Ethnobotanical study of wild edible plants traditionally used by the inhabitants of Lalku Valley, District Swat, Pakistan

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Research

Abstract

Background: The non-cultivated edible plants are collected by local people from the surrounding environment and used in various food recipes. The relationship of human communities with such plants has been considered an ecological balance system since ancient times. Much ethnobotanical research has proven the importance of wild edible plants for the local communities, especially in emergency like war, famine, and drought.

Methods: An ethnobotanical study was conducted in 26 villages/ settlements of Lalku Valley, district Swat to document the wild edible plants used as food by local inhabitants. The data was collected using group discussions and oral face-to-face interviews through semi-structured questionnaires. The related information was collected from 222 local informants (179 males and 43 females). Informants were told about the study's aims and Prior Informed Consent was obtained. The acquired data was analyzed through various statistical indices like Use Reports (UR), and Relative Frequency of Citation (RFC).

Results: A total of 60 plant species belonging to 31 families and 46 genera were reported as wild edible plants (WEPs) traditionally used in the study area. Rosaceae was reported as the dominant plant family with 10 species followed by Lamiaceae 5 while Amaranthaceae and Moraceae with 3 species each. Herbs were reported as the most widely used form with 29 species (48.33%), followed by shrubs with 14 species (23.33%), trees with 12 species (20.00%), and climbers with 2 species (3.33%). Fruits were the most widely used part with 24 species (40.00%), Young shoot with 23 species (39.65%), Leaf with 16 species (26.66%), Seeds and whole plant used with 4 species (6.66%) each, flower with 2 species (3.33%) while bulb and corm with 1 species each (1.66%). Among them, 34 species (56.66%) were consumed uncooked, and 26 species (43.3%) were cooked before consumption. Based on the availability of plants, 26 wild edible plant species are available and collected in the summer season (May-August), 21 species in the spring- early summer season (April- May), and 12 species in the autumn season (September-November).

Conclusions: The local people have rich knowledge related to wild edible plants (WEPs).The results show a strong relationship between the local communities with wild edible plants (WEPs) species which is a potential source to ensure food security. Further studies are required to document and preserve such traditional knowledge.

Keywords: Wild edible plant, Ethnobotany, Traditional knowledge, Relative Frequency of Citation (RFC)

Background

Wild Edible plants (WEPs) have been used as an ancient source of food for humans since the emergence of civilization and are still used traditionally beside advanced agriculture (Abbasi *et al.* 2013).The utilization of WEPs by many rural communities is an integral part of their cultural gastronomic heritage (Abdullah & Andrabi 2021; Kidane & Kejela 2021; Rehman *et al.* 2024). This resource enriches the dietary menu of local communities (Prabakaran *et al.* 2013). These are uncultivated plant species growing in their natural wild habitats and consumed by indigenous communities as food (Mallick *et al.* 2020). These plant species are collected by local communities from the surrounding environment and utilized in various food recipes (Ju *et al*. 2013).They have been utilized by man for multiple purposes since prehistoric times (Fils *et al*. 2020; Rehman *et al.* 2022a).WEPs are a source of food not only for man but also for animals and birds living in the wild (Al-Fatimi 2021). Most wild vegetables are consumed in cooked and fruits in raw forms (Garcia-Herrera *et al.* 2020), while some of them are converted into pickles, sauces (chutni), and jams (murabba) before consumption (Murtem & Chaudhry 2016).

The wild plants are satisfying the food security issues by providing alternative and diverse food sources to the traditional communities of the area (Abbasi *et al.* 2013; Rehman *et al.* 2022b). Due to the existence of many bioactive compounds like fatty acids, complex sugars, vitamins, and proteins (Pieroni *et al.* 2018; Cornara *et al.* 2009), the WEPs can be used to cope with malnutrition problems (Thakur *et al.* 2017). Phytochemical constituents of many plants have been investigated before based on medicinal and nutritional aspects (Sanchez-Bel *et al.* 2015). Besides the importance of plants as edible, their pharmacological properties have also been proven by many researchers throughout the world (Vitalini *et al.* 2013; Punchay *et al.,* 2020; Shin *et al.* 2018; Rehman *et al.* 2022c).

The WEPs not only provide healthy food but also act as medicines against various diseases Pieroni *et al.* 2018; Rehman *et al.* 2023a). These plants possess nutraceutical properties so they can provide health benefits as well (Singh *et al.* 2016). Thus, they could be recommended for the treatment of diseases related to malnutrition (Garcia-Herrera *et al.* 2020). The WEPs are preferable on conventional cultivated plants because they are mostly free of diseases, fertilizers, and pesticides, rich in nutrients, and free of manipulated genes (Shaheen *et al.* 2017; Rehman *et al.* 2023b).This is the reason that most of the wild plants have longer shelf life as compared to the cultivated relatives (Biswas *et al.* 2018). In addition to conventional cultivation, wild plants should be planted through agro-forestry and aforestation programs to ensure the conservation of wild edible plants (Paul *et al.* 2020). It will minimize food security issues and boost income generation for local communities (Golait *et al.* 2021; Rehman *et al.* 2023c).

Pakistan stands in 6th position among the populous most countries in the world with very low income and due to poverty, alternate food sources look more vital for the people. It is estimated that about 60% of the country's population is food insecure (Sleet 2019). Despite the availability of four seasons and a wide diversity of natural resources, the country ranks 11th most food insecure country worldwide (Sundarland 2011; Khadim *et al.* 2023). The problem of food insecurity increases due to overpopulation, poverty, least access to food resources, and local livelihood strategies (Shad *et al.* 2013; Rehman *et al.* 2023d). Wild edible plants (WEPs) can be used as alternative food resources for local communities to compete with the issues of hunger and malnutrition if managed properly (Abdullah *et al.* 2021). Further scientific investigations of these plants are necessary to determine the presence of nutrients and other bioactive compounds to validate their nutritional and medicinal values and to use them safely and effectively (Duguma 2020).To date, insufficient studies have been conducted to document the locally used wild edible plants (Abbas *et al.* 2020; Tareen *et al.* 2016). Therefore, it is vital to bring WEPs under cultivation to reduce pressure on its natural population growing in the wild habitat which will also lead to conservation (Singh *et al.* 2021). Other ways to conserve WEPs in an area may be; sustainable harvesting, involvement of community members, their folk traditions, and maintaining the natural habitats (Cao *et al.* 2020).

The tribal communities although not formally educated, have rich and reliable knowledge about wild food resources and use to transmit it orally from generation to generation (Das 2013). The relationship between human communities and the use of plants has been considered an ecological balance system since ancient times to preserve this resource. Much ethnobotanical research has proven the importance of wild edible plants for the local communities especially in emergencies like war, famine, and drought (Abbasi *et al.* 2013; Rehman *et al.* 2023e). Along with the practice of modern agricultural techniques, the local communities also have a dependence on wild edible plants (WEPs) up to a great extent. Therefore, in this domain of ethnobotany, it is aimed to investigate and document different wild plants being used by ethnic groups of various localities for nutrition and economic proposes (Heinrich *et al.* 2006). The developed countries of Europe consider wild edible plants (WEP) as an iconic factor of the ecosystem (Schulp *et al.* 2014).

Due to rapid urbanization and modernization of the traditional communities' particularly young generations, sudden changes in the eating patterns have been observed which have detrimental effects on health causing malnutrition issues (Bhattarai *et al.* 2009). According to Bhatia *et al.* (2018) some of the key factors held responsible for such changes are; improvement in

the socio-economic conditions of people, advanced agricultural techniques, and connectivity of rural areas with road infrastructures. The migration of rural people to cities and towns is a serious of factors in vanishing the traditional gastronomic culture (Sachan *et al.* 2013; Rehman *et al.* 2024). The practice of utilizing WEPs and traditional knowledge is thus eradicated and needs to be documented for the welfare of mankind (Abdullah & Andrabi 2021; Golait & 2021).There is a need for time to make further efforts to document, integrate, and compile the indigenous knowledge about Plant utilization practices (Pei & Sajise 1995).The ethnobotanical culture can be conserved appropriately if its importance is addressed and understood properly among the local communities.

The present research study was conducted in the Sakhta Valley of district Swat to document the traditional knowledge of WEPs, patterns of utilization, time of collection, and other related information in different tribes. It is hypothesized that (a) the elderly people among the informants are more knowledgeable than the youngsters; (ii) the traditional knowledge is mostly confined to formally uneducated people (iii) the lack of documentation of the traditional knowledge is due to low literacy rate of the informants. The local people of the study area were interviewed in different seasons throughout the year to document the wild edible plants of the area. The current study reports the wild edible plants for the first time in the Sakhra Valley district of Swat, Pakistan.

Materials and Methods

Study area

The study area is located in the Khyber Pakhtunkhwa province, North-West region of Pakistan about 60 kilometers from the district headquarters Saidu Sharif Swat. The geographical coordinates of the area range from 35°03′01″ to 35°11′29″N Latitude and 72°19′48″ to 72°25′28″E Longitude (Fig.1). Sakhra valley lies in the complex Hindu-kush mountain range showing varied topographical conditions (Sher *et al.* 2010) with altitude ranges from 1449 to 3920m above mean sea level (Table 1). Due to the varied geographical and climatic conditions, the area possesses a surprising biodiversity (Ahmad & Ahmad, 2004). The temperature ranges from -5°C in January- February to 30°C in July- August. The area is phytogeographically considered in the Sino-Japanese region where the moon-soon season prevails in the months of July-August in which heavy rainfall occurs (Ahmad & Ahmad, 2004). The plant species in the area are distributed according to the terrain they grow in, for example, deep valleys, mountain slopes, high plateaus mountain tops, etc. These diverse conditions are responsible for the specific and distinctive flora of the region. For convenience the study area was divided into 26 comparts where the local inhabitants were interviewed (Table 1). 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 (Yousafzai *et al.* 2010). The main agricultural products of the area include peach, apple, pear, persimmon, wheat, maize, pulses, and potato while buffalo, cow, sheep, and goat are the common livestock. Due to poverty and low agricultural products, a number of the local people are still dependent on wild edible plants and their products; they collect these plant species in their specific seasons and utilize them for food and for generating revenue by selling in the market as well (Al-Fatimi, 2021). The people of the remote communities have a special relationship with the nearby available plants for getting food, medicines, and generation of income (Ali *et al.* 2017; Khan *et al.* 2019;*Shah et al.* 2024).These plants and their products have been used as food, medicine, and religious customs.

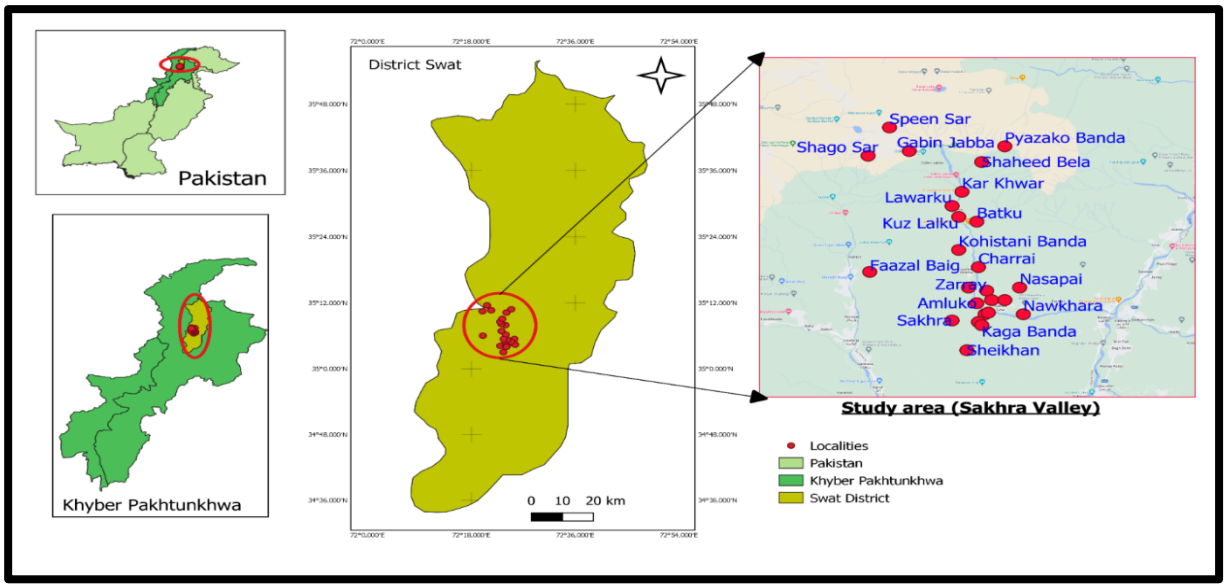


Figure 1. Map of Pakistan, Khyber Pakhtunkhwa and district Swat highlighting the study area

Table 1. The geographical coordinates of 26 sites in the study area.

Name of Locality	Latitude	Longitude	Altitude (amsl))
Amluk	35°04′49″N	72°23′55″E	1544
Barru	35°04′29″N	72°24′11″E	1493
Baaraghat	35°04′59″N	72°24′28″E	1490
Batkuu	35°08′02″N	72°23′56″E	2019
Charraai	35°06′15″N	72°23′58″E	1700
FaazalBaigGarhai	35°06′03″N	72°19′48″E	2064
Gabeen Jabba	35°10′43″N	72°21′28″E	2760
Kagga Banda	35°04′02″N	72°24′07″E	1783
Kar-Khwar	35°09′09″N	72°23′21″E	2135
Kharkaii	35°04′10″N	72°23′57″E	1617
Kohistanai Banda	35°06′57″N	72°23′16″E	2130
Kolattay	35°04′60″N	72°24′56″E	1588
Kuz-Lalku	35°08′11″N	72°23′15″E	2011
LanddaiGarhai	35°05′24″N	72°23′27″E	1620
Lawarkuu	35°08′37″N	72°22′59″E	2025
Nasaapaii	35°05′28″N	72°25′28″E	1712
Nawkharakalay	35°03′57″N	72°23′52″E	1449
Pendayy	35°04′33″N	72°24′19″E	1671
Sakhra village	35°04′13″N	72°22′59″E	1560
Pyazakoo Banda	35°10′52″N	72°24′57″E	2995
Sabbzal	35°04′59″N	72°24′57″E	1511
Sheikhankalay	35°03′01″N	72°23′26″E	2060
Shago-Sar	35°10′31″N	72°19′56″E	3920
Shaheed Bela	35°10′19″N	72°24′01″E	2880
SpeenSarr	35°11′29″N	72°20′45″E	3680
Zarray top	35°05′22″N	72°24′17″E	1735

Data collection

For a collection of ethnobotanical data, the study area was thoroughly visited from March 2022 to fall 2023. The area has 26 villages from where the informants were randomly selected for interviews. The data relating to wild edible plants (WEPs) was carefully collected through oral face-to-face interviews among 222 informants' preferably elderly people of the community. However, the youngsters practicing seasonal collection were also included in the interview. The data collected include local names of the plant species, edible parts, and methods of preparations, taste, and season of collection. Special measures were taken during the documentation of local names of each plant species in various localities and organoleptic confirmation of the collected plants was done in the field where necessary. The taste and smell are important organoleptic properties used to determine a crude drug or food. The characteristics and properties of species are presented in (Table 2).

Plants identification

During the study, 60 plant species were reported from different localities of the area. These plants belong to 31 families and 46 genera which are traditionally used for food by the people (Table 2). The taxonomic identification of plant species was performed with the help of the flora of Pakistan and consulting expert taxonomists. Some of the collected plant specimens were identified using references of botanical data reported from the area in various botanical papers as well following Al-Fatimi, (2019). Besides this, acceptance of taxonomic names of plant species was done by consulting the "World Flora Online" database and "The Plant List" (www.theplantlist.org) following Meve U, Liede, (2003).

Data Analysis

Relative Frequency of Citation (RFC)

The data was analyzed for Relative Frequency of Citation (RFC) following Aziz *et al.* (2018) and Vitalini *et al.* (2013) by the following formula.

$$RFC = FC/N \quad (0 < RFC < 1)$$

Where **FC** shows the number of informants citing a plant species and **N** is the total number of informants.

The citation number was calculated for each wild edible plant (WEPs) species to express the number of informants. The highest number of citations for a plant species states the agreements among people of various communities and the consumption values.

Table 2. Plant Families, Number of Genera and Species

Family	Number of Genera	Number of Species	Number of used parts
Rosaceae	07	10	Fruit: 10
Brassicaceae	02	02	Leaf: 3, Young shoot: 3
Amaranthaceae	01	03	Leaf: 3, Young shoot: 3
Lilliaceae	01	02	Whole: 2
Asteraceae	02	02	Leaf: 1, Whole: 1
Moraceae	02	03	Fruit: 3
Lamiaceae	03	04	Leaf: 3, Young shoot: 3, Seed: 1
Fabaceae	02	02	Legume:Young shoot: 2
Apiaceae	02	02	Young shoot: 1, Seed: 1
Pteridaceae	01	02	Young shoot: 2
Polygonaceae	01	02	Leaf:1, Young shoot: 2
Caryophyllaceae	02	02	Fruit: 1 Young shoot: 1
Solanaceae	02	02	Leaf: 2, Young shoot: 2
Pinaceae	01	02	Seed: 2
Asparagaceae	01	01	Young shoot
Berberidaceae	01	01	Fruit
Ranunculaceae	01	01	Whole
Ulmaceae	01	01	Fruit
Chenopodiaceae	01	01	Leaf
Ebenaceae	01	01	Fruit
Eleagnaceae	01	01	Fruit
Malvaceae	01	01	Leaf, Young shoot
Oliaceae	01	01	Fruit
Cactaceae	01	01	Fruit
Plantaginaceae	01	01	Leaf
Punicaceae	01	01	Fruit
Fagaceae	01	01	Fruit
Cucarbitaceae	01	01	Fruit
Rhamnaceae	01	01	Fruit
Rutaceae	01	01	Fruit
Portulacaceae	01	01	Leaf, Young shoot
Families= 31	**Genera= 46**	**Species= 60**	

Results

Demographic information

The informants of interviews were divided into different categories on the basis of age, gender and profession groups. Among them 23 persons were the age of (15-25 years) (10.36%), 45 people from (25-35) (20.27%), 54 people from (35-45) (23.87%), 57 from (45-55) (25.68%) and 44 individuals with 55-65 years and above (19.82%). Based on gender 179 (80.63%) informants were male while 43 (19.37%) were female. Due to the location of the study area is the far away from cities and towns, most of the participants interviewed were illiterates (39.64%), followed by high school (28.83%), intermediate (22.97%), and graduates (8.56%).Based on profession, the most common informants were farmers (35.59%), followed by shepherds (23.87%), housewives (19.37%), herbal practitioners (11.26%), and teachers (9.96%) (Table 3).

Taxonomic categories of WEPs

A total of 60 wild plant species were reported commonly used as different food recipes in the area. These species belong to 31 families and 46 genera (Table 2). The linking of each plant specimen's voucher number to the related data is crucial for

maintaining clarity and liability in research findings. This practice ensures that each piece of data can be traced back to the specific specimen, thereby enhancing transparency and reliability. It also enables other researchers to verify your work by accessing the physical specimens in herbarium collections. This documentation supports reproducibility, cross-checking, and validation of the research, all critical for maintaining the integrity and scientific reliability of the study. Among the plant families, Rosaceae is the dominating family having (10 species), followed by Lamiaceae (4 species), Amaranthaceae, and Moraceae (3 species) each. Aliaceae, Asteraceae, Brassicaceae, Fabaceae, Apiaceae, Pteridaceae, Polygonaceae, Caryophyllaceae, Solanaceae and Pinaceae (2 species) each, while the remaining17 families are presenting only a single species each.

Among the edible parts of WEPs species, fruit was mostly reported (31.50%) followed by young shoots (30.13%), leaves (21.91%), seeds and plants used as a whole (5.47%) each, flower (2.73%), while bulb and corm (1.36%) each (Table 4). Among the reported plants, 27 species are available in summer season, 21 species in spring while 10 species in autumn. In winter season the temperature falls below O°C which inhibits the occurrence of plant species. Some species like *Medicago polymorpha, Amaranthus spps, Mentha arvense, M. longifolia, Dryopteris ramos*a are collected in their respective seasons, dried and utilized in winter in their unavailability. Due to very cold temperature, the WEPs are almost unavailable in winter which has also been reported by Ahmad & Pieroni (2016).

Table 3. Demographic features of informants selected from the study area:

Factors	Categories	Number of participants	Percentage (%)
Age	15-25	23	10.36
	25-35	45	20.27
	35-45	53	23.87
	45-55	57	25.68
	55-65 and Above	44	19.82
Gender	Male	179	80.63
	Female	43	19.37
Education	Illiterates	88	39.64
	High School	64	28.83
	Intermediate	51	22.97
	Graduates	19	8.56
Profession	Farmers	79	35.59
	Shepherds	53	23.87
	Housewives	43	19.37
	Herbal practitioners	25	11.26
	Teachers	22	9.91

Table 4. Number of species with used parts

Edible Part(s)	Number	Percentage %
Fruit	24	31.51
Young Shoot	22	30.11
Leaf	16	21.95
Seed	04	5.49
Whole	04	5.43
Flower	02	2.75
Bulb	01	1.37
Corm	01	1.35

Table 5. Wild Edible Plants (WEPs), traditionally used by the local people in Sakhra Valley, District Swat.

Botanical name of WEPs, Voucher #	Local name	Family	Life form	The edible part, mode of consumption, and Taste	Medicinal uses	Season of collection	UR	RFC
Allium humile Kunth. HUP0004609	Zangalipiaz	**Aliaceae**	**H**	**Bulb and Leaves** Eaten fresh with bread or mixed and cooked with maize flour with the addition of salt to make bread and served. The bulb is dug out and eaten freshly. **Mild bitter**	Aphrodisiac, Anti-diarrheal, used to treat Asthma and short- breathing	**Apr-May**	190	0.85
Allium griffithianum Boiss. HUP0004627	Ogakai	**Aliaceae**	**H**	**Bulb and Leaves** Eaten fresh with bread or cooked with maize flour with addition of salt to make bread and served. The bulb is dug out and eaten freshly. **Mild bitter**	Asthma and short breathing, Anti-hypertensive, removal of kidney stones	**Apr-May**	195	0.87
Amaranthus caudatus L. HUP0004557	Ganhar	**Amaranthaceae**	**H**	**Young shoots and Leaves** The leaves are cut into small pieces, boiled with the appropriate amount of salt then fried in oil and served with bread. **Mild sweet**.	Blood purifier, anti-hypertensive, Diuretic, Asthma	**Jul- Aug**	200	0.89
Amaranthus spinosus L. HUP0004541	Chalwai	**Amaranthaceae**	**H**	**Young shoots and Leaves** Cut into small pieces, boiled with appropriate amount of salt then fried in oil and served with bread. **Mild sweet**.	Emollient, use to treat Abnormal menstruation	**Jul- Aug**	200	0.89
Amaranthus viridis L. HUP0004567	Chalwai	**Amaranthaceae**	**H**	**Young shoots and Leaves** Cut into small pieces, boiled with appropriate amount of salt then fried in oil and served with bread. **Mild sweet**.	Urinary tract infection, improvement of renal system	**Jul- Aug**	200	0.89
Asparagus gracilis Royle. HUP0000191	Tendoray	**Asparagaceae**	**S**	**Young shoots** Cut into small pieces, boiled then fried in oil and served with or without bread. **Sweet**.	Used as Aphrodisiac, and diuretic	**Mar-Apr**	71	0.32
Berberis lyceum Royle HUP0004576	Kwaray	**Berberidaceae**	**S**	**Fruit** The ripened fruits after collection are served freshly. **Mild sour**	Hepatitis, blood purifier, urinary tract infection, stops bleeding, and used as coolant	**Jun-Jul**	205	0.92

Caltha alba Camb. HUP0004581	Makhanpat	**Ranunculaceae**	**H**	**Leaves**: The leaves are collected, fried after boiling, and served with bread. Due to its deliciousness, it is compared with the taste of butter. **Sweet**	Laxative, improve digestion, treat constipation, increase urination, headache.	**Mar-Apr**	150	0.67
Capsella bursa-pastoris (L.) Medik. HUP0004563	Bambessa	**Brassicaceae**	**H**	**Young shoots and Leaves** The leaves and young shoots are eaten freshly or served after cooking. **Mild sweet.**	Lowers blood pressure, stops bleeding and induce appetite	**Mar-Apr**	39	0.16
Cardaria draba (L.) Desv. HUP0004562	Sharshamplar	**Brassicaceae**	**H**	**Young shoots and Leaves** The leaves are collected, fried after boiling, and served with bread. **Mild bitter**	Appetizer, improve digestion	**Mar-Apr**	51	0.23
Celtiscau scasica Willd. HUP000523	Tagha	**Ulmaceae**	**T**	**Fruit** The semi-dried fruits are eaten after collection. **Sweet**	Blood purifier, anti-allergic	**Sep-Oct**	53	0.24
Chenopodium album L. HUP0004566	Sarmay	**Chenopodiaceae**	**H**	**Young shoots and Leaves** The young leaves and shoots after collection are cut into pieces, boiled/fried, and served with bread. **Mild sweet**	Improve digestion, treatment of hepatitis, healing of throat and adjust the sensation of thrust	**Apr-Jun**	77	0.35
Cichorium intybus L. HUPHUP0000315	Hunn, kasni	**Asteraceae**	**H**	**Leaves** The leaves are boiled in water and squeezed to remove extra bitterness, then fried and eaten with bread. **Mild bitter**	Blood purifier, treatment of hepatitis, typhoid, remove intestinal worms, improve eyesight	**May-Jun**	187	0.84
Cotoneaster nummularia Fisch. & Mey. HUP0000307	Mamanra	**Rosaceae**	**S**	**Fruit** The fruits are eaten freshly after collection. **Sweet**	Hepatitis C, stops bleeding	Aug-Sep	59	0.27
Diospyrus lotus L. HUP0004590	Tor amluk	**Ebenaceae**	**T**	**Fruit** The fruits are collected after turning black, dried, and eaten. In dry form, itcan be stored for quite a long time. **Sweet**	As anti-diarrheal, induce constipation in case of taking over doze	Nov-Dec	210	0.95
Diplazium esculentum (Retz.) Sw. HUP0000190	Ladora	**Athyriaceae**	**H**	**Leaves** The young sprouts are collected, cut into pieces, fried, and served with bread. **Mild sweet**	Used to treat fever, digestive problems and Rheumatism	Mar-Apr	171	0.77

Dryopteris ramosa(Hope) C. Chr. HUP0000191	Kwanjay	**Dryopteridaceae**	**H**	**Leaves** The young, coiled leaves are rubbed to remove the scales, cut into pieces, and boiled. After softening, mixed with curd and served with bread. **Mild sweet**	Used to treat fever, digestive problems and Rheumatism	Mar-Apr	175	0.79
Duchesnea indica (Andr.) Focke HUP0004577	Sarkai	**Rosaceae**	**H**	**Fruit** The fruit after collection is eaten fresh or it may be used to make jams. **Sweet**	Used as antipyretic and improve digestion	Apr-May	70	0.32
Eleagnus umbellate Thunb. HUP0004581	Ghanamrangay	**Eleagnaceae**	**S**	**Fruit** The ripened fruits are collected and served in fresh form. **Sour**	Relieving whooping cough, as astringent to stop bleeding	Jul-Aug	66	0.30
Ficus palmata Forssk. HUP0000119	Enzar	**Moraceae**	**T**	**Fruit** The black and ripened fruit is eaten freshly or dried and stored. **Sweet**	Laxative, Improve digestion, improve respiratory system by removing from respiratory tract, weight gainer, aphrodisiac, to cure cough and fever	Jun-Jul	210	0.95
Lamium amplexicaule L. HUP0004621	Ghutialay	**Lamiaceae**	**H**	**Young shoots** The young shoots are cut into pieces, boiled/ fried, and served with bread. **Mild sweet**	The soup prepared from leaves are used as laxative and improvement of gastro-intestinal system	Mar-Apr	40	0.18
Lathyrus aphaca L. HUP0004683	Kurkmana	**Fabaceae**	**H**	**Fruit/Pod** The pods are boiled with the addition of salt and eaten without bread. **Mild sweet**	Used to treat fever and improve digestion	Apr-May	37	0.17
Malva neglecta Wallr. HUP0004617	Panerak	**Malvaceae**	**H**	**Young shoots and Leaves** The leaves and young shoots are cut into pieces, boiled to soften, fried, and served with bread. **Mild sweet**	The soup prepared from leaves are used as laxative and improvement of gastro-intestinal system	Apr-May	190	0.86
Medicago polymorpha HUP0004561	Shpeshtra	**Fabaceae**	**H**	**Young shoots** The young shoots are boiled, fried, and eaten with bread. **Mild sweet.**	Improve digestion and induce appetite	Mar-Apr	177	0.80

Mentha arvense L. HUP0003981	Podeena	**Lamiaceae**	**H**	**Young shoots and Leaves** The young shoots are ground and mixed with curd and served. The tea prepared from leaves with the addition of sugar is also a common drink. **Mild bitter**	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	Apr-Jul	200	0.90
Mentha longifolia (L) L. HUP0003982	Welanay	**Lamiaceae**	**H**	**Leaves, young shoots**: The freshly collected leaves are cut into minute pieces and mixed with rice to make a traditional recipe and served with butter. **Mild bitter**	The powdered plant is used to relieve abdominal pain, appetizer and improvement the digestive system	Apr-Jul	205	0.92
Morus alba L. HUP0004602	Spin toot	**Moraceae**	**T**	**Fruit** The fruit after ripening is collected and freshly served. It is also dried and stored. **Sweet**	The fruit is used to treat constipation and improvement of digestive system	Apr-May	205	0.92
Morus nigra L. HUP0004621	Tor toot	**Moraceae**	**T**	**Fruit** The fruit after ripening/getting black is collected and freshly served. **Sweet.**	The fruit is used to treat constipation and improvement of digestive system, removal of sputum, irritation of throat and to treat cough	Apr-May	200	0.90
Nasturtium officinale R. Br. HUP0004650	Talmera	**Brassicaceae**	**H**	**Young shoots and Leaves** The young shoots are cut into pieces, fried after boiling and served with bread. **Mild bitter**	Regulation of metabolic activities, gastro-intestinal system, hepatitis	Mar-Apr	190	0.86
Olea ferruginea Royle HUP0004610	Khoona	**Oliaceae**	**T**	**Fruit** The black and ripened fruit is collected and freshly eaten. **Mild bitter**	Hypertension, diabetes, cholesterol regulator, laxative, analgesic, healing of wounds, emollient	Sep-Oct	139	0.63
Opuntia monacantha (Willd.) Ham. HUP0004646	Zuqam	**Cactaceae**	**S**	**Fruit**: The purple-colored fruit is collected carefully and eaten. **Sour**	The stem is used to treat wounds, burns, and improve respiration	Sep-Oct	29	0.13

Pinus roxburghii Sargent. HUP0004501	Nakhtar	**Pinaceae**	**T**	**Seeds** The seeds are collected from the female cones after maturation and eaten as a cheap alternative for the seeds of *Pinus gerardiana* (Chalghoza). **Mild sweet**	Hepatitis C, removal of stones from kidney and urinary bladder, acnes on skin	Dec-Jan	70	0.32
Pinus wallichiana A. B. Jackson HUP0004511	Pewuch	**Pinaceae**	**T**	**Seeds** The seeds are collected from the female cones after maturation and eaten as a cheap alternative to the seeds of *Pinus gerardiana* (Chalghoza). **Mild sweet**	Anti-allergic, facial acnes	Dec-Jan	51	0.23
Plantago lanceolata L. HUP0004502	Jabai	**Plantaginaceae**	**H**	**Leaves** The young leaves are cut into pieces, boiled to get soft, fried, and served with bread. **Mild bitter**	Cough, fever, constipation, and healing of wounds	Mar-Apr	77	0.35
Portulacca oleracea L. HUP0004599	Warkharay	**Portulacaceae**	**H**	**Young shoots and Leaves** Cut into pieces, boiled, mixed with curd, and served with bread. **Mild sour.**	Used to treat fever, inflammation and respiratory problems	Jul-Aug	180	0.81
Prunus cerasiodes D.Don HUP0004516	Annang	**Rosaceae**	**T**	**Fruit** The fruit is collected on ripening and used freshly.**Mild bitter**	Fruit is used to treat cough, fever, and digestive problems	May-Jun	50	0.23
Prunus persica (L.) Batsch. HUP0004555	Shaltalu	**Rosaceae**	**T**	**Fruit** The fruit is eaten after ripening and freshly eaten. **Mild sour**	The fruit is Purgative used to treat constipation	Jul-Aug	115	0.52
Punica granatum L. HUP0004615	Nanguray	**Punicaceae**	**S**	**Seeds** The fruit is collected after ripening and eaten freshly**. Mild sour**	Cough and fever, febrifuge, heart problems, ophthalmic, anti-diarrheal, abnormal menses, infection in the urinary tract	Jul-Aug	130	0.59
Pyrus pashia Buch. Ham ex D.Don HUP0004575	Tora Tangai	**Rosaceae**	**T**	**Fruit** The fruit is stored after collection to get ripened/turned black inside and eaten. **Sweet**	Used to treat cough, fever and digestive problems	Oct-Nov	73	0.33

Pyrus pseudopashia T.T.Yu HUP0004465	Tora Tangai	**Rosaceae**	**T**	**Fruit** The fruit is stored after collection to get ripened/turned black inside and eaten. **Sweet**	Used to treat cough, fever and digestive problems	Oct-Nov	69	0.31
Quercus dilatata Royle. HUP0004537	Banj	**Fagaceae**	**T**	**Fruit**: The fruit are collected, dry heated in fire to cook and eaten after removing the seed coat. **Mild bitter**	Astringent, infection in the urinary tract, anti-diarrheal, inflammation of the throat	Nov-Dec	41	0.18
Rosa brunonii Lindl. HUP0004631	Palwarai	**Rosaceae**	**S**	**Flower** The flowers are boiled with the addition of sugar and cooked till thickening to make jams and served with or without bread. **Sweet**	Laxative, purgative, astringent	Mar-Apr	71	0.32
Rosa webbiana Wallich ex Royle HUP0004623	Zangaligulab	**Rosaceae**	**S**	**Flower** The flowers are boiled with the addition of sugar and cooked till thickening to make jams and served with or without bread. **Sweet**	Astringent, purgative	Mar-Apr	51	0.23
Rubus ellipticus Smith HUP0002843	Guraja	**Rosaceae**	**S**	**Fruit** The ripened fruits are served freshly after collection. **Mild sour**	Abdominal discomfort, cough, laxative, astringents	May-Jun	153	0.70
Rubus fruiticus L. HUP0002854	Karwara	**Rosaceae**	**S**	**Fruit** The ripened fruits are served freshly after collection. **Mild sour**	Hepatitis, typhoid, anti-diarrheal	Jul-Aug	179	0.81
Rubuss anctus Schreber HUP0002855	Baganrra	**Rosaceae**	**S**	**Fruit** The ripened fruits are served freshly after collection. **Mild sour**	Cough, abdominal discomfort, astringent and laxative	Jun-Jul	179	0.81
Rumex dentatus L. HUP0004586	Shalkhai	**Polygonaceae**	**H**	**Leaves** The leaves along with other plant parts are served as green leafy vegetable. **Mild sour**	The root is used as an Aphrodisiac	Mar-Jun	189	0.85
Rumex hastatus D.Don HUP0004573	Tarukai	**Polygonaceae**	**S**	**Leaves** Young shoot: The leaves are boiled with other leafy edibles to make a soup and served with or without bread in summer. **Sour**	Astringent, anti-allergic	Mar-Jun	73	0.32

Salvia lanata Roxburgh HUP0004586	Sobanay	**Lamiaceae**	**H**	**Young shoots, Leaves** **The shoots are collected in spring, fried after boiling, and served with bread**	Diuretic, anti-hypertension, emetic, gastrointestinal problems	Mar-Apr	10	0.04
Silene conoidea L. HUP0004549	Beshka	**Caryophyllaceae**	**H**	**Fruit** The fruit is peeled and eaten fresh. **Mild sweet**	Ophthalmic, emollient	Apr-May	33	0.15
Solanum nigrum L. HUP0004613	Kamacho	**Solanaceae**	**H**	**Young shoots, Leaves** The young shoots and leaves are boiled and fried and served with bread while fruit is directly eaten after turning black. **Mild sour**	Blood purifier, hepatitis, carminative, anti-helminthic	Jul-Aug	78	0.35
Solena amplexicaulis (Lam.) Gandhi HUP0004577	Karkundai	**Cucurbitaceae**	**C**	**Fruit** The red-colored ripened fruit is collected and eaten directly. **Sweet**	Purgative to treat constipation and improve gastrointestinal system	Oct-Nov	31	0.14
Stellaria media (L.) Vill. HUP004599	Olalai	**Caryophyllaceae**	**H**	**Young shoots** The young shoots are cut into pieces, boiled to get soft, fried, and eaten with bread. **Mild sweet**	To treat constipation and improve digestive system	Mar-Apr	41	0.18
Taraxacum officinale Weber HUP0004543	Ziargulay	**Asteraceae**	**H**	**Leaves, Flower**: The young leaves are fried after boiling and eaten with bread, while the tea prepared from flowers is served as traditional drink. **Mild bitter**	Laxative, diuretic to treat renal/ kidney's disorders	Mar-Apr	61	0.27
Thymus linearis Benth. HUP0004529	Sperkai	**Lamiaceae**	**H**	**Seeds** The ripened seeds are collected and used as condiments in various spices to enhance the taste. **Mild bitter**	Used to treat abdominal discomfort, and relieve cough	**Aug-Sep**	55	0.25
*Urtica dioca*Linn. HUP0004585	Sezunkay	**Urticaceae**	**H**	**Young shoots**: Young shoots after boiling are fried and served. **Mild bitter**	Used to treat arthritis, and skin problems	Apr-May	61	0.27
Vibernum grandiflorum Wall. Ex DC. HUP0002931	Ghazmewa	**Caprifoliaceae**	**S**	**Fruit** The ripened fruits are directly eaten. **Sweet**	Laxative, appetizer	Jul-Aug	53	0.24

Vicia sativa L. HUP0004607	Pali/ Mardekakh	**Fabaceae**	**H**	**Fruit/Pod**: The pods are boiled with the addition of salt and eaten without bread. **Mild sweet**	Used to improve digestion and induce appetite	Apr-May	59	0.27
Zanthoxylu marmatum DC. HUP0004526	Dambara	**Rutaceae**	**S**	**Fruit** The fruit is mostly used as condiment for making different recipes (Chatni). **Cool**	The fruit is mostly used as a condiment for making different recipes.	Jul-Aug	34	0.15
Ziziphus jojuba HUP0004517	Badra	**Rhamnaceae**	**T**	**Fruit** The fruit is eaten freshly or in dried form. **Sweet**	Laxative to treat constipation	Aug-Sep	149	0.67

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

Life Forms of WEPs

The recorded plant species belong to different life forms. Among them, 29 species (51%) are herbs, followed by shrubs with 14 species (24.13%), trees with 12 species (20.68%) while 2 species (3.14%) for climbers (Fig. 2)

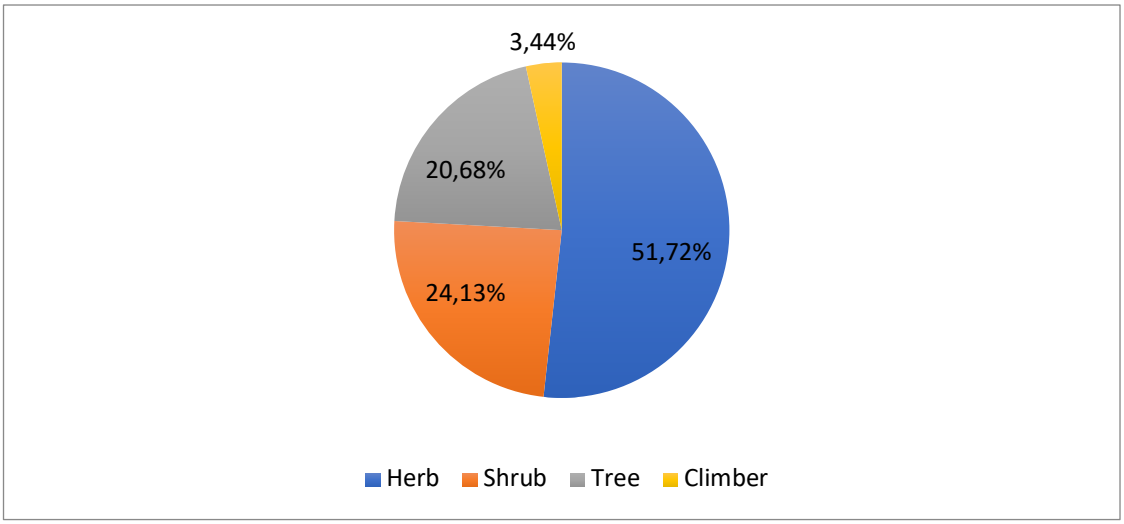


Figure 2. Life forms of the reported edible plants

Mode of utilization of WEPs

The informants reported various recipes prepared after the collection of plant species. These plants or their parts are utilized either freshly or cooked. Out of the total plants, 26 species are commonly used in cooked form, 25 species in uncooked form, while 08 species are used either in cooked or uncooked forms (Table 6).

Table 6. Categorization of WEPs species on the basis of consumption modes

Consumption category	Plant species
Consumed in cooked form	*Amaranthus caudatus*, *Amaranthus spinosus* L., *Amaranthus viridis*, *Caltha alba*, *Cardaria draba*, *Chenopodium album, Cichorium intybus, Diplaziu mesculentum, Dryopteris ramosa, Lamium amplexicaule*, *Malva neglecta*, *Medicago polymorpha, Nasturtium officinale, Plantago lanceolata*, *Rumex dentatus*, *Solanum nigrum*, *Stellaria media*, *Taraxacum officinale*, *Medicago polymorpha, Urtica dioca*
Consumed in un-cooked form	*Berberis lyceum* Royle, *Capsella bursa-pastoris, Celtis causcasica, Cotoneaster nummularia, Diospyrus lotus, Duchesneaindica*, *Eleagnu sumbellata, Ficus palmate, Lathyrus aphaca*, *Mentha arvense,Morus alba* L., *Morus nigra*, *Olea ferruginea, Opuntia monacantha, Pinus roxburghii, Pinus wallichiana, Prunus cerasiodes, Prunus persica, Punica granatum* L., *Pyrus pashia* Buch., Pyrus pseudopashia, *Rosa webbiana* Wallich, *Rumex hastatus, Rubus ellipticus* Smith, *Rubus fruiticus, Silene conoidea* L., *Solena amplexicaulis, Zanthoxylum armatum*, *Ziziphus jujuba*
Cooked/ uncooked	*Allium griffithianum*Boiss. *Allium humile, Mentha arvense, Mentha longifolia, Rumex hastatus , Capsella bursa-pastoris, Lathyrus aphaca*, *Vicia sativa*,

The plant species having high frequency of citation were preferably documented. Among them some species like *Allium griffithianum*, *Allium humile*, *Amaranthus caudatus, Amaranthus spinosus, Amaranthus viridis, Berberis lyceum, Caltha alba, Cichorium intybus, Diospyrus lotus, Eleagnus umbellate, Ficus palmate, Malva neglecta, Mentha arvense, Mentha longifolia, Morus alba* and *M. nigra, Nasturtium officinale, Portulacca oleracea, Prunus persica, Diplazium esculentum, Dryopteris ramosa, Punica granatum, Rubus ellipticus, Rubus fruticosus, Rubus sanctus, Rumex dentatus* and *Medicago polymorpha* were commonly known while other species like *Asparagus gracilis, Capsella bursa-pastoris, Cardariadraba, Celtiscauscasica, Chenopodium album, Cotoneaster nummularia, Duchesnea indica, Lamium amplexicaule* and *Lathyrus aphaca* were known as edible plants by a limited number of informants (Table 3). Out of the total 60 reported species, 48 species were cited by more than 200 informants while the remaining 10 species were reported as edible only by 20 informants. 23 topmost species were cited by more than 150 informants. This shows their popularity and sustainability for use as food by the local communities.

Due to the nutritional values of WEPs, they are being used in the study area satisfying the food security in unpredictable circumstances. According to their use by local communities, the WEPs are classified into 'wild vegetables''wild fruits' and 'Condiments'.

Edible plants used as vegetables

Some of WEPs are routinely used as vegetable in its growing seasons. They are found in undisturbed areas and sides of the agricultural lands. They may be used in fresh form as well as dried and stored for use when their season is off. The species used as vegetables are *Amaranthus caudatus, A. spinosus, A. viridis, Asparagus gracilis, Caltha alba*, *Capsella bursa-pastoris, Cardaria draba, Chenopodium album, Cichorium intybus, Diplazium esculentum, Dryopteris ramose, Lamium amplexicaule, Malva neglecta, Medicago polymorpha, Nasturtium officinale, Plantago lanceolata, Portulacca oleracea, Solanum nigrum, Stellaria media, Taraxacum officinale* and *Urtica dioca.*

Wild edible plants used as fruit

The wild fruits are playing an important role in satisfying the food security of the inhabitants in the area. The reported species with edible fruits include; *Berberis lyceum, Celtiscaus casica, Cotoneaster nummularia, Diospyrus lotus, Duchesnea indica, Eleagnus umbellate, Ficus palmata, Morus alba, M. nigra, Olea ferruginea, Opuntia monacantha, Prunus cerasiodes, P. persica, Punica granatum, Pyrus pashia, P. pseudopashia, Rubusellipticus, R. fruiticus, R. sanctus, Solena amplexicaulis, Vibernum grandiflorum* and *Ziziphus jojuba.* They are collected on ripening and served freshly or stored till drying. The ripening of fruit is organoleptically tested by production of special smell and sweet taste. The most popular fruits, *D. lotus and Z. jojuba, F. palmata, M. alba and M. nigra* are dried and stored. On drying they become very sweet by enrichment of sugar contents, assisting their storage for quite long period of time (Table 6).

These fruit plants not only serve as food sources but also for several benefits like shade, timber for making household appliances, medicines, and fodder for cattle.

Wild plants used as condiments

Some of the reported edible plant species are exclusively used as condiments to enhance the taste of other foods. The species cited by the informants like *Allium griffithianum, A. humile, Rumex dentatus, R. hastatus, Thymus linearis* and *Zanthoxylum armatum* are used in combination with other edible species to make the food more palatable. The seeds of *Thymus linearis* are used to make spices to enhance the taste of food.

Organoleptic characters of WEPs/ edible parts:

During the study, the reported plant species were organoleptically tested to confirm the properties cited by the local informants. The results are given in (Table 5). Among the tested plants/ parts, 14 species of wild edible parts are described as having mild bitter taste, 33 species with mild sweet and sweet taste while 13 species were reported with mild sour and sour taste. The plants having bitter tastes beside their nutritional values are supposed to be a remedy for Diabetes by the local people. The characteristic nutritional and medicinal values of plant species have always aided in the sustenance and protection of the traditional knowledge.

Wild edible plants (WEPs) used for treating various diseases

The indigenous population has great traditional information of primary healthcare needs. During the current study, 40 various disorders were reported which were treated by using 60 wild edible plants. The most common disorders in the research area were indigestion for which 25 species were used, followed by constipation (23spp.), malaria (11 spp.), cough (10spp.), Hepatitis (9 spp.), appetizer and urinary disorders (7 spp. each), Itchy skin (6 spp.), blood purifier and diarrhea (5 spp. each)(Fig 3).

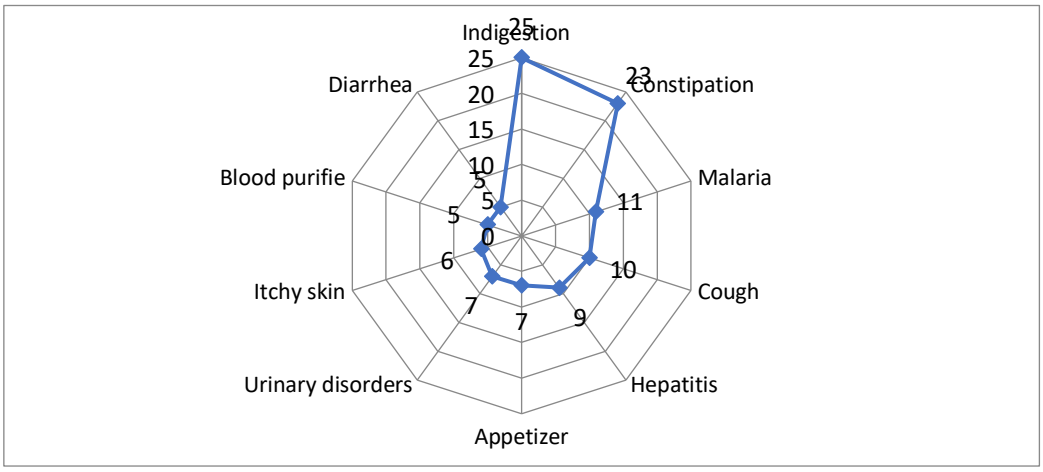
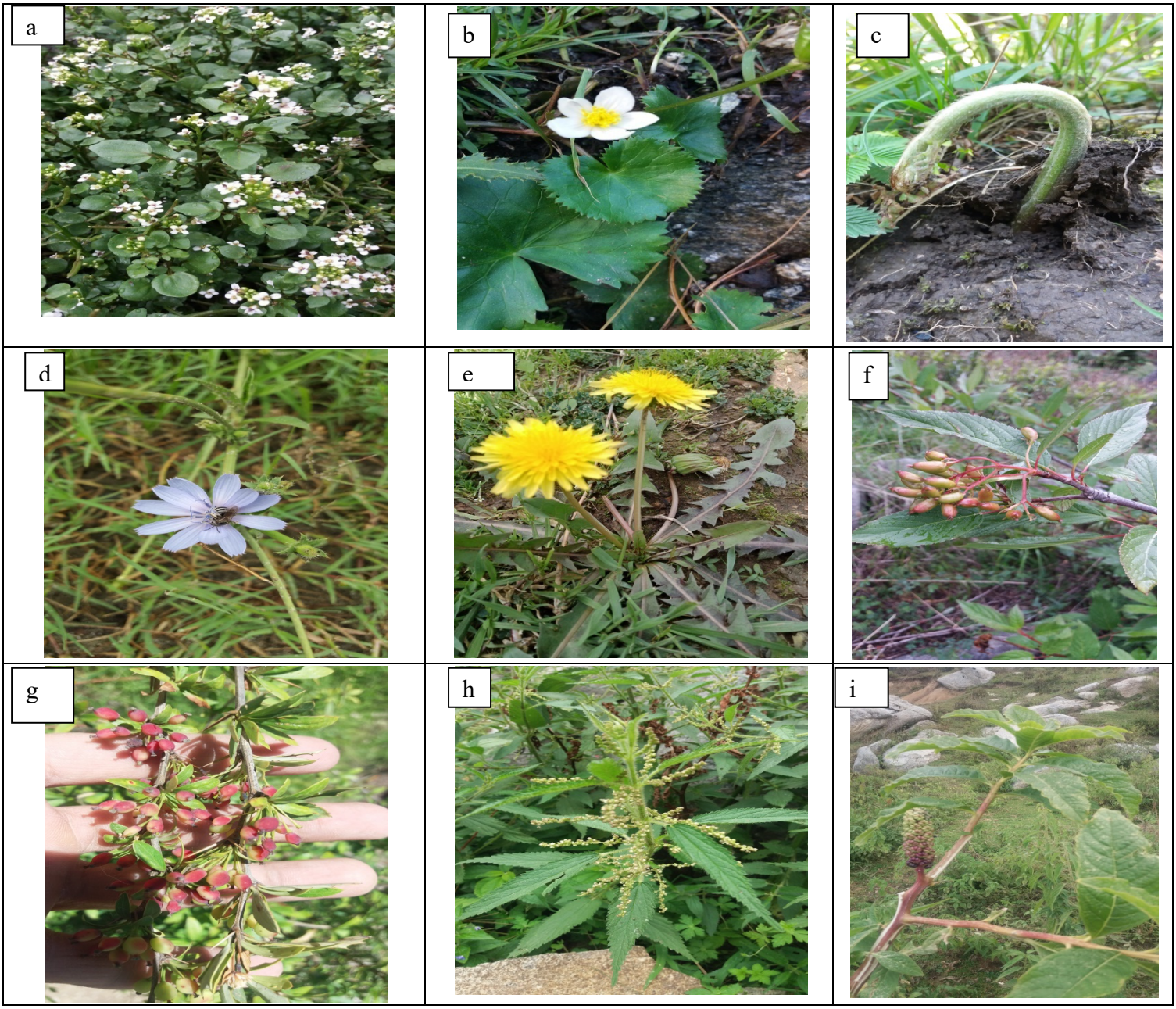


Figure 3. The number of plants used for the treatment of the top10 disorders.



a. *Nasturtium officinalis* R. Br. b. *Caltha alba* Jaquem ex Cambess c. *Diplazium esculentum*L. d. *Cichorium intybus* Linn. e. *Taraxacum officinale* F. H. Wigg. f. *Vibernum grandiflorum* Wall. ex DC. g. *Berberis callibotrys* Wender h. *Urtica dioica* Linn. i. *Phytolacca acinosa* Roxb.

Discussion

During interviewing the local communities, a special attraction of people towards the wild plants was observed. A large proportion of the locality is dependent on WEPs as a primary source of food easily available nearby. The traditional use of the plant species is attributed to food shortage, nutritional values, and local cultural traditions. They used to collect the plant species in their appropriate seasons and times. The local people use the WEPs either as vegetables, fruits, and condiments.

WEPs as Vegetables

After analyzing the data, the plants/ products being used as vegetables are the dominating use category of WEPs in the area with 30 different species. Similar findings have also been reported by other researchers in this regard. For instance, 25 wild plants used as vegetables were reported from North-West Pakistan by Ahmad *et al.* (2019). Another study from Harnai, Balochistan reported 59 vegetable plant species (Tareen *et al.* 2016). From Kurram district, Abbas *et al.* reported 53 wild plants used as vegetables. In the same way, 45 wild vegetables were reported by Abbasi et al., from the Lesser Himalaya of

Pakistan. From Yasin and Ishkoman valleys, Aziz *et al.* (2018) reported 21 wild plant species used as vegetables. The use of plants and their products for food and various herbal therapies are deeply linked with the traditions and cultures of the region (Ahmad 2007; Shinwari & Gillani 2003).

WEPs as Fruits

The second dominant use category of WEPs was found to be fruit with 24 plant species. These fruits are used either in fresh or dried forms. Similar reports have also been published by various researchers. In this regard, Ahmad and Pieroni reported 31 wild plant species used as fruits from Takh-e-Suliman, North-West Pakistan (Ahmad & Pieroni 2016). As quoted above Abbasi *et al* (2013) recorded 35 WEPs used as fruit by the tribal communities of lesser Himalayas. Swat Valley exhibits quite similar climatic conditions as compared to the Lesser Himalayas, especially during the moon soon season. Both regions receive heavy rainfall which is responsible for the diversity of plant species. On the other hand, due to harsh and dry climatic conditions, only 11 wild fruit plants were reported from Dera Ismail Khan by Perez-Negron and Casas (2007).

WEPs as Condiments

During the study, some uses of WEPs other than vegetables and fruits were also observed. Some of them were documented for their use to enhance the taste of various spices like *Thymus linearis*, *Mentha arvense, M. longofolia.* These plants are traditionally used in various spices, sauces, and salads as appetite stimulants. Abbas *et al* (2020) also reported *Mentha arvense* as a common constituent used as salad from district Kurram. Different researchers also reported quite similar findings from various localities. *Thymus linearis* was reported for its use in making herbal tea by Aziz *et al* (2018) from Gilgit-Baltistan. Abdullah *et al* (2021) reported its use as a spice. We found its uses both as a spice and to make herbal tea which is also used as medicine. Some plants are used in combination with others to make special types of sauces. For instance, the fruit of *Zanthoxylum armatum* is crushed in combination with green leaves of *Corriandrum sativum* and *Tamarindus indica* to make a sauce. After comparing the use of plants reported from various localities, certain similarities and differences are observed. The variation in the use of WEPs from area to area may be due to differences in cultures, traditions, and ethnography.

WEPs as drinks

Along with other uses, we documented *Thymus linearis* and *Mentha arvense* for their use in making traditional tea which is a common drink in the area. Aziz *et al*. (2018) also reported *Thymus linearis* for preparing traditional drinks from Ishkoman Valley Gilgit –Baltistan. This tea is not only taken as a drink but also as medicine, especially during whooping cough and abdominal discomfort. Besides the use of WEPs as food, they are also a cheap and effective source of medicine against different ailments (Pieroni & Quave 2006).

Wild edible plants (WEPs) used for treating various diseases

According to the finding of the current study, Indigenous people in the region rely on plant species for usage as medications to treat 40 various diseases. In the present study, we have documented 60 plant species belonging to 31 families. Rehman et al. (2023b) documented 56 plant species belonging to 32 families for treating 24 various respiratory disorders from North Waziristan, Pakistan. Durgapal & Kumar (2024) documented 10 plant species from sacred groves of Kumaon Himalaya. Durgapal et al. (2024) documented 70 plant species belonging to 41 families for treating 19 aliments from selected sacred groves of the Almora District (Western Himalayas), Uttarakhand, India. Ali et al. (2023) documented 100 plant species related to 50 plant families from Tehsil Lahor, District Swabi, Khyber Pakhtunkhwa, Pakistan. Irfan et al. (2018) documented 50 plant species belonging to 34 plant families from tehsil Laalqilla, district Lower Dir, Khyber Pakhtunkhwa, Pakistan. The most prevalent disorders in the research area were indigestion and constipation. Because of poverty, high price of allopathic medicine, and lack of modern health facilities, aboriginal people primarily depend on wild edible plants to treat their health issues. A similar finding was reported by Aziz et al. (2018b), Chaachouay et al.(2019) and; Dastagir et al.(2022)

Conclusion

The current study conducted in Sakhra Valley is the first attempt to document the wild edible plants (WEPs) traditionally used in the area. Due to low economic status, the local inhabitants still collect these plants for their food as well as for generating revenue through selling them in the market. In this regard, 19 plant species were reported as having market values. These plant species are recognized by almost all people in the area. The uses of some plant species like *Cardaria draba, Lamium amplexicaule*, *Rosa brunonii, Rosa webbiana, Salvia spps,* and *Stellaria media* for food are novel for gastronomy. For better understanding, the organoleptic character like the "Taste" of the WEPs was included in the findings. The current study will be proven as a valuable attempt to address the uses of locally available plant resources and will pave

the way for further research in this respect. Although a special attachment of the local communities to the WEPs still exists due to a lack of proper documentation, the traditional knowledge is continuously eliminated from the area. It was also observed that the new generations have the least concerns about this cultural heritage. The area has recently gained tremendous popularity for recreation and tourism which besides its beneficial aspects, has created conservation issues due to human disturbances and over-exploitation. To overcome this problem, the natural habitats of WEPs should be maintained and encroachments of the natural land scapes should be minimized. Properly reported voucher specimens enhance the scientific rigor of botanical studies by providing a reliable reference that ensures reproducibility and supports future taxonomic, ecological, and conservation-related research work. The availability of these specimens ensures transparency and verifiability, making the research more valuable to the broader scientific community.

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.

Funding: The authors have not received any funding for conducting the research.

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 GMS contributed in species identification and preparation of herbarium specimens; SR and FW helped in Writing–review and editing; NA, FA and WH contributed in plants collection and preparation of voucher specimens.

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Literature Cited

Abbas W, Hussain W, Hussain W, Badshah L, Hussain K, Pieroni A. 2020. Traditional wild vegetables gathered by four religious groups in Kurram District, Khyber Pakhtunkhwa, North- West Pakistan. Genetic Resources Crop Evolution 67:152-1536.1

Abbasi AM, Khan MA, Khan N, Shah MH. 2013. Ethnobotanical survey of medicinally important wild edible fruit species used by tribal communities of lesser Himalaya- Pakistan. Journal of Ethnopharmacology 148:528-536.

Abbasi AM, Khan SM, Ahmad M, Khan MA,Quave CL,Pieroni A. 2013.Botanical ethno-veternary in three districts of the Lesser Himalayas of Pakistan. Journal of Ethnobiology Ethnomedicine 9-21.

Abbasi AM, Shah MH, Khan MA. 2015. Wild Edible Vegetables of Lesser Himalayas; Springer: Cham, Switzerland.

Abdullah A, Andrabi SA. 2021. Wild edible plants and fungi used by locals in the Kupwara district of Jammu and Kashmir, India. Pleione 15(2):179-189.

Abdullah A, Khan SM,Pieroni A,Haq A,Haq ZU, Ahmad Z,Sakhi S, Hashim A, Al- Arjani ABF, Alqarawi AA et al. 2021. A Comprehensive Appraisal of Wild Food Plants and Food System of Tribal Cultures in the Hindu Kush Mountain Range; a Way Forward for Balancing Human Nutrition and Food Security. Sustainability 13:5258.

Ahmad F. 2007. Geo-informatics application to investigate agricultural potential in Cholistan desert. Journal of Food Agriculture and Environment 5:310-314.

Ahmad H, Ahmad R. 2004.Agro ecology and biodiversity of the catchment area of Swat river. Nucleus 40 (1-4):67-75.

Ahmad K, Pieroni A. 2016. Folk knowledge of wild food plants among the tribal communities of Takht-e-Suliman Hills, North-West Pakistan. Journal of Ethnobiology Ethnomedicine 12:17.

Ahmad K. Weckerle C.S. Nazir A. 2019. Ethnobotanical investigation of wild vegetables used among local communities in the North-West Pakistan. Acta Societatis Botanicorum Poloniae 88:88.

Al-Fatimi M. 2019. Ethnobotanical survey of medicinal plants in central Abyangevernorate Yemen. Journal of Ethnopharmacology 241:111973.

Al-Fatimi M. 2021. Wild edible plant traditionally collected and used in southern Yemen. Journal of Ethnobiology and Ethnomedicine 17:49.

Ali F, Khan N, Ali K, Imran K. 2017. Influence of environmental variables on the distribution of woody species in Muslim graveyards of Malakand Division, Hindukush Range Mountains of Pakistan. Pakistan Journal of Botany 49(6): 2357-2366.

Ali A, Jan G, Irfan M, Jan FG, Ullah F. 2023. Quantitative Ethnomedicinal study of the Flora of Tehsil Lahor, District Swabi, Khyber Pakhtunkhwa, Pakistan. Ethnobotany Research and Applications 25:1-21. doi:10.32859/era.25.64.1-21.

Aziz MA, Abbasi AM, Ullah Z,Pieroni A. 2020. Shared but threatened: The heritage of wild food plants gathering among different linguistics and religious groups in the Ishkoman and Yasin valleys, North Pakistan. Food 9:601.

Aziz MA, Khan AH, Adnan M, Ullah H. 2018a. Traditional uses of medicinal plants used by indigenous communities for veterinary practices in Bajur Agency, Pakistan. Journal of Ethnobiology Ethnomedicine 14:11.

Aziz MA, Adnan M, Khan AM, Shahat AA, Said MSA, Ullah R. 2018b.Traditional uses of medicinal plants practiced by the indigenous communities at Mohmand Agency, FATA, Pakistan. Journal of Ethnobiology and Ethnomedicine 14:1-16

Bhatia H, Sharma YP, Manhas RK, Kumar K. 2018. Traditionally used wild edible plants of district Udhampur, J&K, India. Journal of Ethnobiology and Ethnomedicine 14(1):1-13.

Bhattarai S, Chaudhary RP, Taylor RS. 2009. Wild edible plants used by the people of Manang district, central Nepal. Ecology of Food and Nutrition 48(1):1-20.

Biswas SC, Majumdar M, Das S, Misra TK. 2018. Diversity of wild edible minor fruits used by the ethnic communities of Tripura, India. Indian Journal of Traditional Knowledge 17(2):282-289.

Cao Y, Li R, Zhou S, Song L, Quan R, Hu H. 2020. Ethnobotanical study on wild edible plants used by three transboundary ethnic groups in Jiangcheng County, Pu'er, Southwest China. Journal of Ethnobiology and Ethnomedicine 16:66.

Cornara L, La rocca A,Marsili S,Mariotti M. 2009. Traditional uses of plants in the Eastern Riviera (Liguria, Italy). Journal of Ethnopharmacology 125:16-30.

Chaachouay N, Benkhnigue O, Fadli M, Ibaoui HE, Zidane L. 2019. Ethnobotanical and ethnopharmacological studies of medicinal and aromatic plants used in the treatment of metabolic diseases in the Moroccan Rif. Heliyon 5(10).

Das P. 2013. Wild Edible Plants of Tripura Tribes. Tribal Research and Cultural Institute, Govt. of India, Agartala, Tripura, India, pp. 146.

Dastagir G, Jan SA, Uza NU, Ahmad I, Bussmann RW. 2022. Traditional knowledge and diversity of medicinal plants in Hindukush range, Tehsil Mastuj, Chitral, Pakistan: An ethnobotany survey. Ethnobotany Research and Applications 24:1-9

Duguma HT. 2020. Wild edible plant nutritional contribution and consumer perception in Ethiopia. International Journal of Food Science 1-16. doi:10.1155/2020/2958623.

Durgapal M, and Kumar M. 2024. A case study on usage patterns of wild edible plants in sacred groves of Kumaon Himalaya. African Journal of Biological Science 6(13: 6780-6797.

Durgapal M, Kumar M, and Arya AK. 2024. Traditional indigenous values of ethnobotanical plants preserved in selected sacred groves of the Almora District (Western Himalayas), Uttarakhand, India. Ethnobotany Research and Applications, 27(48):1-16.

Fils PE, Nana NA, Betti JL, Njimbam OF, Womeni ST, Martin EÁ, Brull GR, Okale R, Fa JE, Funk SM. 2020. Ethnobotanical survey of wild edible plants used by Baka people in Southeastern Cameroon. Journal of Ethnobiology and Ethnomedicine 16(1):1-5.

Garcia-Herrera P, Morales P, Camara M, Fernandez-Ruiz V, Tardio J, Sanchez-Mata MC. 2020. Nutritional and phytochemical composition of Mediterranean wild vegetables after culinary treatment. Foods 9(12):1761. doi: 10.3390/foods9121761.

Golait S, Auti S, Laware S. 2021. Documentation of wild edible leafy vegetable traditionally used by tribal and rural communities of North Maharashtra, India. Plantae Scientia 4(3):148-159.

Irfan M, Khan I, Ali A, Khan R, Ali A, Jan G. 2018. Ethnomedicinal uses of the plants of tehsil Laalqilla, district Lower Dir, Khyber Pakhtunkhwa, Pakistan. Journal of Applied Environmental & Biological Sciences 8(6):61-66.

Ju Y,Zhuo J, Liu B, Long CJ. 2013. Eating from the wild: Diversity of wild edible plants used by Tibetans in Shangrila region, Yunnan, China. Journal of Ethnobiology Ethnomedicine 9:28.

Khadim S, Malik K, Qureshi R, Rehman S. (2023). Ethnogynecological study of traditional therapeutic plants used by the indigenous communities: A case study from District Gujrat Punjab, Pakistan. Ethnobotany Research and Applications 26:1-23.

Khan N, Ali F, Ali K, Shaukat S. 2015. Composition, structure and regeneration dynamics of *Olea ferruginea* Royle forests from Hindukush Range of Pakistan. Journal of Mountain Science 12(3) 647-568.

Kidane L, Kejela A. 2021. Food security and environment conservation through sustainable use of wild and semi-wild edible plants: a case study in Berek Natural Forest, Oromia Special Zone, Ethiopia. Agriculture & Food Security 10(1):1-6.

Mallick SN, Sahoo T, Naik SK, Panda PC. 2020. Ethnobotanical study of wild edible food plants used by the tribal and rural populations of Odisha, India for food and livelihood security. Plant Archives 20(1):661-669.

Menendez-Baceta B,Aceituno- Mata L,Tardio J, Reyes-Garcia V, Pardo-de-Santayana M. 2012. Wild edible plants traditionally gathered in Gorbeialdea (Biscay, Basque Country). Genetic Resources and Crop Evolution 59,:1329-1347.

Meve U, Liede S. 2002. A molecular phylogeny and genetic re-arrangement of the stapelioid Ceropegieae (Apocynaceae-Asclepiadoideae). Plant System Evolution 234:171-209.

Murtem G, Chaudhry P. 2016. An ethnobotanical note on wild edible plants of Upper Eastern Himalaya, India. Brazilian Journal of Biological Sciences 3(5):63-81.

Paul AK, Alam MJ, Alam AH. 2020. Assessment of wild edible fruits consumed through the tribal people of Chittagong Hill Tracts (CHTs), Bangladesh. Indian Journal of Traditional Knowledge 19(3):598-603.

Pei SJ, Sajise P. 1995. Regional study on biodiversity: concepts, frameworks and methods. Yunnan University Press, China.

Perez-Negron E, Casas A. 2007. Use, extraction rates and spatial availability of plant resources in the Tehuacan-Cuicatlan Valley Mexico: The case of Santiago Quiotepec, Oaxaca. Journal of Arid Environment 70:356-379.

Pieroni A,Soukand R, Amin HIM,Zahir H,Kukk T. 2018. Celebrating multi-religious co-existence in Central Kurdistan: The bio-culturally diverse traditional gathering of wild vegetables among Yazidis, Assyrians and Muslim Kurds. Human Ecology 46:217-227.

Prabakaran R, Kumar TS, Rao MV. 2013. Role of non-timber forest products in the livelihood of Malayali tribe of Chitteri hills of Southern Eastern Ghats, Tamil Nadu, India. Journal of Applied Pharmaceutical Science 3(5):56.

Punchay K,Inta A,Tiansawat P,Balslev H,Wangpakapattanawong P. 2020. Traditional knowledge of wild food plants of Thai Karen and Lawa (Thailand). Genetic Resources and Crop Evolution 67:1277-1299.

Rehman S, Iqbal Z, Qureshi R, Rahman IU, Sakhi S, Khan I, Ijaz F. 2022a. Ethnoveterinary practices of Medicinal Plants among Tribes of Tribal district North Waziristan, Khyber Pakhtunkhwa, Pakistan. Frontiers in Veterinary Science 9:815294.

Rehman S, Iqbal Z, Qureshi R, Rahman I-U, Khan MA, Elshaer M, Abu-Bakr-Elsaid NM. 2022b. Ethnogynaecological Knowledge of Traditional Medicinal Plants Used by the Indigenous Communities of North Waziristan, Pakistan. Evidence Based Complementary and Alternative Medicine, 2022:6528264. doi:10.1155/2022/6528264.

Rehman S, Iqbal Z, Qureshi R, Rahman IU, Ijaz F, Khan MA, Alzahrani Y. 2022c. Ethnic practices in treating skin diseases: The traditional dermatologist's role. Clinics in Dermatology. doi:10.1016/j.clindermatol.2022.09.005.

Rehman S, Iqbal Z, Qureshi R, Shah G. M. 2023a. Quantitative ethnobotanical study of medicinal plants used by the indigenous communities of Shawal Valley, District North Waziristan, Pakistan. Ethnobotany Research and Applications 25:1-24.

Rehman S, Iqbal Z, Qureshi R, Shah GM, Irfan M. 2023b. Ethnomedicinal plants usesforthe treatment ofrespiratory disorders in tribal District North Waziristan, Khyber Pakhtunkhawa, Pakistan. Ethnobotany Research and Applications 25:1-16.

Rehman S, Iqbal Z, Qureshi R, AlOmar TS, Almasoud N, Younas M, Irfan M. 2023c. Ethno-Dentistry of Medicinal Plants Used in North Waziristan, Pakistan. International Dental Journal S0020-6539.

Rehman S, Iqbal Z, Qureshi R. 2023d. Ethnomedicinal plants uses for the treatment of gastrointestinal disorders in Tribal District North Waziristan, Khyber Pakhtunkhawa, Pakistan. Ethnobotany Research and Applications 26:1-22.

Rehman S, Iqbal Z, Qureshi R, Younas M. 2023e. Ethnomedicinal study of medicinal plants used by the inhabitants of tribal District North Waziristan, Khyber Pakhtunkhwa, Pakistan. Ethnobotany Research and Applications 26:1-32.

Rehman S, Iqbal Z, Qureshi R, Shah G M, Afzal A, Rahman KU, Shah, SSH. (2024). Quantitative ethnomedicinal survey of wild edible fruits used by the indigenous community in North Waziristan, Khyber Pakhtunkhwa, Pakistan. Ethnobotany Research and Applications 28:1-20

Sachan SK, Patra JK, Thatoi HN. 2013. Indigenous knowledge of ethnic tribes for utilization of wild mushrooms as food and medicine in Similipal Biosphere Reserve, Odisha, Indian Journal of Agriculture and Technology 9(2):403-416.

Sanchez-Bel P, Romojaro A, Egea I, Pretel MT. 2015. Wild edible plants as potential antioxidants or nutritional supplements for beverages minimally processed. LWT-Food Science and Technolgy 62:830-837.

Shad M, Nawaz H, Rehman T, Ikram N. 2013. Determination of some biochemical, phytochemicals and antioxidant properties of different parts of *Cichoriumintybus* L.: A comparative study. Journal of Animal and Plants Sciences 23:1060-1066.

Shah, SHA, Shah, GM, Ali, N, Alam, J, Rehman, S, Alia, A, Basit, A. (2024). Ethnomedicinal survey of medicinal plants traditionally used in Sakhra Valley district Swat, Pakistan. Ethnobotany Research and Applications 29:1-28.

Shaheen S, Ahmad M, Haroon N. 2017. Edible Wild Plants: A solution to overcome food insecurity. In: Edible Wild Plants: An alternative approach to food security. Springer, Cham. doi: 10.1007/978-3-319-63037-3_2.

Sher H, Muhammad A, Hazrat S. 2010. Forest resource utilization assessment for economic development of rural community in northern parts of Pakistan. Journal of Medicinal and Plants Research 17:1786-1789.

Shin T, Fujikawa K, Moe AZ, Uchiyama H. 2018. Traditional knowledge of wild edible plants with special emphasis on medicinal uses in Southern Shan State, Myanmar. Journal of Ethnobiology and Ethnomedicine 14:48.

Shinwari ZK, Gillani SS. 2003. Sustainable harvest of medicinal plants at Bulashbar Nullah, Astore (Northern-Pakistan). Journal of Ethnopharmacology 84: 289-98.

Singh B, Sultan P, Hassan QP, Gairola S, Bedi YS. 2016. Ethnobotany, traditional knowledge, and diversity of wild edible plants and fungi: a case study in the Bandipora district of Kashmir Himalaya, India. Journal of Herbs, Spices & Medicinal Plants 22(3):247-278.

Singh K, Kumar P, Kumar B, Sharma YP, Gairola S. 2021. The wild edible plants of Paddar valley, Jammu division, Jammu and Kashmir, India. Ethnobotany Research and Applications 22:1-21.

Sleet, P. 2019. Food security in Pakistan: Surplus Food is not Enough to Create a Food Secure Country. F.D.I. Islamabad.

Sunderland, T.C.H. 2011. Food security: Why is biodiversity important? International Forest Review 13:265-274.

Tareen NM, Saeed-ur-Rehman MA,Shinwari ZK, Bibi T. 2016. Ethnobotanical utilization of wild edible vegetables in district Harnai of Balochistan Province- Pakistan. Pakistan Journal of Botany 48:1159-1171.

Thakur D, Sharma A,Uniyal SK. 2017. Why they eat, what they eat: Patterns of wild edible plants consumption in a tribal area of Western Himalaya. Journal of Ethnobiology Ethnomedicine. 13, 70.

Vitalini S,Iriti M,Puricelli C,Ciuchi D,Segale A, Fico G. 2013. Traditional knowledge on medicinal and food plants used in Val San Giacomo (Sondrio, Italy) – An alpine ethnobotanical study. Journal of Ethnopharmacology 145:517-529.

Yousafzai SA, Khan N, Wahab M, Ajaib M. 2010. Ethnomedicinal study of Marghazar valley, Pakistan. International Journal of Biolology and Biotechnology 7:409-416.