

Ethnobotanical study of Wild Edible Plants (WEPs) traditionally used in Sakhra Valley, District Swat

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ABSTRACT

The rural communities of Sakhra valley, District Swat are frequently using the locally available wild edible plants (WEPs) for food. Documentation of the traditional knowledge in this respect is carried out for the first time in area. The research study was conducted in 2021-22 in order to document the wild plants used as food by local indigenous peoples in different villages/localities of the area. The data was collected by oral face-to-face interviews after designing a pre-set data capturing questionnaire. For this purpose, total of 222 local informants were interviewed and the Use Reports (UR) and Relative Frequency of Citation (RFC) for each plant species was calculated. During the study, total of 60 plant species belonging to 31 families and 46 genera were reported as wild edible plants (WEPs) traditionally used by the people 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. As for as the life form of plants is concerned, herbs were reported as the most widely used form with 29 species (48.33%), followed by shrubs with 14 species (23.33%), trees 12 species (20.00%) and climbers with 2 species (3.33%). Among the edible plant parts, fruit was reported as 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 plant used as a whole with 4 species each (6.66%), flower with 2 species (3.33%) while bulb and corm with 1 species each (1.66%). Out of the total reported plant species, most of them 34 species (56.66%) are consumed uncooked, 26 species (43.3%) are cooked before consumption. Based on the availability of plants, 26 wild edible plant species are available and collected in summer season (May-August), 21 species in spring- early summer season (April-May) while 12 species in autumn season (September-November). The results show a deep and strong relationship

of the local communities with wild edible plants (WEPs) species which is a potential source insuring the food security. A large proportion of the locality is dependent on WEPs as a primary source of food easily available nearby. The traditional use of these plant species is attributed to food shortage, nutritional values and local cultural traditions. The documentation of the traditional knowledge of WEPs will be of great importance in preserving the traditional heritage from loss due to least concerns from the new generation.

Keywords: Wild edible plant, Ethnobotany, Traditional knowledge

1. INTRODUCTION

Wild Edible plants (WEPs) have been used as an ancient source of food for human being since the emergence of civilization and this resource is still used traditionally beside the emergence of advance agriculture [0]. These non-cultivated plants species are collected by local communities from the surrounding environment and utilized in various food recipes [22]. The WEPs not only provide healthy food but also act as medicines against various diseases [28, 29]. The local people possess plenty of traditional knowledge about the wild edible plants and use to transmit it orally from generation to generation. The relationship between human communities and use of plants has been considered as an ecological balance system since ancient times to preserve this resource. 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 [21]. The developed countries of Europe consider wild edible plant (WEP) as an iconic factor of ecosystem [34]. Numbers of ethnobotanical researches have proven the importance of wild edible plants for the local communities especially in emergency situations like war, famine and drought throughout the world [2, 8]. Along with the practice of modern agricultural techniques, the local communities also have dependence on the wild edible plants (WEPs) up to a great extent. These wild plants are satisfying the food security issues by providing alternative and diverse food sources to the traditional communities of the area [4]. Beside the importance of plants as edible, their pharmacological properties have also been proven by many researches throughout the world [51, 31, 41]. Due to the existence of many bioactive compounds like fatty acids, complex sugars, vitamins and proteins [30, 20], the WEPs can be used to cope with the malnutrition problems [50]. The phytochemical constituents of many plants have been investigated before on the basis of

medicinal and nutritional aspects [33]. The constituents of plants are categorized into primary and secondary metabolites. The primary metabolites generally include carbohydrates, proteins, fats and minerals while alkaloids, terpenoids, flavonoids and phenols etcetera used for various purposes are included in secondary metabolites. The wild plants are comparatively richer source of nutrients and drugs than the cultivated species to improve the human health. It is the need of time to make further efforts to document, integrate and compile the indigenous knowledge about Plant's utilization practices [26]. The ethnobotanical culture can be conserved appropriately if its importance is addressed and understood properly among the local communities.

Pakistan stands 6th position in the populous most countries in the world with very low income [46]. Being a poor country, the alternate food sources looks more vital for the people. It is estimated that about 60% of the country's population is food insecure [46]. In spite of the availability of four seasons and wide diversity of natural resources, Pakistan ranks 11th most food insecure country worldwide [47]. The problem of food insecurity increases due to overpopulation, poverty, least access to food resources and local livelihood strategies [35]. The wild edible plants (WEPs) can be used as alternative food resource for local communities to compete with the issues of hunger and malnutrition if managed properly [7].

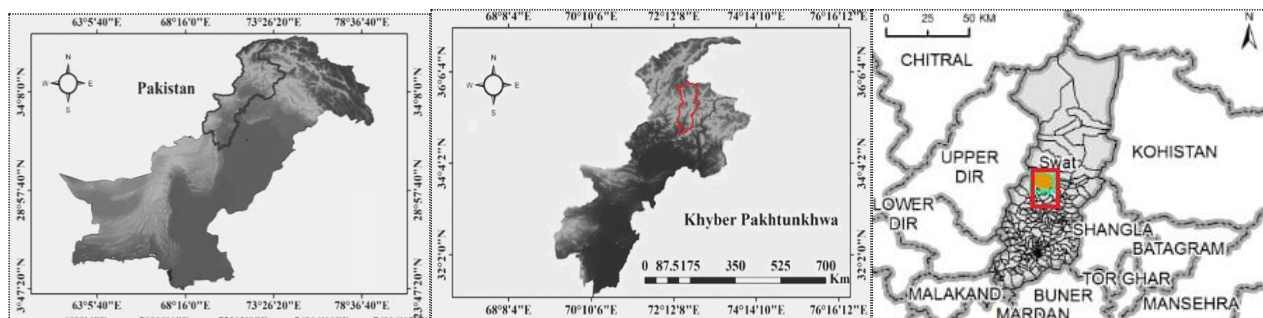
In Pakistan, insufficient studies have been conducted in order to document the locally used wild edible plants [1, 49] while the area under study in this paper has never been reported before. So it is worthy to document the edible species and their method of preparation from the said area. A research study was conducted in March-2020 to October-2021 to document the traditional uses of wild edible plants. The local people of the study area were interviewed in different seasons throughout the year in order to document the wild edible plants of the area. The current study reports the wild edible plants for the first time in Sakhra valley district Swat, Pakistan (Fig. 01).

METHODOLOGY

2.1 Study area

The study area is located in the Khyber Pakhtunkhwa province, North-West region of Pakistan at about 60 kilometers from the district headquarter Saidu Sharif Swat (Fig.1 a,b). Sakhra valley lies in the complex Hindu-kush mountain range showing varied topographical conditions [40] with altitude ranges from 1449 to 3920m above mean sea level (Table 01). Due to the varied geographical and climatic conditions, the area possesses a surprising biodiversity [40, 10]. 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 rain fall occurs [10]. The plant species in the area are distributed according to the terrain they grow in, for example, deep valleys, mountain slopes, high plateaus and mountain tops etc. These diverse conditions are responsible for specific and distinctive flora of the region. For convenience the study area was divided into 26 comparts where the local inhabitants were interviewed (Table 01). 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 [53]. 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, number of the local people are still dependent on the wild edible plants and their products, they use to collect these plant species in their specific seasons and utilize them for food and for generating revenue by selling in the market as well [15]. The people of the remote communities have a special relationship with the nearby available plants for getting food, medicines and generation of income [16, 23]. These plants and their products have been used as food, medicine and for religious customs.



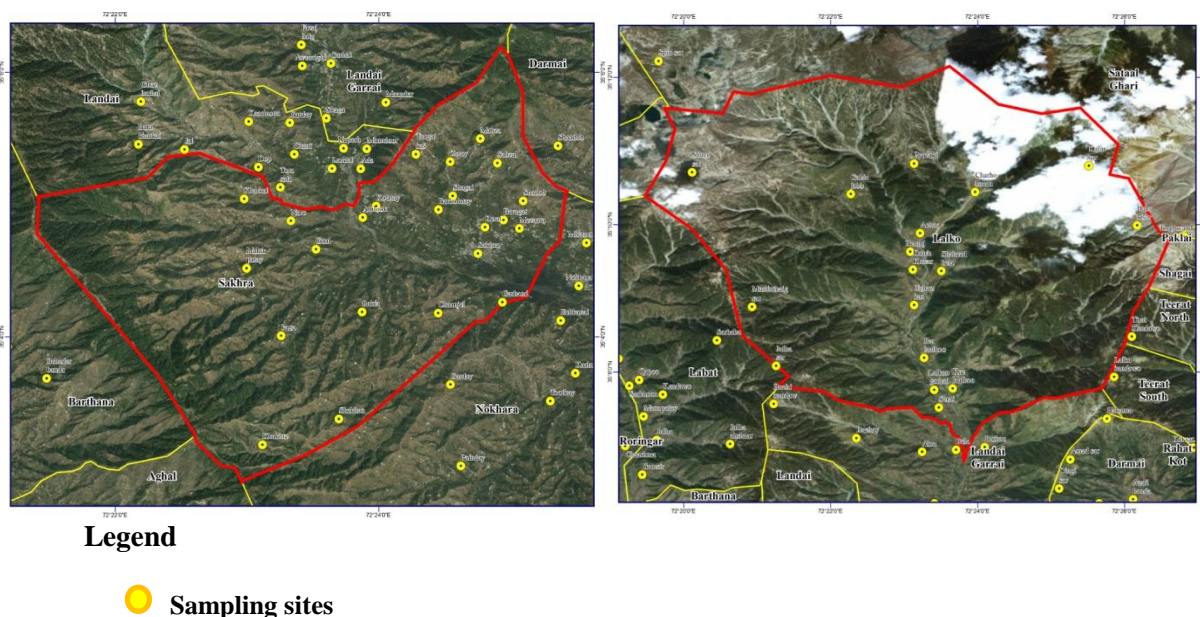


Figure1. Map of the study area, highlighting the sampling sites

Table 01: The geographical coordinates of 26 sites in the study area.

S.No	Name of Locality	Longitude	Latitude	Altitude (meters)
1.	Nawkhara	35°03'57"N	72°23'52"E	1449
2.	Sakhra	35°04'13"N	72°22'59"E	1560
3.	Baru	35°04'29"N	72°24'11"E	1493
4.	Penday	35°04'33"N	72°24'19"E	1671
5.	Sabzal	35°04'59"N	72°24'57"E	1511
6.	Bara ghat	35°04'59"N	72°24'28"E	1490
7.	Nasapai	35°05'28"N	72°25'28"E	1712
8.	Amluko	35°04'49"N	72°23'55"E	1544
9.	Kharkai	35°04'10"N	72°23'57"E	1617
10.	Sheikhan	35°03'01"N	72°23'26"E	2060
11.	Kaga Banda	35°04'02"N	72°24'07"E	1783
12.	Kolatay Chum	35°04'60"N	72°24'56"E	1588
13.	Zarray	35°05'22"N	72°24'17"E	1735
14.	Charra	35°06'15"N	72°23'58"E	1700
15.	Landai Garhai	35°05'24"N	72°23'27"E	1620
16.	Faazal Baig	35°06'03"N	72°19'48"E	2064
17.	Kohistani Banda	35°06'57"N	72°23'16"E	2130
18.	Batku	35°08'02"N	72°23'56"E	2019
19.	Kuz Lalku	35°08'11"N	72°23'15"E	2011
20.	Lawarku	35°08'37"N	72°22'59"E	2025
21.	Kar Khwar	35°09'09"N	72°23'21"E	2135
22.	Shaheed Bela	35°10'19"N	72°24'01"E	2880
23.	Pyazako Banda	35°10'52"N	72°24'57"E	2995
24.	Gabin Jabba	35°10'43"N	72°21'28"E	2760
25.	Speen Sar	35°11'29"N	72°20'45"E	3680
26.	Shago Sar	35°10'31"N	72°19'56"E	3920

2.2 Data collection

The necessary data related to WEPs was carefully collected by the author through oral face-to-face interviews among 222 informant preferably elderly people. However, teenagers practicing seasonal collection of the WEPs were also included in the interview. The Ethnobotanical data that were primarily aimed to document are entitled as: local names of the plants species, family, life form, edible parts, season of collection, methods of preparations, taste and number of Use Reports and Relative Frequency of citation from the informants. Special measures were taken during the documentation of local names of each plant species in various localities in the research area. For confirmation the used parts or products as food obtained from the WEPs were organoleptically tested in the field. The taste and smell are important organoleptic properties used to determine a crude drug or food. Therefore, examination of the wild edible plant species on the basis of taste and smell was taken before its documentation. Most of the collected wild edible plant species were confirmed by a team with the author. The characteristics properties of wild edible plant species are presented in Table 2. For each species three specimens were collected for backup in case of spoiling a specimen during blotting/ pasting processes.

2.3 Demographical data of the Local informants

The participating informants throughout the survey were divided into 5 categories on the basis of age. Among them 24 informants were ranged between the age of (15-25 years) (10.81%), 46 people from (25-40) (20.72%), 54 people from (40-50) (24.32%), 56 from (50- 60) (25.22%) and 42 above 60 years (18.91%). On the basis of gender 178 (80.18%) of the total informants were male while 44 (19.81%) were female. Due to the location of the study area in the far out skirts from cities and towns, most of the informants interviewed (40.50%) were illiterate however, graduates (8.10%), intermediate (23.40%) and high school (27.90%) were also preferably asked for sharing their knowledge about the plants commonly used as food. Professionally majority of the informants (35.13%) were farmers, teachers (9.90%), shepherds (24.32%), herbal practitioners (Hakeems) (10.81%) and house wives (19.81%)(Table.01). Almost all the informants selected for interview use to stay mostly in mountains, forests and alpine pastures. They use to live in the region most of their life which makes them attached with the plants resources. Because of close relationship with nature they possess magnificent amount of knowledge related to the plants and

their uses both as food and medicines. Some of the elderly people above 70 years have never left the area even for decades making a strong and solid relationship with nature and plants resources. The shepherds use to graze their sheep and goats do not reside permanently in the area and practice seasonal migration among plains and hilly areas. In the months of May- June they visit the pastures and remain there for 5-6 months. During this period they mostly rely on plant products both for food and medicine. The permanent residents of the area are divided into various tribes each with characteristics distinguishing characters. They mostly speak “Pashto” language which is totally understandable in the area however, other minor languages like “kohistani”, and “gujri” are also spoken. All informants were interviewed by the author and the conversations were made in Pashto language.

Table.02: Demographic features of informants selected from the study area.

S.No	Factors	Categories	Number of informants	Percentage (%)
1.	Age	15-25	24	10.81
		25-40	46	20.72
		40-50	54	24.32
		50-60	56	25.22
		60- Above	42	18.91
2.	Gender	Male	178	80.18
		Female	44	19.81
3.	Education	High School	62	27.9
		Intermediate	52	23.4
		Graduates	18	8.10
		Illiterates	90	40.5
4.	Profession	Farmers	78	35.13
		House wife	44	19.81
		Teachers	22	9.90
		Shepherds	54	24.32
		Herbal practitioners	24	10.81

2.4 Plants identification

During the study, 60 WEPs 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 in the study area (Table 03). The taxonomic identification of plant species was performed

with the help of flora of Pakistan and consulting expert taxonomists. Some of the collected plants specimens were identified using references of botanical data reported from the area in various botanical researches as well [14]. Beside this, acceptance of taxonomic names of plant species was done by consulting “The Plant List” (www.theplantlist.org) following [25]. The Voucher specimens collected from the area were preserved and mounted on standard herbarium sheets and were deposited in the herbarium of Botany department Hazara University Mansehra Pakistan.

Table 03: Plant Families, Number of Genera and Species

S.No	Family	Number of Genera	Number of Species	Number of used parts
1	Rosaceae	07	10	Fruit: 10
2	Brassicaceae	02	02	Leaf: 3, Young shoot: 3
3	Amaranthaceae	01	03	Leaf: 3, Young shoot: 3
4	Lilliaceae	01	02	Whole: 2
5	Asteraceae	02	02	Leaf: 1, Whole: 1
6	Moraceae	02	03	Fruit: 3
7	Lamiaceae	03	04	Leaf: 3, Young shoot: 3, Seed: 1
8	Papillionaceae	02	02	Legume:, Young shoot: 2
9	Apiaceae	02	02	Young shoot: 1, Seed: 1
10	Pteridaceae	01	02	Young shoot: 2
11	Polygonaceae	01	02	Leaf:1, Young shoot: 2
12	Caryophyllaceae	02	02	Fruit,: 1 Young shoot: 1
13	Solanaceae	02	02	Leaf: 2, Young shoot: 2
14	Pinaceae	01	02	Seed: 2
15	Asparagaceae	01	01	Young shoot
16	Berberidaceae	01	01	Fruit
17	Ranunculaceae	01	01	Whole
18	Ulmaceae	01	01	Fruit
19	Chenopodiaceae	01	01	Leaf
20	Ebenaceae	01	01	Fruit
21	Eleagnaceae	01	01	Fruit

22	Malvaceae	01	01	Leaf, Young shoot
23	Oliaceae	01	01	Fruit
24	Cactaceae	01	01	Fruit
25	Plantaginaceae	01	01	Leaf
26	Punicaceae	01	01	Fruit
27	Fagaceae	01	01	Fruit
28	Cucarbitaceae	01	01	Fruit
29	Rhamnaceae	01	01	Fruit
30	Rutaceae	01	01	Fruit
31	Portulacaceae	01	01	Leaf, Young shoot
	Families= 31	Genera= 46	Species= 60	

2.5 Data analysis

Relative Frequency of Citation (RFC)

Data about the WEPs was collected during the survey in various seasons of the year. Following [52, 19] the data was analyzed quantitatively via the Relative Frequency of Citation (RFC) in order to highlight the significance of a species among the local communities.

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

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

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

Table 04: Wild Edible Plants (WEPs), traditionally used by the local people in Sakhra Valley, District Swat.

S. No	Botanical name of WEPs	Local name	Family	Life form	Edible part, mode of consumption and Taste	Season of collection	UR	RFC
01	<i>Allium humile</i> Kunth.	Zangali piaz	Liliaceae	H	Leaves, Bulb: Eaten fresh with bread or mixed and cooked with maize flour with addition of salt to make bread and served. The bulb is dug out and eaten freshly. Mild bitter	Apr-May	190	0.85
02	<i>Allium griffithianum</i> Boiss.	Ogakai	Liliaceae	H	Leaves, Bulb: 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	Apr-May	195	0.87

03	<i>Amaranthus caudatus</i> L.	Ganhar	Amaranthaceae	H	Leaves, young shoots: The leaves are cut into small pieces, boiled/Macerated with appropriate amount of salt then fried in oil and served with bread. Mild sweet.	Jul- Aug	200	0.89
04	<i>Amaranthus spinosus</i> L.	Chalwai	Amaranthaceae	H	Leaves, young shoots: Cut into small pieces, boiled/Macerated with appropriate amount of salt then fried in oil and served with bread. Mild sweet.	Jul- Aug	200	0.89
05	<i>Amaranthus viridis</i> L.	Chalwai	Amaranthaceae	H	Leaves, young shoots: Cut into small pieces, boiled/Macerated with appropriate amount of salt then fried in oil and served with bread. Mild sweet.	Jul- Aug	200	0.89
06	<i>Asparagus gracilis</i> Royle.	Tendora y	Asparagaceae	S	Young shoots: Cut into small pieces, boiled then fried in oil and served with or without bread. Sweet.	Mar-Apr	71	0.32
07	<i>Berberis lyceum</i> Royle	Kwaray	Berberidaceae	S	Fruit: The ripened fruits after collection are served freshly. Mild sour.	Jun-Jul	205	0.92
08	<i>Caltha alba</i> Camb.	Maknpa t	Ranunculaceae	H	Leaves: The leaves are collected, fried after maceration with little salt and served. Due to its deliciousness it is compared with the taste of butter. Sweet.	Mar-Apr	150	0.67
09	<i>Capsella bursa-pastoris</i>	Bambes a	Brassicaceae	H	Leaves, young shoots: The leaves and young shoots are eaten freshly or served after cooking and frying. Mild sweet.	Mar-Apr	39	0.16
10	<i>Cardaria draba</i> (L.) Desv.	Sharsha mplar	Brassicaceae	H	Leaves, young shoots: The leaves are collected, fried after maceration with little salt and served with bread. Mild bitter.	Mar-Apr	51	0.23
11	<i>Celtis caucasica</i> Willd.	Tagha	Ulmaceae	T	Fruit: The semi-dried fruits are eaten after collection. Sweet	Sep-Oct	53	0.24
12	<i>Chenopodium album</i>	Sarmay	Chenopodiaceae	H	Leaves, Young shoots: The young leaves and shoots after collection are cut into pieces, boiled and served with bread. Mild sweet.	Apr-Jun	77	0.35
13	<i>Cichorium intybus</i>	Hunn, kasni	Asteraceae	H	Leaves:	May-Jun	187	0.84

					The leaves are boiled in water and squeezed to remove extra bitterness, then fried and eaten with bread. Mild bitter			
14	<i>Cotoneaster nummularia</i> Fisch. & Mey.	Mamanra	Rosaceae	S	Fruit: The fruits are eaten freshly after collection. Sweet	Aug-Sep	59	0.27
15	<i>Diospyrus lotus</i>	Toramluk	Ebenaceae	T	Fruit: The fruits are collected after turning black/ripen and eaten till they are soft, or it may also be dried and stored for quite longer time. Sweet	Nov-Dec	210	0.95
16	<i>Diplazium esculentum</i>	Ladora	Athyriaceae	H	Leaves: The young sprouts are collected, cut into pieces, fried and served with bread. Mild sweet.	Mar-Apr	171	0.77
17	<i>Dryopteris ramosa</i>	Kwanjaly	Dryopteridaceae	H	Leaves: The young coiled leaves are rubbed to remove the scales, cut into pieces and boiled. After get softened, mixed with curd and served with bread. Mild sweet.	Mar-Apr	175	0.79
18	<i>Duchesnea indica</i> (Andr.) Focke	Sarkai	Rosaceae	H	Fruit: The fruit after collection is eaten fresh or it may be turned into jams and served with or without bread. Sweet.	Apr-May	70	0.32
19	<i>Eleagnus umbellate</i>	Ghanamrangay	Eleagnaceae	S	Fruit: The fruits after getting red are collected and served fresh. Sour	Jul-Aug	66	0.30
20	<i>Ficus palmate</i> Forssk	Enzar	Moraceae	T	Fruit: The black and ripened fruit is eaten freshly or dried and stored. Sweet	Jun-Jul	210	0.95
21	<i>Lamium amplexicaule</i> L.	Ghutialay	Lamiaceae	H	Young shoots: The young shoots are cut into pieces, macerated after boiling and served with bread. Mild sweet.	Mar-Apr	40	0.18
22	<i>Lathyrus aphaca</i> L.	Kurkmana	Papilionaceae	H	Fruit/Pod: The pods are boiled with addition of salt and eaten without bread. Mild sweet.	Apr-May	37	0.17
23	<i>Malva neglecta</i> Wallr.	Panerak	Malvaceae	H	Leaves, Young shoots: The leaves and young shoots are cut into pieces, boiled to soften, fried and served with bread. Mild sweet.	Apr-May	190	0.86

24	<i>Medicago polymorpha</i> (shpshtry)	Shpesht ra	Papilionaceae	H	Young shoots: The young shoots are boiled, fried and eaten with bread. Mild sweet.	Mar-Apr	177	0.80
25	<i>Mentha arvensis</i>	Podeena	Lamiaceae	H	Leaves, young shoots: The young shoots are grinded and mixed with curd and served. The tea prepared from leaves with addition of sugar is also a common drink. Mild bitter	Apr-Jul	200	0.90
26	<i>Mentha longifolia</i>	Welana y	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	Apr-Jul	205	0.92
27	<i>Morus alba</i> L.	Spin toot	Moraceae	T	Fruit/Catkin: The fruit after ripening/getting creamy white are collected and freshly served. Sweet.	Apr-May	205	0.92
28	<i>Morus nigra</i> L.	Tor toot	Moraceae	T	Fruit/Catkin: The fruit after ripening/getting black are collected and freshly served. Sweet.	Apr-May	200	0.90
29	<i>Nasturtium officinale</i>	Talmera	Brassicaceae	H	Leaves, young shoots: The young shoots are cut into pieces, fried after boiling and served with bread. Mild bitter	Mar-Apr	190	0.86
30	<i>Olea ferruginea</i>	Khoona	Oliaceae	T	Fruit: The black and ripened fruit is collected and freshly eaten. Mild bitter	Sep-Oct	139	0.63
31	<i>Opuntia monacantha</i> (Willd.) Ham.	Zuqam	Cactaceae	S	Fruit: The purple colored fruit is collected carefully and eaten. Sour	Sep-Oct	29	0.13
32	<i>Pinus roxburghii</i>	Nakhtar	Pinaceae	T	Seeds: The seeds are collected from the female cones after maturation and eaten as a cheap alternative for the seeds of <i>Pinus gerardiana</i> (Chalghoza). Mild sweet	Dec-Jan	70	0.32
33	<i>Pinus wallichiana</i>	Pewuch	Pinaceae	T	Seeds: The seeds are collected from the female cones after maturation and eaten as a cheap alternative for the	Dec-Jan	51	0.23

					seeds of <i>Pinus gerardiana</i> (Chalghoza). Mild sweet			
34	<i>Plantago lanceolata</i> L.	Jabai	Plantaginaceae	H	Leaves: The young leaves are cut into pieces, boiled to get soft, fried and served with bread. Mild bitter	Mar-Apr	77	0.35
35	<i>Portulacca oleracea</i> L.	Warkharay	Portulacaceae	H	Leaves, young shoots: Cut into pieces, boiled, mixed with curd and served with bread. Mild sour.	Jul-Aug	180	0.81
36	<i>Prunus cerasiodes</i> D.Don	Annang	Rosaceae	T	Fruit: The fruit are stored after collection to get ripened/turn black inside and eaten. Mild bitter	May-Jun	50	0.23
37	<i>Prunus persica</i>	Shaltalu	Rosaceae	T	Fruit: The fruit are eaten after ripening and freshly eaten. Mild sour.	Jul-Aug	115	0.52
38	<i>Punica granatum</i> L.	Nanguray	Punicaceae	S	Seeds: The fruit is collected after ripening and eaten freshly. Mild sour	Jul-Aug	130	0.59
39	<i>Pyrus pashia</i> Buch. Ham ex D.Don	Tora Tangai	Rosaceae	T	Fruit: The fruit are stored after collection to get ripened/turn black inside and eaten. Sweet	Oct-Nov	73	0.33
40	<i>Pyrus pseudopashia</i> T.T.Yu, Acta	Tora Tangai	Rosaceae	T	Fruit: The fruit are stored after collection to get ripened/turn black inside and eaten. Sweet	Oct-Nov	69	0.31
41	<i>Quercus dilatata</i>	Banj	Fagaceae	T	Fruit: The fruit are collected, dry heated to cooked and eaten after removing the seed coat. Mild bitter	Nov-Dec	41	0.18
42	<i>Rosa brunonii</i> Lindl.	Palwari	Rosaceae	S	Flower: The flowers are boiled with addition of sugar and cooked till thickening to make jams and served with or without bread. Sweet	Mar-Apr	71	0.32
43	<i>Rosa webbiana</i> Wallich ex Royle	Zangali gulab	Rosaceae	S	Flower: The flowers are boiled with addition of sugar and cooked till thickening to make jams and served with or without bread. Sweet	Mar-Apr	51	0.23
44	<i>Rubus ellipticus</i> Smith	Guraja	Rosaceae	S	Fruit: The ripened fruits are served freshly after collection. Mild sour	May-Jun	153	0.70

45	<i>Rubus fruiticus</i>	Karwar a	Rosaceae	S	Fruit: The ripened fruits are served freshly after collection.	Jul-Aug	179	0.81
46	<i>Rubus sanctus</i> Schreber	Baganra	Rosaceae	S	Fruit: The ripened fruits are served freshly after collection. Mild sour	Jun-Jul	179	0.81
47	<i>Rumex dentatus</i> L.	Shalkha y	Polygonaceae	H	Leaves: The leaves along with other plant parts are served as green leafy vegetable. Mild sour	Mar-Jun	189	0.85
48	<i>Rumex hastatus</i> D.Don	Tarukay	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	Mar-Jun	73	0.32
49	<i>Salvia</i>	Sobana	Lamiaceae	H	Leaves/young shoots:	Mar-Apr	10	0.04
50	<i>Silene conoidea</i> L.	Bashka	Caryophyllaceae	H	Fruit: The fruit is peeled and eaten fresh. Mild sweet.	Apr-May	33	0.15
51	<i>Solanum nigrum</i> L.	Kamach u	Solanaceae	H	Leaves, young shoots: The young shoots and leaves are boiled and fried and served with bread while fruit is directly eaten after ripening. Mild sweet	Jul-Aug	78	0.35
52	<i>Solena amplexicaulis</i> (Lam.) Gandhi	Kakora, karkund ay	Cucurbitaceae	C	Fruit: The red colored ripened fruit is collected and eaten directly. Sweet.	Oct-Nov	31	0.14
53	<i>Stellaria media</i> (L.) Vill.	Olalai	Caryophyllaceae	H	Young shoots: The young shoots are cut into pieces, boiled to get soft, fried and eaten with bread. Mild sweet.	Mar-Apr	41	0.18
54	<i>Taraxacum officinale</i> Weber	Ziargula y	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.	Mar-Apr	61	0.27
55	<i>Thymus linearis</i> Benth.	Sperkai	Lamiaceae	H	Seeds: The ripened seeds are collected and used as condiment in various spices to enhance the taste. Mild bitter.	Aug-Sep	55	0.25
56	<i>Urtica dioica</i>	Sezunka y	Urticaceae	H	Young shoots: Young shoots after boiling are fried and served. Mild bitter.	Apr-May	61	0.27

57	<i>Viburnum grandiflorum</i> Wall. Ex DC.	Ghaz mewa	Caprifoliaceae	S	Fruit: The ripened fruits are directly eaten. Sweet.	Jul-Aug	53	0.24
58	<i>Vicia sativa</i> L.	Mardek akh	Papilionaceae	H	Fruit/Pod: The pods are boiled with addition of salt and eaten without bread. Mild sweet.	Apr-May	59	0.27
59	<i>Zanthoxylum armatum</i> DC.	Dambar a	Rutaceae	S	Fruit: The fruit is mostly used as condiment for making different recipes. Cool.	Jul-Aug	34	0.15
60	<i>Ziziphus jojoba</i>	Badra	Rhamnaceae	T	Fruit: The fruit is eaten freshly or in dried form. Sweet.	Aug-Sep	149	0.67

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

3. RESULTS

3.1 Taxonomic categories of WEPs

In the current study, 60 wild plant species were reported commonly used as food sources in the area, belonging to 31 families and 46 genera. The ethnobotanical data; species, genera and families of the recorded wild edible plants (WEPs) of the study area are presented in Table 03. Among the recorded families of edible plants, Rosaceae is the dominating family having (10 species), followed by Lamiaceae (4 species), Amaranthaceae, and Moraceae (3species for each). Liliaceae, Asteraceae, Brassicaceae, Papilionaceae, Apiaceae, Pteridaceae, Polygonaceae, Caryophyllaceae, Solanaceae and Pinaceae (2species for each) while the remaining 17 families are presenting only a single species each.

People of the area name and classify the wild edible plants by their own local names. They are able to differentiate among the plant species having nearly similar morphological characters. They also have ideas about the seasons of their availability and habitats. Mostly the plant species and their edible parts are known with the same names (Table 6). However, different species of the same genus are known with different local names. For instance, the local name of *Amaranthus caudatus* L. is “Ganhar” while *Amaranthus viridis* L. is locally called “Chalwai”. These different local names are helpful in avoiding the confusion among different plant products, which is essential for expressing the palatable properties of species of the same genera and also for toxicity of avoidable species. The local people reported no specific names for prepared dishes however mostly they were named after the source plant species.

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). These plant species and their products are collected during different seasons of the year. The local inhabitants better know the seasons and times of collection of WEPs (shuja 51). 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 0°C which inhibits the occurrence of plant species. Some species like *Medicago polymorpha*, *Amaranthus spp*s, *Mentha arvensis*, *M. longifolia*, *Dryopteris ramosa* etcetera are collected in their respective seasons, dried and utilized in winter in their unavailability (Fig....). Due to very cold temperature, the WEPs are almost unavailable in winter [11].

Table 04: Number of species and their used parts

Edible Part(s)	Number	Percentage %
Fruit	24	31.50
Young Shoot	22	30.13
Leaf	16	21.91
Seed	04	5.47
Whole	04	5.47
Flower	02	2.73
Bulb	01	1.36
Corm	01	1.36

3.2 Life Forms of WEPs

The recorded WEPs of the area 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.02)

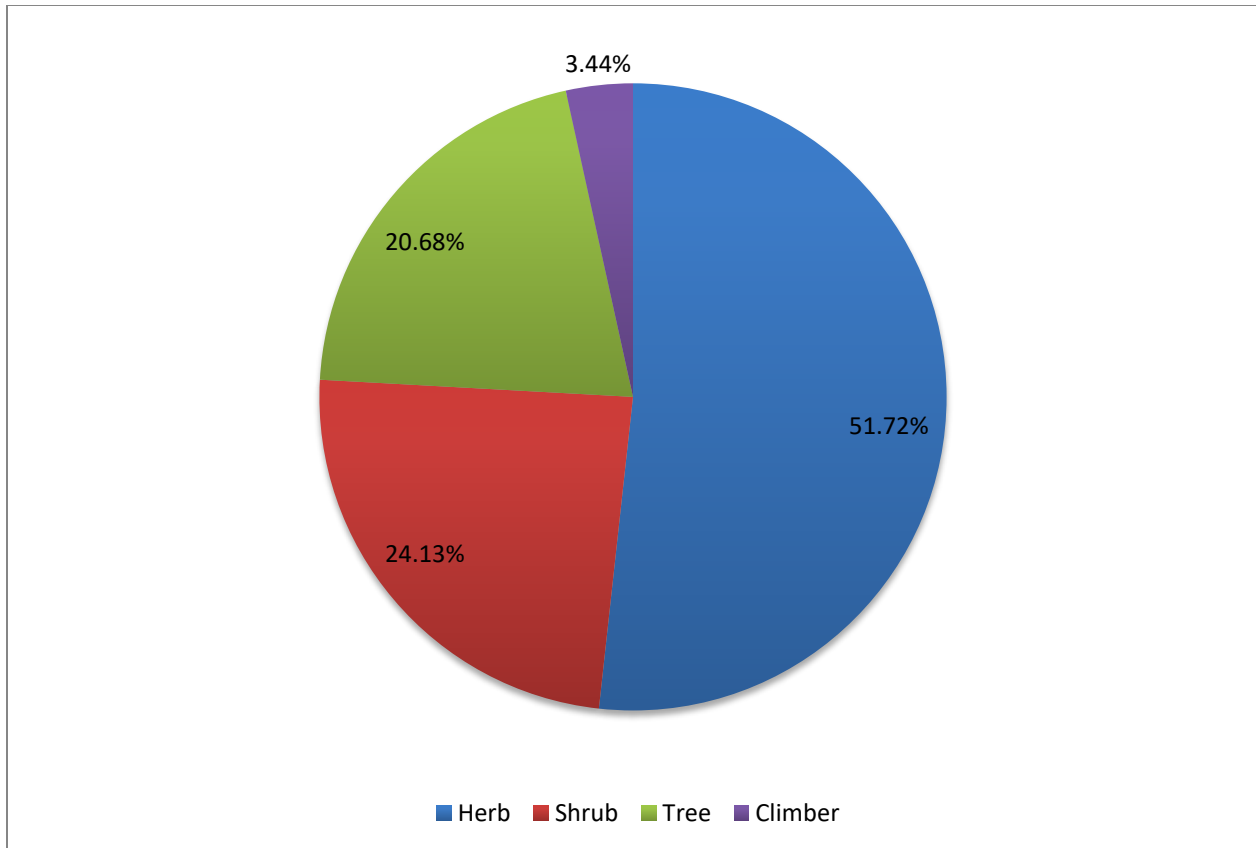


Figure2. Different life forms of wild edible plants

3.3 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 after collection while some of them are dried, stored and then utilized in the seasons of their unavailability/scarcity. Out of the total cited 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). For instance, *Allium griffithianum*, *Allium humile* are utilized both in cooked and uncooked forms.

Table 05: Categorization of WEPs species on the basis of consumption modes

Consumption category	Plant species

1. Consumed in cooked form	<i>Amaranthus caudatus</i> L., <i>Amaranthus spinosus</i> L., <i>Amaranthus viridis</i> L., <i>Caltha alba</i> Camb., <i>Cardaria draba</i> (L.), <i>Chenopodium album</i> , <i>Cichorium intybus</i> , <i>Diplazium esculentum</i> , <i>Dryopteris ramosa</i> , <i>Lamium amplexicaule</i> L., <i>Malva neglecta</i> , <i>Medicago polymorpha</i> , <i>Nasturtium officinale</i> , <i>Plantago lanceolata</i> L., <i>Rumex dentatus</i> L., <i>Solanum nigrum</i> L., <i>Stellaria media</i> (L.), <i>Taraxacum officinale</i> , <i>Medicago polymorpha</i> , <i>Urtica dioica</i>
2. Consumed in uncooked form	<i>Berberis lyceum</i> Royle, <i>Capsella bursa-pastoris</i> , <i>Celtis caucasica</i> , <i>Cotoneaster nummularia</i> , <i>Diospyrus lotus</i> , <i>Duchesnea indica</i> , <i>Eleagnus umbellata</i> , <i>Ficus palmate</i> , <i>Lathyrus aphaca</i> L., <i>Mentha arvensis</i> , <i>Morus alba</i> L., <i>Morus nigra</i> L., <i>Olea ferruginea</i> , <i>Opuntia monacantha</i> , <i>Pinus roxburghii</i> , <i>Pinus wallichiana</i> , <i>Prunus cerasioides</i> , <i>Prunus persica</i> , <i>Punica granatum</i> L., <i>Pyrus pashia</i> Buch., <i>Pyrus pseudopashia</i> , <i>Rosa webbiana</i> Wallich, <i>Rumex hastatus</i> , <i>Rubus ellipticus</i> Smith, <i>Rubus fruticosus</i> , <i>Silene conoidea</i> L., <i>Solena amplexicaulis</i> , <i>Zanthoxylum armatum</i> DC
3. Cooked/ uncooked	<i>Allium griffithianum</i> Boiss. <i>Allium humile</i> Kunth, <i>Mentha arvensis</i> , <i>Mentha longifolia</i> , <i>Rumex hastatus</i> D.Don, <i>Capsella bursa-pastoris</i> , <i>Lathyrus aphaca</i> L, <i>Vicia sativa</i> L, <i>Ziziphus jojoba</i>

During the survey, the wild edible plants growing in the area 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 umbellata*, *Ficus palmate*, *Malva neglecta*, *Mentha arvensis*, *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*, *Cardaria draba*, *Celtis caucasica*, *Chenopodium album*, *Cotoneaster nummularia*, *Duchesnea indica*, *Lamium amplexicaule* and *Lathyrus aphaca* were known as edible plants by a limited number of informants (Table 6). 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 top

most species were cited by more than 150 informants. This shows their popularity and sustainability for use as food by the local communities. (Fig of top species)

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” and “wild fruits” and “Condiments”.

3.4 Wild edible plants used as vegetables

Some of WEPs are routinely used as vegetable in their 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 traditionally as vegetables include, *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 dioica* (Fig). These WEPs are commonly known and used as palatable dishes throughout the community.

3.5 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*, *Celtis caucasica*, *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*, *Rubus ellipticus*, *R. fruticosus*, *R. sanctus*, *Solena amplexicaulis*, *Viburnum grandiflorum* and *Ziziphus jojoba*. 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. jojoba*, *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 a number of benefits like shade, timber for making household appliances, medicines and fodder for cattle etcetera [21].

3.6 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 lenearis* are used to make spices to enhance the taste of food.

3.7 Organoleptic characters of WEPs/ edible parts:

During study, the reported plants species were organoleptically tested to confirm the properties cited by the local informants. The results are given in Table 6. Among the tested plants/ parts, 14 species of wild edible parts are described having mild bitter taste, 33 species with mild sweet and sweet taste while 13 species were reported with mild sour and sour tastes. 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.





4. DISCUSSION

Comparative

During interviewing the local communities of the research area, a special attraction of people towards the wild plant resources 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 these plant species is attributed to food shortage, nutritional values and local cultural traditions. They use to collect the plant species in their appropriate seasons and times. The local people use the WEPs either as vegetables, fruits and condiments.

4.1 WEPs as Vegetables

After analyzing the data, the plants/ products being used as vegetables is the dominating use category of WEPs in the area with 30 different species. Similar findings have also been reported from other researchers in this regards. For instance, 25 wild plants used as vegetable were reported from North-West Pakistan by Ahmad et al., 2019 [13]. Another study from Harnai, Balochistan reported 59 vegetable plant species [49]. From Kurram district, Abbas et al., reported 53 wild plants used as vegetable [1]. In the same way 45 wild vegetables were reported by Abbasi et al., from the Lesser Himalaya of Pakistan [0]. From Yasin and Ishkoman valleys Aziz et al., [18.a] reported 21 wild plants species used as vegetable. The use of plants and their products for food and various herbal therapies are deeply linked with the traditions and cultures of the region [9, 42].

4.2 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 [11]. As quoted above Abbasi et al., recorded 35 WEPs used as fruit by the tribal communities of lesser Himalaya [4]. Swat valley exhibit quite similar climatic conditions as compared to the Lesser Himalaya 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 [27].

4.3 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 arvensis*, *M. longifolia*. These plants are traditionally used in various spices, sauces and salad as the appetite stimulants. Abbas et al., also reported *Mentha arvensis* as a common constituent used as salad from district Kurram [1]. Different researchers also reported quite similar findings from various localities. *Thymus linearis* was reported for its use to make herbal tea by Aziz et al., from Gilgit-Baltistan [19]. Abdullah et al., 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, 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 use of WEPs from area to area may be due to difference in cultures, traditions and ethnography.

4.4 WEPs as drinks

Along with other uses, we documented *Thymus linearis* and *Mentha arvensis* for their use in making traditional tea which is a common drink in the area. Aziz et al., also reported *Thymus linearis* for preparing traditional drink from Ishkoman valley Gilgit –Baltistan [19]. This tea is not

only taken as a drink but also as medicine especially during the whooping cough and abdominal discomfort. Beside the use of WEPs as food, they are also a cheap and effective source of medicine against different ailments [28].

CONCLUSIONS

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 own food as well as for generating revenue through selling them in the market. In this regard, 19 plant species were reported having market values. These plant species are recognized by almost all people of the area. The uses of some plants species like *Cardaria draba*, *Lamium amplexicaule* L., *Rosa brunonii*, *Rosa webbiana*, *Salvia spp*s and *Stellaria media* for food are novel for the gastronomy. For better understanding, the organoleptic character like “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 a way for further researches in this respect.

Although a special attachment of the local communities with the WEPs still exists but due to lack of proper documentation, the traditional knowledge is continuously eliminating from the area. It was also observed that the new generations have least concerns about this cultural heritage. The area has recently gained tremendous popularity for recreation and tourism which beside 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 landscapes should be minimized.

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