary bladder	Resins/ Oral	0.028	62	0.42
Pinus wallichiana A. B. Jacks. HUP0004511	Pewuch	Pinaceae	T	Resin, seeds	Anti-allergic, facial acnes	Resins/ Oral	0.019	66.6	0.5
Pistacia integerrima J. L. Stewart ex Brandis HUP0004572	Shnaii	Anacardiaceae	T	Bark	Treatment of hepatitis B and C, typhoid	Extract/ Oral	0.109	91.7	0.96
Plantago lanceolata L. HUP0004502	Jabai	Plantaginaceae	H	Whole	Cough, fever, constipation and healing of wounds	Maceration/ Oral	0.056	79.5	0.9
Plantago major L. HUP0004503	Jabai	Plantaginaceae	H	Whole	Piles and abnormal menses, analgesic, mouth wash, toothache, laxative	Maceration/ Oral	0.053	69.3	0.65
Polygonatum verticellatum (L.) All. HUP0004516	Pramol	Lilliaceae	H	Root	Gynecological problems, emollient, galactogogue	Extract/ Oral	0.026	54.7	0.42
Polygonum aviculare L. HUP0004577	Bandakay	Polygonaceae	H	Whole	Astringent, emetic for stomach wash	Poultice/ Top, Extract/Oral	0.027	53	0.39
Polygonum coagnatum Meisn. HUP0004599	Bandakay	Polygonaceae	H	Whole	Astringent, emetic for stomach wash	Poultice/ Top, Extract/	0.018	54.6	0.3
Potentilla reptans L. HUP0004579	Spanja	Rosaceae	H	Whole	Astringent, anti-diarrheal, urinary tract infection	Poultice/ Top, Extract/	0.037	53	0.4
Primula denticulate Sm. HUP0004575	Mamira	Primulaceae	H	Rhizome	Ophthalmic, emollient, removal of black spots on skin	Powder/ Oral Paste/ Top	0.118	96.4	1
Prunella vulgaris L. HUP0004465	Astukhuddus	Lamiaceae	H	Whole	Cough and fever, arthritis and rheumatism, piles, respiratory problems	Extract/ Oral	0.091	88.7	0.92
Punica granatum L. HUP0004615	Nanguray	Punicaceae	S	Fruit, bark	Cough and fever, febrifuge, heart problems, ophthalmic, anti-diarrheal, abnormal menses, infection in urinary tract	Powder/ Oral	0.200	88	0.9
Quercus dilatata Lindl. ex Royle HUP0004537	Banj	Fagaceae	T	Fruit, bark	Astringent, infection in urinary tract, anti-diarrheal, inflammation of throat	Powder/ Oral	0.071	74.5	0.9

Rabdosia rugosa (Wallich ex Benth.) Hara HUP0004589	Burtas, sperkay	Lamiaceae	S	Whole	Anti-diabetic, hepatitis, mouth ulcer	Powder/ Oral	0.072	82.5	88
Raphanus raphanistrum L. HUP0004632	Zangali mulai	Brassicaceae	H	Whole	Dermatological diseases, gastro-intestinal	Extract/ Top, Oral	0.030	53.2	0.51
Rhododendron anthopogon D. Don HUP0004620	Gulnameer	Ericaceae	S	Leaf, flower	Analgesic, headache, sneezing	Powder/ Smell	0.019	69.3	0.55
Ricinus communis L. HUP0004587	Arhanda	Euphorbiaceae	S	Seeds, oil	Analgesic, laxative, purgative	Extract/ Oral	0.065	60.3	0.77
Robinia pseudoacacia L. HUP0004592	Kekar	Papilionaceae	T	Bark, leaf, flower	Anti-diarrheal, strengthening teeth and gums,	Powder/ Oral	0.082	69.3	0.69
Rosa webbiana Wall. ex Royle HUP0004623	Zangali gulab	Rosaceae	S	Flower	Astringent, purgative	Decoction/ Oral	0.101	85.1	0.72
Rosa brunonii Lindl. HUP0004631	Pulwaray	Rosaceae	S	Flower	Laxative, purgative, astringent	Decoction/ Oral	0.083	80	0.75
Rubia cordifolia L. HUP0004661	Kargha makhuka	Rubiaceae	H	Fruit, leaf	Astringent to stop bleeding in minor injuries	Poultice/ Top	0.018	50	0.35
Rubus ellipticus Sm. HUP0002843	Guraja	Rosaceae	S	Fruit, leaf	Abdominal discomfort, cough, laxative, astringents	Maceration/ Oral	0.064	83.2	0.85
Rubus fruticosus Agg. HUP0002854	Karwara	Rosaceae	S	Fruit, leaf	Hepatitis, typhoid, anti-diarrheal	Extract/ oral	0.099	86.3	0.85
Rubus sanctus Schreb. HUO0002855	Baganra	Rosaceae	S	Fruit, leaf	Cough, abdominal discomfort, astringent and laxative	Extract/ oral	0.063	85.5	0.85
Rumex dentatus L. HUP0004586	Shalkhay	Polygonaceae	H	Leaf, root	Aphrodisiac	Decoction/ Oral	0.027	86.2	0.66
Rumex hastatus D.Don HUP0004573	Trewakay	Polygonaceae	S	Whole	Astringent, anti-allergic	Poultice/ top	0.045	81.6	0.61
Salvia lanata Roxb. HUP0004620	Kyan, sobanay	Lamiaceae	H	Whole	Diuretic, anti-hypertension, emetic, gastrointestinal problems		0.062	67.7	0.57
Sambucus wightiana Wall. ex Wight & Arn. HUP0004590	Chajin	Sambucaceae	S	Whole	Laxative, diuretic, febrifuge, remove sputum from respiratory tract	Powder/ Oral	0.046	81.6	0.62

Sarcococca saligna (D.Don) Muell.Arg. HUP0004586	Ladand	Buxaceae	S	Whole	Gas-trouble, carminative, relieve flatulence	Powder/ Oral	0.027	69.5	0.54
Silene conoideae L. HUP0004549	March butay	Caryophyllaceae	H	Whole	Ophthalmic, emollient	Decoction/ Oral, Eyes	0.027	55.3	0.53
Silene vulgaris (Moench) Garcke HUP0004646	Takla	Caryophyllaceae	H	Whole	Ophthalmic, emollient	Decoction/ Oral, Eyes	0.036	70.2	0.44
Smilax glaucophylla Klotzch HUP0004581	Zeelai	Smilacaceae	S	Root	Emollient, general tonic	Decoction/ Oral	0.036	52.2	0.50
Solanum nigrum L. HUP0004613	Kamachu	Solanaceae	H	Whole	Blood purifier, hepatitis, carminative, anti-helminthic	Extract/ Oral	0.045	66.7	0.82
Sonchus asper (L.) Hill. HUP0004577	Dokac	Asteraceae	H	Whole	Astringent, healing of wounds	Poultice/ Oral	0.018	52	0.41
Taxus fauna Nan Li & R.R. Mill HUP0004599	Banya	Taxaceae	T	Bark, leaf	Anti-diabetic, hepatitis C	Tea/ Oral	0.063	66.7	0.71
Thymus linearis Benth. HUP0004529	Speerkai	Lamiaceae	H	Whole	Stomach and abdominal discomfort, cough and flu, typhoid, hepatitis	Tea/ Oral	0.217	99	1
Tribulus terrestris L. HUP0004543	Markundai	Zygophyllaceae	H	Fruit	Astringent, aphrodisiac, urinary tract infection and mouth ulcer	Powder/ Oral	0.066	61.2	0.52
Scutellaria chamaedrifolia Hedge & Paton HUP0004541	Ghutyala	Lamiaceae	H	Whole	Gastro-intestinal problems, abdominal discomfort	Powder/ Oral	0.017	50	0.38
Skimmia laureola (DC.) Sieb & Zucc.ex Walp. HUP0004620	Nameer	Rutaceae	S	Whole	Respiratory problems, strengthening and improvement of heart functions, bronchodilator	Smoke/ inhale	0.167	100	1
Solanum dulcamara L. HUP0004619	Mrach	Solanaceae	S	Whole	Diuretic, hepatitis, joint pain	Extract/ Oral	0.059	50	0.45
Solanum surattense Burm. f. HUP0004619	Ghana	Solanaceae	H	Whole	Asthma, cough, arthritis, diuretic	Powder/ Oral	0.044	58.4	0.49

Sorbaria tomentosa (Lindl.) Rehder HUP0002931	Speen gulay	Rosaceae	S	whole	Astringent, abdominal pain	Poultice/ Top	0.053	72.2	0.61
Urtica dioica L. HUP0004585	Sezunkay	Urticaceae	H	Whole	Astringent, hepatitis, diuretic, gynecological disorders	Maceration/ Oral	0.048	59.7	0.57
Valeriana jatamansi Jones HUP0004599	Mushke bala	Valerianaceae	H	Root	Tonic for general body weakness, constipation and gastro-intestinal disorders	Extract/ Oral	0.056	90.2	0.85
Verbascum Thapsus L. HUP0004610	Khar ghwag	Scrophulariaceae	H	Whole	As bandage for healing of wounds and acnes	Poultice/ top	0.042	59.6	0.55
Tagetes minuta L. HUP0004607	Dengaan	Asteraceae	H	Whole	Remove stones from kidney and urinary bladder, piles	Decoction/ Oral	0.030	61.8	0.48
Taraxacum officinale Weber. HUP0004604	Ziargulay, han	Asteraceae	H	Whole	Laxative, diuretic, renal disorders	Maceration/ Oral	0.041	94.7	0.90
Typha angustata Bory & Chaub. HUP0004657	Lukha	Typhaceae	H	Root	Astringent, abdominal pain, healing of wounds	Poultice/ Top	0.066	81.5	0.60
Verbena officinalis L. HUP0004517	Shinchai	Verbenaceae	H		Gas-trouble, piles, analgesic, stomach and abdominal discomfort	Decoction/ Oral	0.181	76.5	0.44
Viburnum grandiflorum Wall. ex DC. HUP0004583	Ghaz meva	Caprifoliaceae	S	Fruit	Laxative, appetizer	Fresh/ Oral	0.018	57.3	0.65
Viola betonicifolia Sm. HUP0004594	Banafsha	Violaceae	H	Flower	Febrifuge, hepatitis, laxative, sedative, analgesic, improve gastro-intestinal function	Tea/ Oral	0.099	95.5	1.00
Viola caenescens Wall. ex Roxb. HUP0004598	Banafsha	Violaceae	H	Flower	Febrifuge, hepatitis, laxative, sedative, analgesic, improve gastro-intestinal function	Tea/ Oral	0.119	95.5	1.00
Vitex negundo L. HUP0004593	Marwandai	Verbenaceae	S	Whole	Insect repellent, expectorant, vermicide, arthritis and rheumatism	Tea/ Oral	0.048	67.3	0.80
Zanthoxylum armatum DC. HUP0004526	Dambara	Rutacaeae	S	Fruit, bark	Anti-diarrheal, gas-trouble, appetizer, improve heart functions, remove bad smell of mouth	Powder/ oral	0.073	76	0.79

H= Herb, **S**= Shrub, **T**=Tree, **C**= Climber, **UR**= Use Reports, **FL**= Fidelity level and **RFC**= Relative Frequency of Citation

Used Parts of the medicinal Plants (MPs)

Various parts of the plants are traditionally used in different drug formulations. Different scientific researchers have proved that various plant parts are responsible for synthesis and accumulation of secondary metabolites/compounds having medicinal effects (Butt *et al.* 2015). In the current study, the whole plant used in drug formulation was the leading group represented by 60 species (39.21%), followed by leaves with 30 species (19.60%) and fruit with 28 species (18.30%). Other parts of plants like bark with 23 species (15.03%), seeds with 14 species (9.15%), root with 12 species (7.84%), rhizome with 11 species (7.18%) are also represented (Fig. 3). Plants resins and young shoots of 7 and 6 species are used marking a total of (4.57% and 3.92%) respectively while flower with 2 species (1.22%). Various parts of the medicinal plants were reported to be used against different ailments after processing for easy administration (Table 3). The use of ethnomedicinal recipes prepared from various plant parts has also been reported from other studies (Kala 2005, Phumthum *et al.* 2018). Giday *et al.* (2010) have found leaves and shoots to be the frequently used parts in drug formulations because of the convenience of their collection and the presence of active compounds in high concentration. The leaf collection and medication preparations from leaves are so easy as compared to the other plant parts. For this reason, leaves are commonly used in herbal remedies preparation (Rehman *et al.* 2023b). The removal of leaves from the therapeutic plants can cause less harm as compared to the removal of other parts of the plant (Rehman *et al*. 2023b).

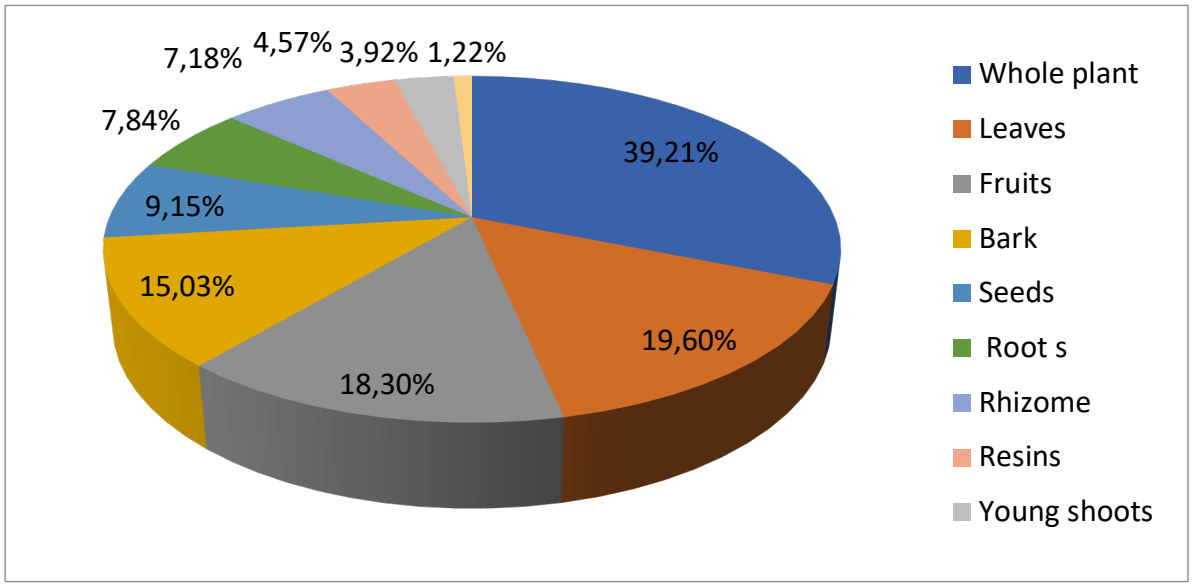

Figure 3. Plant parts used in herbal remedies preparation

Mode of preparations

Powder was among the most commonly used forms representing 55 species (35.94%), followed by extract' with 29 species (18.95%), and 'decoction' 17 species (11.11%). Other modes like 'Direct use' with 12 species (7.84%), 'Maceration' with 10 species (6.53%), 'Paste' with 9 species (5.88%), 'Tea' with 8 species (5.22%), 'Resin' and 'Juice' with 4 species (2.61% each) are also reported. The lowest value of mode of utilization was associated with 'Tablet' and 'Poultice' represented 3 and 2 species respectively (1.96% and 1.30%) (Fig. 4). The inhalation of the smoke of only a single species (*Skimia laureola*) was also reported (Table 3). Powder as the most commonly used form has also been reported by (Bhattarai *et al.* 2010; Togola *et al.* 2005). Similarly, powder and decoction were documented as the most frequently used methods for herbal remedies preparation in previous research work (Shah *et al.* 2020; Rehman et al. 2023). Also, similar findings were reported by other researchers (Butt *et al.* 2015; Rashid *et al.* 2015). For the use of ethnomedicine, the route of administration of the drug is also considered very important and the easiest ways of using the drug are sought (Giday *et al.* 2010). Most of the prepared ethnomedicine were reported to be taken orally, representing 80% (122 species) of the total plants. On the other hand 16% (24 species) were reported for topical/external uses while administration through nose and eyes represented only 2% (3 species each).

Relative Frequency of Citation (RFC)

To know about the prominence of a plant relative to another species RFC was calculated following (Umair *et al.* 2019); Sujarwo & Caneva 2016). The results show RFC value ranges from 1 to 33%. The medicinal plants having the highest RFC values were *Berberis lyceum* (0.33), *Berberis jaeschkeana* (0.32), *Berberis callibotrys* (0.31), *Cannabis sativa* and *Olea*

ferruginea (0.27) each, *Justicia adhatoda* (0.24), *Paeonia emodi* (0.23), *Mentha arvensis*, *Morus nigra* and *Thymus linearis* (0.21 each) while *Punica granatum* and *Ficus palmata* have the value of (0.20) each (Table 3). The high RFC values recorded for a species show its high medicinal values with a high number of citation (Bano *et al.* 2014). The plant species having high RFC values must be further evaluated for the presence of pharmaceutically active compounds through advanced techniques to discover new drugs (Khan *et al.* 2020). These plants have bioactive compounds concentrated to their respective parts having a potential to be used against different ailments (Mir *et al.* 2017). During the study some plants were reported with very low RFC values which coincide with other studies conducted throughout Pakistan (Majeed *et al.* 2020; Wali *et al*. 2018). The low RFC values may be due to the limited exchange of traditional knowledge among the informants or lack of its proper documentation (Muhammad *et al.* 2019). The relative citation of frequency reveals the tribe's familiarity with the healing properties of particular plants. It also indicates accessibility and efficacy with fewer side effects (Vitalini *et al.* 2013; Kayani *et al.* 2015). Those medicinal plants having maximum RFC value must be further evaluated for phytochemical and pharmaceutical analysis to identify their bioactive compounds for any medication preparation (Vitalini *et al.* 2013; Yaseen 2019).

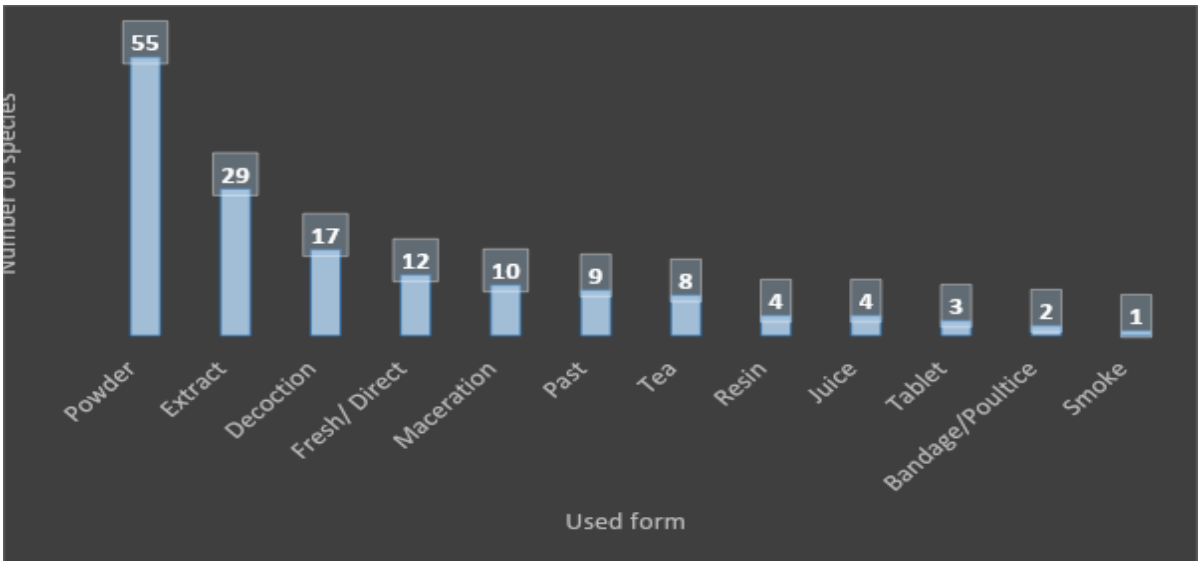

Figure 4. Mode of Preparations

Fidelity Level (FL)

The Fidelity level is generally calculated to know how much a plant species is ideal for a specific ailment among the informants (Sivasankari *et al.* 2014). The recorded FL values ranged from 50 -100%. The results showed 31 species having FL values above 90%. Among the reported species *Skimia laureola* has the FL value (100%), *Ajuga bracteosa, Ajuga parviflora, Mentha arvensis, M. longifolia,* and *Thymus linearis* (99%), *Caltha alba, Ficus palmate* (98%) each, *Mirabilis jalapa,* and *Primula denticulate* (96%) each while *Berberis jaeschkeana, Diospyrus lotus* and *Viola* species have FL values of (95%) each (Table 3). The high FL values indicate that such species are highly preferred for its specific use among the informants (Musarrat *et al.* 2014; Ullah *et al.* 2014). The FL also indicates occurrence of a specific ailment in an area (Bibi *et al*. 2014). The highest fidelity level (FL) value determines the choice of participants to cure the particular ailment (Bisi-Johnson *et al.* 2010; Karakose 2022). It is a fact that the higher the plant's utilization, the higher will be the FL value (Sahil 2014; Rehman *et al.* 2023d).

Relative popularity level (RPL)

The RPL is calculated to investigate about the degree of popularity of a species among the informants (Abbas *et al.* 2020). The high RPL values indicate the higher extent of popularity of the specie among the informants and vice versa. *Ajuga bracteosa, Asparagus gracilis, Berberis callibotrys, Aconitum chasmanthum, Aesculus indica, Artemisia scoparia* and *Colchicum luteum* were declared as the most popular species having the RPL values 0.9 to 1.0. The RPL values of reported plants showing the extent of popularity are given in Table 3.

Informants consensus factor (ICF)

ICF was used to identify medicinal plants used by inhabitants of the study area to cure a group of disorders. In other words, the ICF value explains the cultural consistency in the use of a group of medicinal plants to cure a particular disease (Cerqueira *et al.* 2020).The use of plant species was reported for 24 ailment categories ranging from simple fevers to complicated health

problems like gastrointestinal, respiratory, hepatic, arthritis, rheumatism and problems of the heart and blood circulatory system (cardiovascular diseases) (Table 4). The informants reported most of the plant species for more than one ailment category. Gastrointestinal disorders were the dominant ailment category with 81 use reports followed by disorders of urinary tract with 36 use reports. To stop bleeding in minor injuries (astringent) (30 species), for respiratory problems (28 species), skin disorders (23 species), and liver diseases (19 species) while 15 species were reported as blood purifiers. Disorders related to urinary tract were reported as the second most common category being treated (Figure 3). The range of ICF values was from 0.27 (sexual problems) to 0.54 (gastrointestinal problems). The average ICF value calculated was 0.42. Similar findings have also been reported by (Kadir *et al*. 2012; Singh *et al*. 2012), in which gastrointestinal disorders were the dominant disease category followed by cardiovascular problems. Sher *et al* (2020) also reported gastrointestinal disease as the dominating category followed by ophthalmic/eye ailments). Similar results were documented by (Shah *et al.* 2020; Birjees *et al.* 2021; Rehman et al. 2023e), who reported the maximum ICF value for gastrointestinal disorders. Medicinal plants with highest ICF values indicate that the local person has a well-defined choice criterion, and that indigenous knowledge is shared among informants about their effectiveness (Mootoosamy and Mahomoodally 2014). Therefore, therapeutic plants with maximum ICF values are to be preferred for advanced studies on phytochemical and pharmacological basis.

Table 4. The Informants consensus factor (ICF) values of 24 ailment categories

Category of Ailment	**ICF= Nur-Nt/Nur-1**	**Category of Ailment**	**ICF= Nur-Nt/Nur-1**
Gastro-intestinal system	110/51= 0.54	Skeleto-muscular system	17/09= 0.50
Respiratory system	65/32= 0.51	Gynecological problems	14/09= 0.38
Excretory system	59/30= 0.50	Sexual problems	12/09= 0.27
Astringent/to stop bleeding	51/28= 0.46	General body weakness	11/08= 0.30
Skin problems	39/23= 0.42	As appetizer	09/05= 0.50
Hepatic/Liver problems	31/19= 0.40	Anti-diabetic	08/05= 0.42
Wounds healing	30/19= 0.37	Cardiac/Heart problems	07/04= 0.50
Blood purifier	23/15= 0.36	Psychological problems	05/03= 0.50
Fever	23/15= 0.36	Venomous/Antidote	05/03= 0.50
Pain relievers	21/13= 0.40	Ear, Nose, Throat (ENT)	05/03= 0.50
Ophthalmic	18/09= 0.52	Lactation problems	04/03= 0.33
Dental problems	11/08= 0.30	Anti-malarial	04/03= 0.33

Novelty of the research study

In district Swat numbers of ethnobotanical studies have been conducted to date however, no such work reported specifically on the Sakhra valley. Most of the studies presented the qualitative aspects of medicinal flora lacking appropriate quantitative analysis. The current research work was an attempt to make a complete investigation about the floristic diversity and traditional uses of medicinal plants of the area both qualitatively and quantitatively along with proper documentation of traditional knowledge. Besides documentation, serious threats to medicinal flora are highlighted like encroachments for new agricultural lands, construction of roads, deforestation, overgrazing, and overexploitation of medicinal plants. The main causes for depletion of traditional knowledge are lack of proper documentation of the existing knowledge, least interest from young people of the community, lower literacy rate and oral transfer. However, a large section of the community still prefers plant-based medicines to treat their ailments.

Conclusions

The current study recorded a total of 153 plant species belonging to 63 families and 100 genera, which are used by traditional healers to treat various ailments. It is revealed that the indigenous people of the study area possess a rich traditional knowledge inherited from their forefather and records of this important knowledge has provided novel information from the study area. It is the first attempt to document the medicinal plants (MPs) traditionally used in the concerned area. The dominant family was Lamiaceae. The dominant mode of preparation was powder. The highest RFC values were recorded for *Berberis lyceum.* The medicinal plant with a 100% Fidelity level was *Skimia laureola.* The maximum ICF value was reported for gastrointestinal disorders. It was found that the elder generation possessed an enormous traditional knowledge on therapeutic plants as compared to the younger generation. Based on the present studies results, therapeutic plants scoring relative frequency of citation, and fidelity level values must be further tested for their phytochemical and pharmacological research.

Declarations

Ethics approval: Before commencement of interviews, prior informed consent was obtained individually from all the informants.

Availability of data and materials: All the data obtained from informants during the study are included in the manuscript.

Conflict of interests: The authors mentioned in the manuscript have no competing interests.

Consent for publication: Not applicable as no personal data is included in the paper.

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Contributions: SHAS designed and conducted the field work, analyzed the data and wrote the manuscript; GMS and NA supervised the research work and revised the manuscript; JA and AG contributed in species identification and preparation of herbarium specimens; SR helped in Writing−review and editing; NA, KR and AB contributed in plants collection and preparation of voucher specimens.

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