

Documenting the wild edible plant's resources used by Pushtoons, Balochis and Brahvis as survival strategy in the arid Province of Balochistan, NW Pakistan

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Abstract

The current paper elaborates the wild edible plants' (WEPs) diversity, and associated traditional knowledge among three ethnic groups of Balochistan Province, Pakistan. The field trips were carried out in 2018-2020 employing purposive sampling techniques for respondents. We used open ended semi-structured interviews for data collection. A total of 195 interviews reported 140 plant species in 44 families and 105 genera. Family Brassicaceae (10.17%) showed maximum representation along with Asteraceae (10%), and Apiaceae (6.42%). Eight (8) used categories were determined i.e. eaten fresh (47 spp. 33.57%), as vegetable (46 spp., 32.85%), vegetable and salad (15 spp, 10.71%), salad (14 spp, 10%), beverages only (8 spp, 5.71%), and flavor (7 spp, 5%). Leaves (54 spp., 38.57%) were the most used part followed by fruits (44 spp, 31.42%), tubers (13, 9.28%), bulb (11, 7.8% species), whole plant (8, 5.7%), flowers (4, 2.8%), seeds (4, 2.8), shoots (3, 2.14) young stem (2, 1.42). Seventy five (75) species (53.57%) were cited for mutual utilization and the rest 65 (46.42%) were used differently. Pashtuns hold comparatively significant traditional knowledge and exclusively utilize 44 (31.42%) plant species. Similarly, the Pushtoons and Balochis were sharing considerable species i.e. 13 (9.28%). Jaccard index (JI) discovered that 92 plant species were reported for the first time from the province as WEPs for instance *Ferula costata*, *F. oopoda*, *Ferula assa-foetida*, *Allium zhobicum*, *Asphodelus tenuifolius*, and *Menoicus linifolius* etc. Effect of age, gender and was observed in addition to inter-cultural knowledge heterogeneity. Several geo-climatic changes and anthropogenic factors are causing the fragmentation of existing knowledge. The promotion of these WEPs as crops would underpin the food security and socioeconomic development in the region.

Introduction

The arid regions of the world occur in both northern and southern hemispheres and occupy 26–35% of the earth surface (Archibold, 2012). Generally, they are characterized with scarce precipitation, dispersed settlements, raised temperature, reduced evaporation, sparse settlements, and limited agricultural potential (Fiebig-Wittmaack *et al.*, 2012; Gaur and Squires, 2018). Pakistan displays 80% of its total area as arid, semi-arid and hyper arid comprising the deserts of Punjab, Sindh and Balochistan Provinces (Baig and Al-Subaiee, 2009). Balochistan (60° – 70°E and 24°.0–32°.0 N) is the largest and least populated of four Pakistan's provinces displaying maximum arid landforms. It covers an area of 347190 Km² i.e. 44% of the country's north-western terrains. It is a topographically, ethnically, culturally and biologically rich province with the elevational range of 1500 to 3578 above sea level (Ahmed, 2020; Naz *et al.*, 2020). Astonishingly, it is regarded as the underprivileged province among the four Pakistan's provinces. The endemic handicaps impeding socio-economic development may include perennial drought, harsh environment, poor infrastructure, remote and patchy population, socio-political uncertainty, typical tribal society and feudalism (Khetran, 2011), (Harrison, 1978), (Bhattacharjee, 2015), (Shah and Khan, 2022), (Tabassum and Bhatti, 2020), (Naz *et al.*, 2020), (Rehman, 1995; Shah and Khan, 2022), etc.

Moreover, annual flood hits, drought, mining activities, climate change and population expansion pushing the region towards distinctive ecological and social deterioration. Currently, Balochistan is enduring rapid and extensive urbanization due to CPEC (Pak-China Economic Corridor) efforts. This mega project is believed to be a potential factor for the provincial development but profound geo-climatic impacts in the region is not negligible (Khetran and Saeed, 2017; Farooqui and Aftab, 2018). The fast growing population has caused rapid consumption of natural and biological resources (Imran *et al.*, 2013). These latent factors may prone to ecosystem disability of deserts, mountains, excessive land use, and extraction of vegetation and habitat destruction leading biodiversity loss. As a result regional developmental efforts have caused large scale social turbulence, outmigration, mass displacement, and ecosystem imbalances leading the declining, fragmentation and dispersion of plant based folk knowledge. S

Socio-economically, Balochistan presents a typical agro-pastoral human society as the 93% of the province is rangeland (Rehman, 1995). These communities still live simple village life and mainly rely on limited farming, animal husbandry and limited biological resources for survival. Wild edible plants (WEPs) have played a central role in their food systems as "functional foods" due to their availability, easy access, nutritional and medicinal value (Basra *et al.*, 2018; Abdullah *et al.*, 2021). Their importance in income generation, poverty reduction, nutritional balance, food security, and agricultural diversification of remote traditional communities has been emphasized in several studies (Sundriyal and Sundriyal, 2001; Daniel and Shimane, 2011; Khrumo and Deb, 2018; Kidane and Kejela, 2021). Fragmented botanical literature addressing floristic diversity, medicinal plants, phytosociology (Shah *et al.*, 2006), (Anjum *et al.*, 2020) (Imran *et al.*, 2013), (HAQ *et al.*, 2021), (Anjum *et al.*, 2020), (Tareen *et al.*, 2010), (Zaidi and Crow Jr, 2005), (Ahmed *et al.*, 2020), etc. But an article articulating the wild food ethnobotany of this interesting socio-botanically province is still missing. However, cross-cultural heritage is still unexplored. These circumstances made the studies urgent on regional biological diversity and conservation. We hypothesized that the province with ample remote populations from urban centers, prevailed poor socio-economic and dominant agro-pastoral communities possesses significant wild edible plant taxa in food chain. Their plant based knowledge in transition due to developmental activities. The present study has been conducted with two objectives 1) to record the folk knowledge about wild edible plants 2) to examine how these three ethnic groups (Pushtoons, Balochis and Brahvis) differently utilize these plant based food source.

Materials And Methods

The study area

Balochistan (30.12 N ; 67.01 E) is the largest, least populated and underprivileged province of Pakistan dominated with mountainous and arid desert terrains (Khawaja and Xinhai, 2013; Mushtaq and Mirza, 2022). It is bounded in the west by Iran, in the east by Punjab and Sindh (provinces of Pakistan), in the south by Arabian Sea and in the north by Afghanistan. The province host 12.34 million total population (Ahmad, 2005; Ahmed, 2019) comprising 52% Baloch and 36% Pashtuns and 12% collectively Barahvis, Hazaras, Sindhis, Punjabis, Uzbeks, and Turkmens (Ahmed and Khan, 2020; Raj, 2022). Balochistan has long history rooted back in the Stone Age (Khan, 2002) and recent archaeological research at Mehrgarh has discovered 9000 years old interesting human civilization (Gupta *et al.*, 2006; Jarrige *et al.*, 2013). In the old days, Balochistan also remained crossroad and ruling land of the world famous conquerors and warriors such as Alexander (325 B. C.), Seleucus Nicator, Graeco-Bactrians), Macedonians, Arabs, Ghaznavies, Mangols and Mughals. In 712, Muslim started to

rule Balochistan and continued till 1838. British took the ruling reign of the region in 1839 in some territories. After 1947 partition, the princely states of Mekran, Kharan, Lasbela and Kalat state acceded to Pakistan 1947. In 1955, Balochistan was merged into one unit of West Pakistan and emerged as one of the four new provinces of Pakistan (Khan, 2012; Majeed, 2015). Topographically, it exhibits variety of physical features covering 80% area by mountainous, 15% inter-mountainous flood plains and deserts and 5% coastal plains. It exhibits five physiographic zones i.e. upper and lower highlands; plains, and deserts (Abbas et al., 2018; Rafiq et al., 2022). Mountain ranges of Koh-e-Sulaiman, Tobak Kakari, Murdar, Zarghoon, Takatu, and Chiltan are also found. Rivers such as Zhob, Nari, Bolan, Pishin, Lora, Mula, Hub, Porali, Hingol, Rakshan and Dash are the main water courses. The coastline stretches for about 760 kilometers, with several peninsulas and promontories with desolated sea ports. Major part of the province is mountainous and dry presenting only 5% arable lands characterized with arid and semi-arid environmental conditions (Ashraf and Routray, 2015; Abbas et al., 2018). It serves as the reservoir of raw materials for national industries across the country such as iron, copper, gold, silver, lead, zinc, barite, chromite, coal, gypsum, limestone (marble), silica sand and many more (Malkani, 2012; Malkani et al., 2017; Akhtar et al., 2021). Generally, the climate is arid and semi to hyper arid but changes with respect to topographic features (Qaisrani et al., 2021). Mainly the winter is very cold and characterized with scanty snowfall and temperature falls below – 1C. Summer is hot and dry particularly the plains’ temperature goes up to 50C. Precipitation pattern is unpredictable receiving average rainfall ranges from 30 to 300 mm (Ahmed et al., 2016) shaping diverse ecological systems, habitat variability, species richness. Floristically, it falls in the Irano-Turanian region which contributes more 45% plant taxa in the Flora of Pakistan. Mangroves, scrub forest, sub-tropical, desert and riverine forest are the main regional vegetation formation. Greek Juniper (*Juniperus excelsa*) and Chilgoza Pine (*Pinus gerardiana*) are the principal forest trees (Qutab-ud-Din et al., 1989; Sultani et al., 1993). However, the juniper forest is the world’s oldest woods and declared as Biosphere reserve in 2013 by Pakistani Government.

Table 1 Geographical, ethnic and social features of visted localities.

Districts	Elevation (m)	Longitude	Latitude	Population	Pushtoon Clans	Balochi Clans	Brahvi Clans	Social Livelihood
Awaran	400	26 27 55 N	65 15 34 E	121,680	Nil	Muhammad Hasni, Bizanjo, Mirwani, Sajdi	Shahwani	Agriculture and Livestock
Barkhan	1100	29 54 09 N	69 31 30 E	171,556	Nil	Khetran, Aspani, Sadrani	Nil	Agriculture and Livestock
Bolan (Kech)	150	29 29 06 N	67 38 05 E	237,030	Nil	Rind, Jatoi, Mastoi	Kurd, Bangulzai, Siyapad, Parkani, Raisani, Samalani	Agriculture and Livestock
Duki	1090	30 09 41 N	68 34 15 E	6,384	Tareen, Loni, Nasar	Nil	Nil	Agriculture and Livestock
Gwadar	10	25 08 10 N	62 19 28 E	90,762	Nil	Hott, Kalmati, Makrani	Nil	Agriculture and Livestock
Harnai	900	30 06 20 N	67 55 53 E	200,000	Tareen, Wanechi	Nil	Nil	Agriculture and Livestock
Kalat	2100	29 02 21 N	66 35 26 E	412,232	Nil	Muhammad Hasni, Ahmadzai	Lango, Zehri, Shahwani	Agriculture and Livestock
Kharan	700	28 34 56 N	65 24 58 E	156,152	Nil	Muhammad Hasni	Mengal	Agriculture and Livestock
Khuzdar	1200	27 49 25 N	66 36 31 E	802,207	Nil	Bizanjo, Makrani, Muhammad Hasni	Mengal, Zehri, Sinari, Samalani	Agriculture and Livestock
Kila Abdullah	1300	30 55 24 N	66 29 03 E	757,578	Achakzai, Jogezai	Nil	Nil	Agriculture and Livestock
Kila Saifullah	1550	30 42 32 N	68 21 44 E	342,814	Kakar, Achakzai, Jogezai	Nil	Nil	Agriculture and Livestock
Kohlu	825	29 54 01 N	69 15 05 E	214,805	Nil	Marri	Nil	Agriculture and Livestock
Lasbela	35	25 48 59 N	66 37 14 E	574,292	Nil	Gujjar, Motak, Muhammad Hasni, Mirwani	Nil	Agriculture and Livestock
Loralai	1400	30 22 54 N	68 31 55 E	397,400	Kakar, Kudezai, Nasar	Nil	Nil	Agriculture and Livestock
Mastung	1700	29 48 08 N	66 48 44 E	266,461	Nil	Hasni, Rind	Shahwani, Lahri, Bangulzai, Mengal	Agriculture and Livestock
Musakhel	1341	30 51 34 N	69 48 52 ES	167,017	Musakhel	Buzdar, Jaffar	Nil	Agriculture and Livestock

Districts	Elevation (m)	Longitude	Latitude	Population	Pushtoon Clans	Balochi Clans	Brahvi Clans	Social Livelihood
Nasirabad	75	28 32 18 N	68 12 43 E	490,538	Nil	Domki, Bugti, Marri, Umrani, Lashari, Jamali	Lehri, Nichari, Bangulzai	Agriculture and Livestock
Nushki	1000	29 33 39 N	66 00 32 E	178,796	Nil	Muhammad Hasni	Lehri, Nichari, Bangulzai	Agriculture and Livestock
Panjgur	990	26 59 21 N	64 05 46 E	316,385	Nil	Gichki, Raees, Muhammad, Hasni, Makrani, Shehdadzai, Mirwani	Zehri, Mengal, Badini, Rodini	Agriculture and Livestock
Pishin	1550	30 35 22 N	66 59 52 E	736,481	Kakar	Nil	Nil	Agriculture and Livestock
Quetta	1650	30 14 30 N	67 06 20 E	1.001 M	Kakar, Bazai, Kasi, Barech, Davi	Marri, Bugti	Raisani, Qambrani	Agriculture and Livestock
Sherani	1000	31 35 05 N	69 43 52 E	153,116	Sherani, Harifal	Nil	Nil	Agriculture and Livestock
Sibi	135	29 33 39 N	67 52 59 E	157,000	Nil	Chandio, Gishkori, Marri, Jatoi, Domki, Lashari, Rind	Shahwani, Bangulzai, Mengal, Lehri, Guhramzai, Jatak	Agriculture and Livestock
Surab	1771	28 29 08 N	66 15 17 E	200,000	Nil	Shehdadzai, Muhammad Hasni	Zehri, Mengal, Qambrani, Samalani	Agriculture and Livestock
Turbat	500	26 00 58 N	63 01 29 E	213,557	Nil	Gichki, Raees, Marri, Makrani, Raees, Mirwani	Zehri, Mengal	Agriculture and Livestock
Zhob	1400	31 21 35 N	69 25 19 E	46,248	Mandokhail, Kakar, Safi, Nasar, Babar, Lawoon	Nil	Nil	Agriculture and Livestock
Ziarat	2400	30 23 04 N	67 43 33 E	160,422	Kakar, Dotani, Panzai	Nil	Nil	Agriculture and Livestock

Data collection

The field surveys were conducted consecutively for three years in the Balochistan Province from spring 2018 to winter 2020. Purposive sampling techniques (Tongco, 2007) were used and participants were selected who were engaged with farming, pastoralism, ethnobotanical plant collection and horticulture. Informed consent from all participants was verbally obtained prior to conducting interviews and ethical guidelines prescribed by the International Society of Ethnobiology (ISE, 2008) were followed. During the course of survey, in-depth open ended and semi-structured interviews (Abbas et al., 2021) were conducted with 195 selected villagers (100 Pushtoons, 50 Balochis and 45 Barahvis) participants. Communication was made in houses, markets, village gathering areas and pasture lands.

Mostly, the conversations were made in Pushtoo by authors (2, 4, and 5) but used Urdu language as *Lingua Franca* with Balochi and Barahvi participants. The participants were ranged in ages from 20 to 80 years with 50 average ages. Respondents were asked about local name(s), gathering areas, the plant part(s) used, preparations recipes and marketing details. During the interviews, informants were always asked to show the reported plants (fresh or dried), whenever available. Moreover, the plants were photographed and collected in the field and identified by local guides. The taxonomic nomenclature was based mainly on Flora of Pakistan (Nasir, and Ali, 1970–1989; Ali, and Nasir, 1990–1991; Ali, and Qaiser, 1993–2018), and flora of China http://www.efloras.org/flora_page.aspx?flora_id=2. Botanical nomenclature and family assignments followed World Online Flora <http://www.worldfloraonline.org/>. The identified specimens were given voucher numbers, labeled, stamped and stored in Karachi University Herbarium Karachi, Pakistan.

Data analysis

The collected data were analyzed by Fidelity level (FL). FL is the percentage of informants claiming the use of plant species for same major purpose. It is calculated using the method as adopted by Friedman et al. (1986) and Alexiades and Sheldon (1996).

$$FL (\%) = lp / lu \times 100$$

Here,

lp is the number of informants who independently suggested the use of a plant species for a particular disease and *lu* is the total number of informants who mentioned the same plant for any disease.

A comparison of the ethnobotanical data among the considered linguistic groups was carried out by Jaccard Similarity Index (for each pair of the considered communities) (Abdul Aziz *et al.*, 2020a), used for gauging the similarity and diversity of sample sets, following the application designed by (González-Tejero *et al.*, 2008)

The Jaccard similarity index was calculated as follows:

$$J(X, Y) = |X \cap Y| / |X \cup Y|$$

X = Individual set of plant uses recorded among group X;

Y = individual set of plant uses recorded among group Y.

Furthermore, the collected data were qualitatively compared with the existing Pakistani food ethnobotanical literature (Abdul Aziz *et al.*, 2020b) in order to identify possible novel plant uses.

Results And Discussion

Respondents' demography

A total 195 informants (100 Pushtoons, 50 Balochis and 45 Barahvi) participated in the ethnobotanical interview processes. During the interviews, respondents were asked about wild vegetable gathering and use. Gender wise 150 men and 65 women responded for conversation. The little females' participation in survey reflects the social norms of the study area. The feudal lord system, conservative social set up, and family norms limit women's mobility outside the home or local community and interacting with others. Immobility not only limits women from interacting others but also limit access to economic opportunities, education, formal employment and participation in development (Bhasin, 2011). In such typical villages life and transhumant societies they are playing role as sheep owners, house servant and nurse. The World Bank identifies mobility as a key determinant of women's empowerment and finds the norms of seclusion the 'most important constraint' in women's access to services and participation in society and the economy (Morrison and Morrison, 2007). Based on social subsistence they were comprised of peasant (45%) farmers, shepherds (42%), wood cutters (10%), and gems miners (3%) and traditional healers (30%). Fifty five (28%) people were above 60 years followed 45 (23%) (between 40 and 60) and 30 (15%) (between 20 and 40). The respondents were from Pushtoon, Balochi and Barahvi ethnic background as depicted in Table 2. All participants were Muslims. Limited Christian and Hindu communities also reside in urban areas but they had little knowledge of wild food. It may be attributed with their close circled sociability and agricultural activities. They mostly use market-available wild vegetable species such as *Caralluma tuberculata*, *Portulaca oleracea*, *Amaranthus viridis*, and *Allium umbilicatum*, *Pinus gerardiana*. Pushtoons are more remarkable in gathering plants. The informants had varying levels of education with 68 (%) had no formal education, 35% primary level, 15%, Middle level, 5% high school level, 3% graduate, 2% masters level and only 2% above masters level. The majority of the interviewers lacked formal schooling. As illiteracy has always been a serious problem in Balochistan (Buzdar, 2018). Male and females are denied access to education, and literacy is low, particularly among females (Naz, 2003; Nawaz *et al.*, 2022). The dominated illiteracy particularly in women seems to be factor for their confidence and reclusiveness in addition to feudal social setup.

Table 2 Demographic features of participants.					
Variables		Pushtoon	Balochi	Barahvi	Total
Sex ratio	Men	70	30	30	130
	Women	30	20	15	65
Religion (faith)	Muslim (Sunni)	Muslim (Sunni)	Muslim (Sunni)	Muslim (Sunni)	NA
(Ahmad and Akif, 2007)	Between 20–40 years	30	25	22	
	Between 40–60 years	45	50	55	
	Between 60–80 years	55	65	70	
Education Level	Illiterate	68	70	70	
	Primary	35	30	28	
	Middle	15	10	9	
	High School	5	4	4	
	Graduate	3	2	2	
	Masters	2	2	2	
	Above master	2	1	1	
Livelihoods	Farmers	45	30	40	
	Shepherds	42	55	45	
	Wood cutters	10	5	6	
	Gemstone workers	3	2	2	
	Healers	30	20	25	

The reasons for the lack of standard education in Balochistan are many lack of awareness, socio-economic problems, law and order situation, and lack of facilities which, in turn, results from the lack of interest on the part of the authorities concerned. The agriculture sector is relatively smaller as only 5% of the province is covered by the Indus basin. The province of Balochistan possesses a vast geographical area and low capacity for education service, has traditionally ranked lowest among education indicators in Pakistan (Ahmad and Akif, 2007). It characterized with low net enrolment rate in education institute (<https://www.unicef.org/pakistan/stories/unicef-eu-supported-balochistan>) (Niaz et al., 2021).

Taxonomic diversity and utilization of wild edible plants

The present study came up with the inventory of 140 wild edible plant taxa in 44 families and 105 genera. The families showed maximum presentation were Brassicaceae (15 species) followed Asteraceae (14 species), Apiaceae and Liliaceae (9 species each); Lamiaceae (8 species), and Rhamnaceae, Rosaceae and Polygonaceae (6 species each). The habit of recorded species was annual herbs (68 species) the most utilized group followed by shrubs (38), perennial herbs (22) and trees (10) (Fig. 4).

Table 3
Presentation of families in wild edible plants of the region.

Family	No. of species	Total No. of species	%	Family	No. of species	Total No. of species	%
Aizoaceae	1	140	0.714	Nyctaginaceae	1	140	0.714
Amaranthaceae	2	140	1.428	Oleaceae	1	140	0.714
Amaryllidaceae	8	140	5.714	Oxalidaceae	1	140	0.714
Anacardiaceae	3	140	2.142	Pinaceae	1	140	0.714
Apiaceae	9	140	6.428	Plantaginaceae	1	140	0.7142
Arecaceae	1	140	0.714	Poaceae	2	140	1.4285
Asclepidaceae	2	140	1.428	Polygonaceae	6	140	4.285
Asphodelaceae	1	140	0.714	Portulacaceae	1	140	0.714
Asteaceae	14	140	10	Lythraceae	1	140	0.714
Boraginacea	2	140	1.428	Rhamnaceae	6	140	4.285
Brassicaceae	15	140	10.714	Rosaceae	6	140	4.285
Capparaceae	2	140	1.428	Salvadoraceae	1	140	0.714
Caprifoliaceae	1	140	0.714	Sapotaceae	1	140	0.7142
Caryophyllaceae	2	140	1.428	Solanaceae	5	140	3.571
Chenopodaceae	3	140	2.1428	Tiliaceae	1	140	0.714
Convolvulaceae	1	140	0.714	Typhaceae	1	140	0.714
Cucurbitaceae	2	140	1.428	Ulmaceae	1	140	0.714
Ephedraceae	3	140	2.142	Valerianaceae	1	140	0.714
Fabaceae	4	140	2.857	Vitaceae	1	140	0.7142
Geraniaceae	1	140	0.714	-	-	-	-
Grossulariaceae	1	140	0.714	-	-	-	-
Lamiaceae	8	140	5.714	-	-	-	-
Leonticaceae	1	140	0.714	-	-	-	-
Liliaceae	9	140	6.428	-	-	-	-
Menispermaceae	1	140	0.714	-	-	-	-
Moraceae	3	140	2.142	-	-	-	-

Gathering habitats, used categories and recipes

All species were found to be restricted to particular habitat types. The wild food plant species were gathered from variety of habitats mostly from dry mountain slopes (63 species, 45.7%). The other habitat types contributed as wild food plants 30 species from plains areas, 35 species from cultivated lands, 6 species found along water channels, on the banks of rivers and streams. 3 species reported from mountain rocks and remaining 3 species grown as weed in crop fields. Balochistan's mountains are semi-arid and display dry and rocky slopes of different exposure (Abbas et al., 2018). The use pattern was classified eight (8) used categories i.e. beverages (8 species), beverages and flavor (1 species), edible fresh (47 species), flavor (7 species), salad (14 species), vegetable (46 species), vegetable and flavor (2 species), vegetable and salad (15 species). The use of wild edible species, consumed in many ways in the study area, depends on taste and preference. There were many recipes for the preparation of wild vegetables in the area. The cooking methods reported for all wild vegetables in the different cultural communities of Balochistan derived from interviewing the local people. A large number of leafy vegetables including *Sonchus oleraceus*, *Cucumis prophetarum*, *Goldbachia pendula*, *Polygonum polycnemoides*, *Lepidium draba*, *Chenopodium album*, *Polygonum aviculare*, *Portulaca oleracea*, *Erodium cicutarium*, *Silene Conoidea*, *Rumex chalepensis*, *Trigonella foenum-graceum*, *Descurainia Sophia*, *Sisymbrium altissimum*, *Lactuca orientalis*, *Rumex vesicarius*, *Chenopodium foliosum*, *Strigosella cabulica* are boiled in water until water is vaporized then added fried onion and garlic. Tomatoes, green chilies, coriander and cumin may be added, depending on their availability and flavor.

Ferula oopoda fresh stem, *Mentha royleana*, fresh leaves and green twigs of *Ferula assa-foetida* are collected roasted and serve as salad. *Allium rubellum*, *Peucedanum beluchistanicum* and *Peucedanum ferulaefolium* also used in salads. Bulbs of *Fritillaria gibbosa* locally known as *Gagra*, and *Gagea quettica*, *Gagea Balochistanica* and *Gagea persica* known as Anjuri in Pushto are dug out and used as salad also cooked with vegetables. Many wild plants are used in making beverages *Lallemantia royleana*, *Thymus linearis*, *Hymenocrater sessilifolius*. The whole plants of *Plantago amplexicaulis* cut, soaked in cold water and kept in shade for few minutes then taken as cold drink in summer season. *Hymenocrater sessilifolius* leaves are soaked in water over night and the

infusion utilize as morning drink. Fresh as well as dried leaves of *Thymus linearis* used in flavoring food and making Qehwa (boiled drink) tea without milk. Crushed seeds of *Ziziphora tenior*, *Lallemantia royleana* and leaves are also used in drinks. The fresh fruits of *Cucumis prophetarum* cut into pieces and cooked with onion and tomatoes. Seeds/grain of *Panicum antidotale* ground and used in making bread. In most of the cases it is reported that fresh fruits are directly eaten but *Cordia ghraf* and *Capparis spinosa* cooked fruits are eaten with curd, fruits are also used in making pickle. Fruits *Solanum incanum* and *Withania coagulans* used in making cheese. *Punica granatum* Fruits are dried ground into powder and used as salt. A local sweet dish *Pusa* made by grinding *Pistacia atlantica* fruits with sugar and eaten it with breads.

Part(s) used and marketing of WEPs

The inhabitants of Balochistan province were using 12 different plant parts in their wild edible plants. All the wild vegetables are mainly consumed in young growing stages. Mostly the green leaves or aerial parts of the plant are used. Leaves (54 species) and fruits (44 species) were the frequent using plant part. The utilization of other parts was revealed as tubers (13 species), bulb (11 species), whole plant (8 species), flowers (4 species), seeds (4 species), shoots (3 species), young stem (2 species), petiole (1 species), twig (1 species) and inflorescence (1 species). The studied communities were selling only 33 (23.57%) species of WEPs in the local markets with prizes ranging from 50 to 800 rupees. The major remaining portion 107 (77%) species were in traditional food practices. This endorses the high species richness and significant indigenous knowledge of food ethnobotany. The WEPs potential of the area may be transformed to for agricultural diversification. This practice would be effective for easy survival, economic development and food security of the arid province (Aziz et al., 2022). The remote communities are traditional and have limited socio-economical perceptions to change their life routines. They are oblivious of possible innovation using the wealth of these advantageous plants. The long term social activities may underpin to know the worth and effective practice for its sustainability and socioeconomic development.

Table 4
Botanical, vernacular, ecological and ethnobotanical description of wild edible Flora of Balochistan Province, North Western Pakistan.

Botanical Taxon/ Family/voucher code	Vernacular name in Pushto (P), Balochi (B) & Barahvi (V)	Habit/ Gathering area	Used categories	Used part(s)	Gastronomic recipe	Market Selling	RFCs
<i>Zaleya pentandra</i> (L.) C. Jeffrey Aizoaceae	Wahu (P), Lular, Wahu (V)	Ph /Plain areas	Vegetable	Leaves	Leaves are chopped and cooked as vegetable	No	0.01025641
<i>Amaranthus blitum</i> L. /Amaranthaceae	Mariro (P)	Ah /Grows as weed	Vegetable	Whole plant	Whole plant collected, cut into pieces and cooked with spices	No	0.153846154
<i>Amaranthus viridis</i> L./ Amaranthaceae	Saag (P), zahrin kalpir (B)	Ah /Grows as weed	Vegetable	Leaves	Leaves collected, boiled and cooked with onion, tomatoes and spices	No	0.256410256
<i>Allium umbilicatum</i> Boiss. /Amaryllidaceae	Piazan (P), Pimalako (B & V)	Ah /Among cultivated fields	Vegetable, salad	Leaves, Bulbs	Fresh leaves used as salad, bulbs used in place of onion in curry	Yes Rs.200 /Kg	0.256410256
<i>Allium zhobicum</i> /Amaryllidaceae	Khatol (P)	Ah /Plain areas	Salad	Whole plant	Whole plant cut into pieces and used as salad	No	0.102564103
<i>Allium registanicum</i> Wendelbo/ Amaryllidaceae	piazi, Anjori (P)	Ah /Plain areas	Salad	Leaves	Leaves eaten as salad	No	0.076923077
<i>Allium rubellum</i> M.Bieb./ Amaryllidaceae	Anjori (P)	Ah /Mountain slopes	Salad	Leaves, bulbs	leaves collected and bulbs dug out peeled and eaten as salad	No	0.051282051
<i>Allium caroli-henrici</i> Wendelbo/ Amaryllidaceae	Sur Khatool (P)	Ah /Plain areas	Vegetable	Bulbs	dug out Bulbs are peeled and cooked with vegetables and spices	No	0.025641026
<i>Allium dolichostylum</i> Vved./ Amaryllidaceae	Khokhai (P)	Ah /Plain areas	Salad	Leaves	Leaves chopped and used in salad	No	0.020512821
<i>Allium griffithianum</i> Boiss./ Amaryllidaceae	Khokhai, Kokan (P)	Ah /Plain areas	Salad	Leaves	Leaves eaten as salad	No	0.066666667
<i>Allium roylei</i> Stearn/ Amaryllidaceae	Kokan (P)	Ah /Mountain slopes	Vegetable	Leaves, bulb	leaves and bulb are cooked as vegetables	No	0.051282051
<i>Pistacia atlantica</i> Desf. /Anacardiaceae	Sharawan Shanay (P), Gwan, Badwar, Yadun, Gir (B), Kasor (V)	Tr /Mountain slopes	Edible	Fruits	Fruits are ground with Sugar (GHUR) for making sweet local recipe known as <i>Pusa</i> .	Yes Rs.200/Kg	0.153846154

Botanical Taxon/ Family/voucher code	Vernacular name in Pushto (P), Balochi (B) & Barahvi (V)	Habit/ Gathering area	Used categories	Used part(s)	Gastronomic recipe	Market Selling	RFCs
<i>Rhus mysurensis</i> B. Heyne ex Wight & Arn./ Anacardiaceae	Kahira (B), Kasela (V)	Sh /Mountain rocks	Edible	Fruits	Fresh fruits are edible	No	0.01025641
<i>Pistacia khinjuk</i> Stocks/ Anacardiaceae	Uzhgai, Shanay (P), Khinjuk (B), Kasur (V)	Tr /Mountain slopes	Edible	Fruits	Fresh fruits are eaten. Local sweet dish i.e. is <i>Pusa</i> is made.	Yes Rs.200/Kg	0.153846154
<i>Ferula assa-foetida</i> L./ Apiaceae	Hanja, Raghiband (P), Hing (B), Hing (V)	Ah /Among cultivated fields	Edible	Branches	The green twigs are roasted on low flam and used in salad	Yes Rs.800/Kg	0.102564103
<i>Ferula oopoda</i> (Boiss. & Buhse) Boiss./ Apiaceae	Lewanai, Raghiban, Da Ushenar (P), Hing (B), Hanjir (V)	Ah /Mountain slopes	Salad	Stem	The fresh stem roasted on low flame and used as salad	Yes Rs.800/Kg	0.102564103
<i>Ferula costata</i> Korovin ex Nasir/ Apiaceae	Stagh (P), Hing (B), Hing (V)	Ah /Mountain slopes	Salad	Branches	The fresh juicy green stem & branches are used as salad or sucked its juice	Yes Rs.800/Kg	0.102564103
<i>Elwendia persica</i> Boiss./ Apiaceae	Tora Zira (P), Hum (B)	Ah /Mountain slopes	Flavour	Seeds	Seeds are collected dried and used flavouring food	Yes Rs.300/Kg	0.051282051
<i>Peucedanum aucheri</i> Boiss./ Apiaceae	Raghibolai (P)	Ah /Mountain slopes	Salad	Leaves	Fresh leaves used as Salad	Yes Rs.200/Kg	0.046153846
<i>Peucedanum beluchistanicum</i> Wolff/ Apiaceae	Raghibolai (P)	Ah /Mountain slopes	Salad	Leaves	Fresh leaves used as Salad	Yes Rs.200/Kg	0.041025641
<i>Peucedanum ferulaefolium</i> Gilli / Apiaceae	Raghibolai (P)	Ah /Mountain slopes	Salad	Leaves	Fresh leaves used as Salad	Yes Rs.200/Kg	0.035897436
<i>Schumannia karelinii</i> (Bunge) Korovin/ Apiaceae	Da murghai pushi (P)	Ah /Plain areas	Vegetable	Tuberous roots	dug out Bulbs are peeled and cooked with vegetables and spices	No	0.01025641
<i>Foeniculum vulgare</i> Mill./ Apiaceae	khwazawalani (P), Rizeh (B), Raz (V)	Ah /Among cultivated fields	Edible	Fruits	Fresh fruits are edible	Yes Rs.150/Kg	0.061538462
<i>Nannorrhops ritchiana</i> (Griff.) Aitchison/ Arecaceae	Mazari (P), Daz (B), Pesh (V)	Sh /Mountain slopes	Edible	Fruit	Fresh fruits are edible	No	0.030769231
<i>Glossonema varians</i> (Stocks) Benth. ex Hook.f./ Asclepidaceae	Gulloo Khurram (P), Shagoshag, Guragunduk, Galaon (B), Munga, Khurumb, Khurram (V)	Ah /Along water channels	Edible	Fruits	Fruit are edible	No	0.015384615

Botanical Taxon/ Family/voucher code	Vernacular name in Pushto (P), Balochi (B) & Barahvi (V)	Habit/ Gathering area	Used categories	Used part(s)	Gastronomic recipe	Market Selling	RFCs
<i>Caralluma tuberculata</i> N.E.Br./ Asclepidaceae	Pamanay (P), Marmotak (B), Apitak (V)	Ph /Mountain slopes	Vegetable	Whole plant	Whole plant collected, chopped and cooked as vegetable	Yes Rs.200/Kg	0.102564103
<i>Asphodelus tenuifolius</i> Cav. /Asphoelaceae	Basri (P), Pimaluk (B)	Ah /Plain areas	Vegetable, salad	Flowers, leaves	Boiled flowers eaten as vegetable, Leaves used as salad or cook as vegetable	No	0.179487179
<i>Scorzonera paradoxa</i> Fisch. & C.A.Mey./Asteraceae	Dagham (B), Asguch (V)	Ph /Mountain slopes	Vegetable	Tubers	Tubers dug out, peeled and used in place of onion in curry	No	0.01025641
<i>Sonchus oleraceus</i> (L.) L. /Asteraceae	Azghai (P), Kalamo, Gogru (B), Agut (V)	Ah /Along water channels	Vegetable	Leaves	The fresh leaves are collected boil in water and fried.	No	0.102564103
<i>Launaea procumbens</i> (Roxb.) Ramayya & Rajagopal/ Asteraceae	Shatrag Bhuttri (P), Shanturrug (B)	Ah /Plain areas	Vegetable	Leaves	Leaves are chopped and cooked as vegetable	No	0.030769231
<i>Helianthus annuus</i> L./ Asteraceae	Namar gulai, Zarhgulai (P)	Ah /Among cultivated fields	Edible	Seeds	Seeds are collected and dried to eat	Yes Rs.100/Kg	0.025641026
<i>Epilasia acrolasia</i> (Bunge) Lipsch./ Asteraceae	Sarshako (B)	Ah /Among cultivated feilds	Salad	Leaves	Fresh leaves are collected and used in salad	No	0.01025641
<i>Cymbolaena griffithii</i> (A.Gray) Wagenitz/ Asteraceae	Da Murghai pusha (P)	Ah /Among cultivated feilds	Vegetable	Whole plant	Young herbaceous plants are mixed with onion and cooked as vegetable	No	0.01025641
<i>Lactuca orientalis</i> (Boiss.) Boiss./ Asteraceae	Sandrashai, Sandran (P), Mrialko (B), Aghut (V)	Sh /Among cultivated feilds	Vegetable	Leaves	Young Leaves, shoots used in Salad as well as chopped and cooked as vegetable	No	0.01025641
<i>Scorzonera raddeana</i> C.Winkl./ Asteraceae	Arghuch (P), Dagham (B), Asguch (V)	Ph /Mountain slopes	Vegetable	Tubers	Tuberous roots dug out and cooked with other vegetables	No	0.01025641
<i>Koelpinia linearis</i> Pall./ Asteraceae	Shawai Rish (P), Murubi, Zimpud, Zampad (B), Rish-buzuk (V)	Ah /Mountain slopes	Vegetable	Leaves	Leaves are cooked as vegetables	No	0.01025641

Botanical Taxon/ Family/voucher code	Vernacular name in Pushto (P), Balochi (B) & Barahvi (V)	Habit/ Gathering area	Used categories	Used part(s)	Gastronomic recipe	Market Selling	RFCs
<i>Scorzonera pusilla</i> Pall./ Asteraceae	Paroka (P), Dagham (B), Asguch (V)	Ph /Mountain slopes	Vegetable	Tubers	Tubers are mixed with vegetables and cooked.	No	0.01025641
<i>Reichardia tingitana</i> (L.) Roth/ Asteraceae	Dodolak (P)	Ah /Mountain slopes	Vegetable	Leaves	Fresh or dried leaves are chopped and cooked as vegetable	No	0.01025641
<i>Scorzonera litwinowii</i> Krasch. & Lipsch./ Asteraceae	Papoka (P), Dagham (B), Asguch (V)	Ph /Plain areas	Vegetable	Tubers	Tuberous roots are dug out and cooked as vegetable	No	0.01025641
<i>Tragopogon gracilis</i> D.Don	Shabe (P)	Ph /Mountain slopes	Vegetable	Leaves	Leaves are cooked as vegetables	No	0.01025641
<i>Lactuca dissecta</i> D.Don/ Asteraceae	Poi boti (V)	Ah /Mountain slopes	Vegetable	Whole plant	Whole plant collected chopped and cooked as vegetable	No	0.01025641
<i>Cordia ghraf</i> (Forssk.) Ehren. Ex Asch/ Boraginacea	Lasori (P), Jangli Liwar (B)	Sh /Plain areas	Flavor	Fruit	Ripened fruits are edible and used in making pickles	No	0.01025641
<i>Ehretia obtusifolia</i> Hochst. ex A.DC./ Boraginacea	Kanero ,sio (P), Kahiho (B), Puzo gowangi (V)	Sh /Plain areas	Edible	Fruits	Fresh fruits are edible	No	0.025641026
<i>Menoicus linifolius</i> (Steph. ex Willd.) DC/Brassicaceae	Ghoelera (P)	Ah /Mountain slopes	Vegetable	Whole plant	Whole plant collected cut into pieces and cooked as vegetable	No	0.102564103
<i>Alliaria petiolata</i> (M.Bieb.) Cavara & Grande/ Brassicaceae	Sagpanre (P)	Ah /Mountain slopes	Vegetable, flavour	Leaves	Leaves eaten as salad as well as used flavouring food	No	0.061538462
<i>Strigosella africana</i> (L.) Botsch. / Brassicaceae	Khatol (P), Chambar, Sochako, Chambrak (B), Bahushok, Chamav (V)	Ah /Among cultivated feilds	Vegetable	Whole plant	Whole parts of plant cooked as vegetable	No	0.051282051
<i>Lepidium sativum</i> L./ Brassicaceae	Tartezak (P)	Ah /Among cultivated fields	Salad	Leaves	Fresh leaves are collected and used as salad	No	0.025641026
<i>Diplotaxis griffithii</i> (Hook.f. & Thomson) Boiss./ Brassicaceae	Tarikh sag,Sizgai (P), Janbo (B), Janbo (V)	Ah / Mountain slopes	Vegetable, salad	Leaves	Fresh leaves cooked as vegetable as well as used as salad	No	0.020512821

Botanical Taxon/ Family/voucher code	Vernacular name in Pushto (P), Balochi (B) & Barahvi (V)	Habit/ Gathering area	Used categories	Used part(s)	Gastronomic recipe	Market Selling	RFCs
<i>Crambe cordifolia</i> Steven/ Brassicaceae	Skharyai (P)	Ph /Mountain slopes	Vegetable	Roots, leaves	Root and leaves both are cooked as vegetable	No	0.01025641
<i>Lepidium draba</i> L./ <i>Cardaria draba</i> / Brassicaceae	Baska (P), Bush (B), Halia (V)	Ah /Among cultivated feilds	Vegetable	Leaves, Shoots	Fresh leaves and shoots are collected cut into pieces and cooked as vegetable	No	0.025641026
<i>Sisymbrium altissimum</i> L./ Brassicaceae	Roosh (p), Guto (B), Roosh (V)	Ah /Among cultivated feilds	Vegetable, salad	Leaves, shoots	Young Leaves, shoots used in Salad as well as chopped and cooked as vegetable	No	0.061538462
<i>Strigosella cabulica</i> Boiss./ Brassicaceae	Khatool (P), Ochrikawa (B), Ochrikawa (V)	Ah /Mountain slopes	Vegetable	Leaves	Fresh leaves cooked as vegetable with spices	No	0.051282051
<i>Sisymbrium brassiciforme</i> C.A. Mey. / Brassicaceae	Buskai (P), Shuvaran (B), Shuvaran (V)	Ah /Plain areas	Vegetable	Leaves	Young Leaves and shoots chopped and cooked as vegetable as well as used as salad	No	0.046153846
<i>Descurainia sophia</i> (L.) Webb ex Prantl/ Brassicaceae	Roosh (P)	Ah /Among cultivated feilds	Vegetable, salad	Leaves	Fresh leaves used as salad as well as cooked as vegetable	No	0.030769231
<i>Goldbachia pendula</i> Botsch./ Brassicaceae	Gwapanre (P)	Ah /Among cultivated feilds	Vegetable	Leaves	Fresh leaves are collected chopped and cooked as vegetable	No	0.015384615
<i>Goldbachia laevigata</i> (M.Bieb.) DC./ Brassicaceae	Gwapanre (P)	Ah /Among cultivated feilds	Vegetable	Leaves	Leaves are collected, chopped boiled and cooked as vegetable	No	0.015384615
<i>Moricandia sinaica</i> (Boiss.) Boiss./ Brassicaceae	Sezgai panre	Ph /Mountain slopes	Vegetable	Leaves	Leaves are cooked as vegetables	No	0.01025641
<i>Sisymbrium irio</i> L.	Shersham (P), Roosh (B), Roosh (V)	Ah /Grows as weed	Salad	Leaves	Young Leaves used as Salad	No	0.051282051
<i>Capparis decidua</i> (Forssk.) Edgew./ Capparaceae	Kirha (P), Kaled (B & V)	Sh /Plain areas	Edible	Fruits	Fresh fruits are edible	No	0.117948718

Botanical Taxon/ Family/voucher code	Vernacular name in Pushto (P), Balochi (B) & Barahvi (V)	Habit/ Gathering area	Used categories	Used part(s)	Gastronomic recipe	Market Selling	RFCs
<i>Capparis spinosa</i> L./ Capparaceae	Kirof (P), Khawarg (B), Pahinro (V)	Sh /Mountain rocks	Flavor	Fruits	Cooked fruits are eaten with curd, fruits are also used in making pickle	No	0.076923077
<i>Viburnum cotinifolium</i> D. Don./ Caprifoliaceae	Thorayi (P)	Sh /Mountain slopes	Edible	Fruits	Fresh fruits are edible	No	0.01025641
<i>Acanthophyllum squarrosum</i> Boiss./ Caryophyllaceae	Khah Aghagzai, Shalwar-Dirr (P), Shah- verdar, Kucha- ghazi (B), Kanda Bagh (V)	Sh /Mountain slopes	Edible	Root, flower	Roots are dug out, dried and ground into fine powder mixed with flower and eaten in the form of pastry	No	0.051282051
<i>Silene conoidea</i> L./ Caryophyllaceae	Gardi (P), Dardiri (V)	Ah /Among cultivated feilds	Vegetable	Leaves	Fresh leaves used as salad as well as cooked as Vegetable	No	0.015384615
<i>Haloxylon griffithii</i> (Moq.) Boiss./ Chenopodaceae	Shorai (P), Traht, Kaal (B), Sadagh, Lana, Bundi (V)	Sh /Plain areas	Edible	Seeds	Dry seeds are edible	No	0.01025641
<i>Chenopodium foliosum</i> Asch./ Chenopodaceae	Sag (P)	Ah /Mountain slopes	Vegetable	Leaves, inflorescence	Fresh leaves and Inflorescence chopped and cooked as vegetable	No	0.01025641
<i>Chenopodium album</i> L./ Chenopodaceae	Torsag (P), Lullar, Kalpir, Maliro (B), Maler (V)	Ah /Among cultivated feilds	Vegetable	Leaves	Fresh leaves are collected, boiled and cooked	No	0.102564103
<i>Convolvulus spinosus</i> Burm. f./ Convolvulaceae	Lawanar (P), Dolko, Ritachak (B), Delankur, Titok, Sahsa (V)	Sh /Mountain slopes	Vegetable	Flowers	Fresh flowers are boiled and cooked with spices and onion	No	0.020512821
<i>Cucumis prophetarum</i> L./ Cucurbitaceae	Zaran chibit (B)	Ph /Among cultivated feilds	Flavor	Leaf	The fresh fruits are collected, cut into pieces and cooked with onion and tomato	No	0.01025641
<i>Cucumis melo var agrestis</i> Naudin/ Cucurbitaceae	Gidra wal (P), Golaro (B), Chibarwal (V)	Ah /Among cultivated feilds	Vegetable	Fruit	Fresh fruit collected, boiled and cooked as vegetable	Yes Rs. 50/Kg	0.025641026
<i>Ephedra intermedia</i> Schrenk & C.A.Mey. Ephedraceae	Ghat oman (P), Sarshako (B), Hum (B), Narom (V)	Sh /Mountain slopes	Edible	Fruits	Fresh fruits are edible	Yes Rs.400/Kg	0.076923077
<i>Ephedra procera</i> C.A.Mey. /Ephedraceae	Narai Oman (P), Hum (B), Narom (V)	Sh /Mountain slopes	Edible	Fruits	Fresh fruits are edible	Yes Rs.400/Kg	0.076923077

Botanical Taxon/ Family/voucher code	Vernacular name in Pushto (P), Balochi (B) & Barahvi (V)	Habit/ Gathering area	Used categories	Used part(s)	Gastronomic recipe	Market Selling	RFCs
<i>Ephedra gerardiana</i> Wall. ex Stapf. Ephedraceae	Narai Oman (P), Hum (B), Narom (V)	Sh /Mountain slopes	Edible	Fruits	Fresh fruits are edible	Yes Rs. 400/Kg	0.076923077
<i>Prosopis cineraria</i> (L.) Druce/ Fabaceae	Kikar (P), Mer (B), Hajero (V)	Tr /Plain areas	Vegetable	Seeds, Pods	Seeds are edible, Immature pods cooked as vegetable	No	0.01025641
<i>Erodium cicutarium</i> (L.) L'Hér./ Geraniaceae	Sagdandan, /Wazai (P), Saidandan (B), Saidandan (V)	Ah /Among cultivated feilds	Vegetable	Leaves	Leaves boiled and cooked with spices	No	0.01025641
<i>Ribes heterotrichum</i> C.A. Mey/ Geraniaceae	Sre nane (P)	Sh /Mountain rocks	Edible	Fruits	Fresh fruits are edible	No	0.01025641
<i>Lallemantia royleana</i> (Benth.) Benth./ Lamiaceae	Malangian (P)	Ah /Among cultivated feilds	Beverage	Seeds	Seeds are crushed and used in making drinks	Yes Rs. 200/Kg	0.041025641
<i>Ziziphora tenior</i> L./ Lamiaceae	Mori (P), Indarkah (B)	Ah /Among cultivated feilds	Beverage	Seeds, leaves	Seeds are crushed and leaves are chopped and used as local drink	No	0.015384615
<i>Nepeta bracteata</i> Benth./ Lamiaceae	Zufa Sugarai (P), Simsok (B), Chingum boti (V)	Ah /Mountain slopes	Beverage	Leaves	Fresh leaves are collected, crushed and used in making drinks	No	0.01025641
<i>Perovskia abrotanoides</i> Kar./ Lamiaceae	Gwaree, Tirkh (P), Torik (B), Purchenk (V)	Sh /Mountain slopes	Beverage	Leaves	Fresh leaves are collected, chopped and used in making local drinks	No	0.01025641
<i>Hymenocrater sessilifolius</i> Benth./ Lamiaceae	Sarsanda v	Ph /Mountain slopes	Beverage	Leaves	Leaves are soaked in water over night and the infusion utilize as morning drink	No	0.01025641
<i>Perovskia atriplicifolia</i> Benth./ Lamiaceae	Gwari (P), Gowaridarna (B), Gowaridarna (V)	Ph /Mountain slopes	Vegetable, salad	Flower	Fresh flower are used as salad or cooked as vegetable	No	0.01025641
<i>Mentha royleana</i> Wall. ex Benth. / Lamiaceae	Shinshobai (P), Purchinak (B), Purchinak (V)	Ph /Along water channels	Salad	Leaves	The fresh leaves are collected roasted and used as salad. Sometimes used fresh leaves are used without roasting.	Yes Rs.200/Kg	0.051282051

Botanical Taxon/ Family/voucher code	Vernacular name in Pushto (P), Balochi (B) & Barahvi (V)	Habit/ Gathering area	Used categories	Used part(s)	Gastronomic recipe	Market Selling	RFCs
<i>Thymus linearis</i> Benth./ Lamiaceae	Marvai (P)	Ah /Mountain slopes	Beverage, flavour	Leaves	Fresh as well as dried leaves used in flavouring food and making tea	No	0.01025641
<i>Bongardia chrysogonum</i> (L.) Spach/ Lamiaceae	Pucca Tutucka (P), Pashmook-i- talkh (B)	Ph /Mountain slopes	Vegetable, salad	Root	Roots are eaten as salad and cooked with jawari (corn) flour in making pastries	No	0.025641026
<i>Eremurus stenophyllus</i> (Boiss. & Buhse) Baker/ Lilliacae	Shaze (P), Sarshako (B), Sarshako (V)	Ph /Mounatin slopes	Vegetable	Leaves	Leaves collected chopped and cooked with meat	Yes Rs.70/Kg	0.056410256
<i>Eremurus persicus</i> (Jaub. & Spach) Boiss./ Lilliacae	Da khara shazay (P), Sarshako (V)	Ah /Plain areas	Vegetable	Leaves	Leaves are cooked as vegetable	Yes Rs.70/Kg	0.056410256
<i>Tulipa stellata</i> Hook./ Lilliacae	Khatol, sindai (P), Govarikh (B), Govarikh (V)	Ph /Mountain slopes	Vegetable	Bulbs	Bulbs are dug out peeled and used as salad or cooked vith vegetables	No	0.051282051
<i>Ixiolirion tataricum</i> (Pall.) Schult. & Schult.f./ Lilliacae		Ghunyaray, Charasakay (P), Bulah (B), Bulah (V)	Ah /Among cultivated fields	Vegetable, salad	Bulbs	Bulbs are dug out, peeled and used as salad as well as cook as vegetable	No
<i>Gagea quettica</i> Levichev & Ali/ Lilliacae		Unjorai, Da mala, ghanrakai (P)	Ah /Plain areas	Vegetable, salad	Bulb	Bulb are dug out used as salad and cooked with vegetables	No
<i>Gagea Balochistanica</i> Levichev & Ali		Unjorai (P)	Ah /Plain areas	Vegetable, salad	Bulb	Bulb are dug out used as salad and cooked with vegetables	No
<i>Gagea persica</i> Boiss./ Lilliacae		Unjorai (P)	Ah /Plain areas	Vegetable, salad	Bulb	Bulb are dug out used as salad and cooked with vegetables	No
<i>Fritillaria gibbosa</i> Boiss./ Lilliacae		Gagara (P)	Ph /Plain areas	Vegetable, salad	Bulb	Bulb are dug out used as salad and cooked with vegetables	No
<i>Tulipa lehmanniana</i> Merckl/ Lilliacae		Sur sindai, Sindai (P), Govarikh (B), Govarikh (V)	/Mountain slopes	Vegetable, salad	Bulbs	Bulbs are dug out peeled and used as salad or cooked vith vegetables	No

Botanical Taxon/ Family/voucher code	Vernacular name in Pushto (P), Balochi (B) & Barahvi (V)	Habit/ Gathering area	Used categories	Used part(s)	Gastronomic recipe	Market Selling	RFCs
<i>Cocculus pendulus</i> (J.R.Forst. & G.Forst.) Diels/ Menispermaceae		Zamor, Parwatki (P), Zahmur (B), Zamur (V)	Sh /Mountain slopes	Vegetable	Root, leaves	Roota and leaves both are cooked as vegetable	No
<i>Ficus johannis</i> Boiss./ Moraceae		Inzar ,Injeer (P), Anjir (B), Hanjir (V)	Sh /Mountain slopes	Edible	Fruits	Fresh fruits are edible	No
<i>Ficus carica</i> sub/spp carica L./Moraceae		Inzar (P), Anjir (B), Hanjir (V)	Sh /Mountain slopes	Edible	Fruits	Fresh fruits are edible	Yes Rs.200/Kg
<i>Ficus palmata</i> Forssk./ Moraceae		Inzar (P), Anjir (B), Hanjir (V)	Sh /Mountain slopes	Edible	Fruits	Fresh fruits are edible	No
<i>Boerhavia procumbens</i> Banks ex Roxb./ Nyctaginaceae		Khurhchaka (P) Pathri (B)	Ph /Plain areas	Vegetable	Tuberous roots	Tuberous roots are dug out and cooked as vegetable	No
<i>Olea ferruginea</i> (Aiton) Steud./ Oleaceae		Showan, Shananai (P), Khat (B), Kato, Khot (V)	Tr /Mountain slopes	Edible	Fruits	Fresh fruits are edible	Yes Rs.80/Kg
<i>Oxalis corniculata</i> L./ Oxalidaceae		Lewnai booti (P)	Ah /Among cultivated fields	Edible	Leaves	The fresh leaves are collected and chew by children	No
<i>Trigonella foenum-graceum</i> L./ Papalioneae		Mulkhuzay (P)	Ah /Among cultivated fields	Vegetable, flavour	Leaves	Leaves are cooked with vegetables to flavour the curry	Yes Rs.100/Kg
<i>Vicia monantha</i> Retz./Fabaceae		Matar (P)	Ah /Among cultivated fields	Edible	Seeds	Fresh seeds are edible	No
<i>Lathyrus aphaca</i> L./ Fabaceae		Zanghli matar (P), Rewari (B), Rewari (V)	Ah /Among cultivated fields	Edible	Fruits, seeds	Used as fruit/ Seeds collected and dried to eat	No
<i>Caragana ambigua</i> Stocks / Fabaceae		Makhai (P), Chairraj, Chitik (B), Chidrig (V)	Sh /Mountain slopes	Vegetable, salad	Flowers, fruits	yellow flowers eaten as salad as well as Fruits are cooked with meat	No
<i>Pinus gerardiana</i> Wall. ex D.Don/ Pinaceae		Zanrghozai,Chalghoza (P)	Tr /Mountain slopes	Edible	Seeds	Fresh fruits are edible	Yes Rs.5000/Kg
<i>Plantago amplexicaulis</i> Cav./ Plantaginaceae		Spaghol, Shingpara, Danich (P), Danchik (B)	Ah /Along water channels	Beverage	Whole plant	The whole plants are cut and soaked in cold water. Kept in shade for some time then taken as cold drink	No

Botanical Taxon/ Family/voucher code	Vernacular name in Pushto (P), Balochi (B) & Barahvi (V)	Habit/ Gathering area	Used categories	Used part(s)	Gastronomic recipe	Market Selling	RFCs
<i>Panicum miliaceum</i> L./ Poaceae		Azbhan, China (P), Azhdum (B), Azhdun (V)	Ah /Plain areas	Edible	Seeds	Seeds/grain ground into flour and used in making bread	No
<i>Panicum antidotale</i> Retz./ Poaceae		Washa (P), Gharam (B), Gomaz (V)	Ah /Among cultivated fields	Edible	Seeds	Seeds are ground into flour and used in making bread	No
<i>Rheum ribes</i> L./ Polygonaceae		Pushai (P), Rawash (B), Filgoosh (V)	Ph /Mountain slopes	Salad	Petiole	Petiole cut into pieces and used as Salad	Yes Rs.100/Kg
<i>Rumex vesicarius</i> L./ Polygonaceae		Tarwashkai (P), Hari Gosh (B), Homaz (V)	Ah /Mountain slopes	Vegetable, salad	Leaves	Leaves used as Salad or cooked with spices and potatoes as vegetable	No
<i>Polygonum polycnemoides</i> Jaub. & Spach/ Polygonaceae		Sag (P)	Ah /Among cultivated fields	Vegetable	Leaves	Frsh leaves are boiled and cooked with onion	No
<i>Rumex dentatus</i> L./ Polygonaceae		Parpanray, Torpanray (P), Hari Gosh (B), Homaz (V)	Ah /Among cultivated fields	Vegetable	Leaves	Young Leaves chopped and cooked as vegetable	No
<i>Rumex chalepensis</i> Mill. / Polygonaceae.		Parpanray (P), Hari Gosh (B), Homaz (V)	Ph /Among cultivated fields	Vegetable	Leaves	Fresh leaves are boiled cooked as vegetable while juicy petiole peeled and used to chew	No
<i>Polygonum aviculare</i> L. Polygonaceae.		Seresh, Banduke, Bannali, Kesru (P), Seresh (B), Soeris (V)	Ah /Among cultivated fields	Vegetable	Leaves	boiled Leaves are used as vegetable and eaten with bread	No
<i>Portulaca oleracea</i> L. /Portulacaceae		Pakharay (P), Pichlo, Shurdako (B), Mirri (V)	Ah /Among cultivated fields	Vegetable	Leaves	Leaves are collected chopped and cooked with onion and tomatos. A local dish <i>Pakhari Tarkari</i> is also made.	No
<i>Punica granatum</i> L./ Lythraceae		Nargosa Aningai (P), Hanor (B), Dahrun (V)	Tr /Mountain slopes	Edible	Fruits	Fruits are dried ground into powder and used as salt	Yes Rs.150/Kg

Botanical Taxon/ Family/voucher code	Vernacular name in Pushto (P), Balochi (B) & Barahvi (V)	Habit/ Gathering area	Used categories	Used part(s)	Gastronomic recipe	Market Selling	RFCs
<i>Ziziphus spina-christi</i> (L.) Desf./ Rhamnaceae		Beray/ karkanrha (P), Konar (B), Konar (V)	Tr /Plain areas	Edible	Fruits	Fresh fruits are edible	Yes Rs. 50/Kg
<i>Rhamnus persica</i> P. Lawson/ Rhamnaceae		Sarawan (P), Toruno (B), Birori (V)	Sh /Mountain slopes	Edible	Fruits	Fresh fruits are edible	No
<i>Sageretia thea</i> (Osbeck) M.C. Johnst./ Rhamnaceae		Manray (P), Hari Gosh (B)	Sh /Mountain slopes	Edible	Fruits	Fresh fruits are edible	No
<i>Rhamnus pentapomica</i> R. Parker/ Rhamnaceae		Sarawan (P), Toruno (B), Birori (V)	Tr /Mountain slopes	Edible	Fruits	Fresh fruits are edible	No
<i>Ziziphus oxyphylla</i> Edgew./ Rhamnaceae		Haynanay, Gurgula (P)	Sh /Plain areas	Edible	Fruits	Fresh fruits are edible	No
<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn./ Rhamnaceae		Beray (P), Pins (B & V), Pins (V)	Sh /Plain areas	Edible	Fruits	Fresh fruits are edible	Yes Rs.50/Kg
<i>Prunus rechingeri</i> (Browicz) R.R.Stewart/ Rosaceae		Zanghli Charay (P)	Tr /Mountain slopes	Edible	Fruits	Fresh fruits are edible	No
<i>Rosa beggeriana</i> Schrenk ex Fisch. & C.A.Mey. /R. lacerans/ Rosaceae		Sirai (P), Surai (B)	Sh /Mountain slopes	Edible	Fruits, petals	Fresh fruits are edible	Yes Rs. 500/Kg
<i>Cotoneaster persicus</i> Pojark./ Rosaceae		Sharu, sharawai, Tora Sharu (P)	Sh /Mountain slopes	Edible	Fruits	Fresh fruits are edible	No
<i>Crataegus wattiana</i> Hemsl. & Lace/ Rosaceae		Naghuncha, Ghunza (P)	Sh /Mountain slopes	Edible	Fruits	Fresh fruits are eaten.	No
<i>Rubus sanctus</i> Schreb./ Rosaceae		korharay (P)	Sh /Along water channels	Flavor	Fruits	Fruit are collected dried and used in flavouring food	No
<i>Cotoneaster nummularius</i> Fisch. & C.A.Mey./ Rosaceae		Sharawai (P)	Sh /Among cultivated fields	Edible	Fruits	Fresh fruits are edible	No
<i>Salvadora oleoides</i> Decne./ Salvodoraceae		Pilu ,kater (P), Peer, Khabbar, Karuch (B), Kator (V)	Sh /Plain areas	Edible	Fruits	Fresh fruits are edible	No
<i>Monothea buxifolia</i> (Falc.) A. DC./ Sapotaceae		Gurguray (P)	Plain areas	Edible	Fruits	Fresh fruits are edible	Yes Rs.150/Kg
<i>Lycium ruthenicum</i> Murray/ Solanaceae		Zargulan (P), Jarik (B), Jarak (V)	Sh /Plain areas	Beverage	Fruits	Fresh fruits are edible as well as used in making tea	No
<i>Lycium depressum</i> Stocks/ Solanaceae		Ziruk, Rinzuk (P), Garathi, Zirok (B)	Sh /Among cultivated fields	Edible	Fruits	Fresh fruits are edible	No
<i>Solanum nigrum</i> var. nigrum L./ Solanaceae		Mangobai (P), Kach mach (B), Lillan Balokk (V)	Ah /Among cultivated fields	Edible	Fruits	Fresh fruits are edible	No
<i>Withania coagulans</i> Stocks./ Solanaceae		Khamazur (P), Panirbad (B), Pareyband (V)	Sh /Mountain slopes	Flavor	Seeds	Seeds are used for making cheese	Yes Rs.100/Kg

Botanical Taxon/ Family/voucher code	Vernacular name in Pushto (P), Balochi (B) & Barahvi (V)	Habit/ Gathering area	Used categories	Used part(s)	Gastronomic recipe	Market Selling	RFCs
<i>Solanum incanum</i> L./ Solanaceae		Bahar Didi (P), Batag (B), Bhaer (V)	Sh /Mountain slopes	Flavor	Fruits	Fruits are used in making cheese/ juice used in making curd	No
<i>Grewia tenax</i> (Forssk.) Fiori/ Tiliaceae		Kango (P), Liwaar, Ganghi, Potronk (B), Catarch, Gangi, Kango (V)	Sh /Plain areas	Edible	Fruits	Fresh fruits are edible	Yes Rs. 150/Kg
<i>Typha domingensis</i> Pers./ Typhaceae		Lukha, Shokhan (P), Kull (B), Kull (V)	Ph /Along water channels	Edible	Rhizome	The rhizomes are dug out, peeled, chewed and sucked its juice.	No
<i>Celtis australis</i> L./ Ulmaceae		Tagha (P), Tagas (B)	Tr /Mountain slopes	Edible	Fruits	Fresh fruits are edible	No
<i>Valerianella oxycoryncha</i> Fisch. & C.A.Mey/ Valerianaceae		Charpuk (P), Charpuk (B), Charpuk (V)	Ph /Mountain slopes	Vegetable	Whole plant	Whole plant collected cut into pieces and cooked as vegetable	No
<i>Ampelopsis vitifolia</i> (Boiss.) Planch. /Vitaceae		Mar Malue (P)	Sh /Mountain slopes	Edible	Fruits	Fresh fruits are edible	No

Cross-cultural comparison

The recorded WEPs for local naming for commonness in local nomenclature revealed that the Balochi and Barahvi used similar names for 19 plants. Baloch and Barahvi, both are considered as Baloch clans except use different languages. The Barahvi are Baloch, "Barahvi is a language created by Baloch during a war in which the enemies knew their language and predicted their moves and to counter that they have to create this language (Rahman, 1996; Durrani, 2012). They practice same cultural dresses, life style, and social and religious festivals. On the hand, Barahvi Speaking people are considered to be offshoot of Dravidian origin of South India are now living beside Baloch on shared home land while Baloch are Iranian Aryan (Durrani, 2012). There are also instances that a particular tribe is speaking Balochi in one place while same tribe is speaking Barahvi in other place. Bilingualism and intermarriage is very common among adjoining area while a clear difference and lack of understanding is visible in the area of distance. The some representatives with similar local names in Balochi and Barahvi languages are *Mentha royleana* (local name Purchinak), *Lathyrus aphaca* (Rewari), *Ixiolirion tataricum* (Bulah), *Sisymbrium irio* (Roosh), *Sisymbrium brassiciforme* (Shuvaran), *Ziziphus nummularia* (Pins) and *Ziziphus spina-christi* (Konar), *Capparis decidua* (Kaled), *Allium umbilicatum* (Pimalako), *Perovskia atriplicifolia* (Pimalako), *Strigosella cabulica* (Ochrikawa), *Diploaxis griffithii* (Janbo), *Typha domingensis* (Kull), *Eremurus stenophyllus* (Sarshako), *Ferula costata* and *Ferula assa-foetida* (both are referred as Hing), *Tulipa lehmanniana* and *Tulipa stellate* (Govarikh, Saidandan). The Pushtoon and Brahvi used same local name for two plants only i.e. Wahu for *Zaleya pentandra* and Roosh for *Sisymbrium altissimum*. Similarly, Pushtoon and Balochi both name Tagha for *Celtis australis* and Balochi, Brahvi and Pushtoon only use similar name for *Valerianella oxycoryncha* as Charpuk. This strengthens the historical and cultural nexus with Balochis and Barahvis. Furthermore, the Pushtoons showed many differences in local naming of plants with both Balochis and Barahvis.

Comparative selection of wild edible plants

Comparative assessment for utilization based on three ethnic communities revealed that the Pushtoon community comparatively holds considerable knowledge about WEPs. They utilized 44 (31.42%) plant species out of 140 species. They are the second largest ethnic group and constitute 36% of the population mainly inhabit the northern Balochistan. Pushtoon was extremely well-presented in interview process. Pushtoon retain wild food plants knowledge as compare to Balochis and Barahvis. However the traditional practice of gathering wild plants for food is vividly alive among all considered locals in Balochistan. Because there are also great regional disparities within the province northern Balochistan shows the districts with the highest prevalence of under-nutrition. The Balochi and Barahvi groups, on the other hand, have limited selectiveness, employing only two species each. The species of collective utilization of all three communities were 75 (53.57%) in number. Similarly, the Pushtoons and Balochis shared 13 (9.28%), Pushtoon and Barahvi, (2 species) and Balochi and Barahvi (2 species). This pattern is linked to the fact that Pushtoon and Balochis are still traditionally engaged in many similar activities as they are more populated as compare to Barahvi community. The cross-cultural ethnobotanical analysis has shown that remarkable commonalities were observed among the selected studied groups. The indigenous knowledge of Balochis and Pushtoons indicated the overlapping pattern of wild plant uses

confirms some form of cross interaction among these communities, which shared the same environmental and sociocultural space for a few centuries. Barahvi gather less wild food plants and share only a few plants with Pushtoon which may have limited the exchange of plant knowledge and practices with Pushtoon, while share more plants with Balochi. This may be due to the fact that these ethno-religious groups live together in more areas as compare to Pushtoon and have followed endogamic marriage patterns for centuries. However, study participants confirmed us in their narratives that knowledge on WFPs goes beyond linguistic and religious boundaries and they have the perception that they all follow the same food patterns.

Transmission and fragmentation of traditional knowledge

A significant volume of traditional knowledge associated with food ethnobotany exists in the province and presented by all ethnic communities. But it is being limited to the aged people and cause low intergenerational transmission as reported in various studies (Aziz et al., 2022; Bibi et al., 2022). In the marginalized human societies the utilization and business of WEPs are perceived as laborious practice with low profit (ARSHAD et al., 2022). Hence, the young people abandon to traditional practices and prefer modern businesses. Moreover, cultural modernization, fashioned life pattern and food trend also contribute to lessen the worth of these knowledge. The events such as special day celebration to promote the value and transmission could be effective to invigorate the local traditional knowledge. The inclusion of ethnobotany/local ecological knowledge in the syllabus at school level could also be fruitful for the retention and practice of the available indigenous knowledge. The cross-cultural intermarriages between different cultural groups may lead to the homogenization of traditional knowledge. Similarly, remoteness, drought, accessibility, poor infrastructure, socio-political uncertainty and feudalism social set up trigger the mass outmigration that direct cause the traditional knowledge fragmentation. The botanists hesitate to conduct the research in the province due to endemic and harsh geo-political uncertainty.

Relative frequency citations (RFCs)

The documented WEPs were quantitatively analyzed with RFCs to know cultural importance of the recorded species. The RFCs value ranges from 0.30 to 0.01. *Portulaca oleracea*, *Amaranthus viridis* *Allium umbilicatum*, *Pinus gerardiana* and *Asphodelus tenuifolius* scored high RFC values i.e. 0.30, 0.25, 0.25, 0.17 and 0.15 respectively. The consumption of wild edible plant species was based on five factors: hunger due to paucity of food, spicing staple foods, cultural preservation, therapeutic benefit, and market worth. It is further noted that the herbs are the most important source of wild food (RFC =) while grass are the least (RFC =). Edible species each. The four plant species with the highest RFC were *Portulaca* Oleaceae, *Amaranthus viridis*, *Allium umbilicatum*, *Pinus gerardiana* and *Ximenia americana*.

Jaccard index (JI)

The literature review for all cited plant species discovered that 88% of the reported species have not been report from Pakistan. The rest 22% of species were already reported as WEPs from different parts of the country. The mostly documented species were *Rumex dentatus*, *Chenopodium album*, *Oxalis corniculata*, *Silene conoidea* and *Celtis australis*. The comparison of indigenous knowledge on food plants is helpful to determine the difference between region arising due to ecological (Ladio et al. 2007), historical (Meorman 1998) and organoleptic differences. The Jaccard index (JI) is a quantitative index used to compare the ethnobotanical data with previous reports, specifically from adjoining areas. In this study, the data was compared with 37 previously published articles of Pakistan. The similarity percentage with allied areas ranges from 0.51–8.56. The highest JI value (8.56) was with data reported previous from Hindu Kush Mountain Range, KPK. The lowest JI value (0.51) was with data reported previous from Tehsil Timergara, District Dir of KPK. JI values with data reported previous from District Killa Abdullah and Mahal Kohistan of Province Balochistan were very less, because the previous research work in the areas of Balochistan was not specifically on the edible plants which affected the cross comparison analysis which was mainly with edible plants. While the reason of higher JI similarity with data of Hindu Kush Mountain Range, KPK was the research work which was only on edible plants. From this analysis we can say that different factors including cross-marriages, subsistence earning ways, religious believes, social interactions and migration also affect the food consumption within the communities of different provinces. Comparative analysis of present findings with reported literature revealed 92 new plant species, which have rarely been documented so far in the Pakistan. Among these new reports *Ferula costata*, *F. oopoda*, *Ferula assa-foetida*, *Allium zhobicum*, *Asphodelus tenuifolius*, *Sonchus oleraceus*, *Menoicus linifolius* *Capparis decidua* were mostly reported species from the region (Table 1). Consequently, documenting and comparing intensity of knowledge among local communities, which can provide a novel source of food plants consumption and indicates the high degree of ethnobotanical novelty in the study area.

Table 5
Jaccard index of the recorded plant taxa from the study area.

Author citation	Study Area	Province	Total reported plant species = b	Total species common in both areas = c	c*100	a + b	(a + b)-c	Jl
Ahmad et al. 2012	Cholistan Desert	Punjab	90	8	800	230	222	3.60
Iqbal et al. 2021	Head Maralla	Punjab	119	8	800	259	251	3.19
Majeed et al. 2021	District Jhelum	Punjab	77	14	1400	217	203	6.90
Qureshi et al. 2007	District Mianwali	Punjab	26	3	300	166	163	1.84
Shah et al. 2020	Central Punjab	Punjab	27	8	800	167	159	5.03
Shaheen et al. 2020	Lahore	Punjab	5	4	400	145	141	2.84
Zareen et al. 2013	Central Punjab	Punjab	102	3	300	242	239	1.26
Awan et al. 2013	Mountainous region	Gilgit Baltistan	49	2	200	189	187	1.07
sAbdullah & Khan 2020	Tribal belt	Pak Afghan Border	63	14	1400	203	189	7.41
Jan et al. 2016	District Killa Abdullah	Balochistan	35	3	300	175	172	1.74
Panhwar & Abro 2007	Mahal Kohistan	Sindh & Balochistan	50	6	600	190	184	3.26
Mirani et al. 2016	Lower Sindh	Sindh	1	1	100	141	140	0.71
Hamayun	District Buner	NWFP	94	5	500	234	229	2.18
Abbas et al. 2020	Kurram District	KPK	55	14	1400	195	181	7.73
Abdullah et al. 2021	Hindu Kush Mountain Range	KPK	63	16	1600	203	187	8.56
Ibrar et al. 2007	Ranyal Hills, District Shangla	KPK	97	6	600	237	231	2.60
Afzal et al. 2009	Northren Pakistan	KPK	85	3	300	225	222	1.35
Ahmad et al. 2011	Tehsil Kabal, District Swat	KPK	140	14	1400	280	266	5.26
Ahmad et al. 2016	Takht-e- Sulaiman Hills	KPK	51	14	1400	191	177	7.91
Ahmad et al. 2019	North west Pakistan	KPK	25	4	400	165	161	2.48
Ali et al. 2018	Swat Valley	KPK	100	8	800	240	232	3.45
Aziz et al. 2020	Chitral	KPK	55	9	900	195	186	4.84
Gulzar et al. 2019	District Malakand	KPK	50	4	400	190	186	2.15
Jan et al. 2011	Dir Kohastan Valleys	KPK	65	3	300	205	202	1.49
Khan & Musaraf 2014	Sheikh Maltoon, District Mardan	KPK	92	3	300	232	229	1.31
Khan et al. 2003	Gokand Valley, District Buner	KPK	138	11	1100	278	267	4.12
Khan et al. 2015	Tehsil Charbagh, District Swat	KPK	122	7	700	262	255	2.75
Khan et al. 2018	District Charsadda	KPK	40	6	600	180	174	3.45
Marwat et al. 2011	D.I. Khan	KPK	11	4	400	151	147	2.72
Murad et al. 2013	Banda Daud Shah, District Karak	KPK	58	3	300	198	195	1.54

Author citation	Study Area	Province	Total reported plant species = b	Total species common in both areas = c	c*100	a + b	(a + b)-c	Jl
Nasrullah et al. 2012	Jandool Valley, Dir Lower	KPK	67	6	600	207	201	2.99
Naveed et al. 2018	District Swabi	KPK	104	4	400	244	240	1.67
Samreen et al. 2016	Takht-e- Sulaiman Hills	KPK	203	5	500	343	338	1.48
Shah et al. 2019	District Tor Ghar	KPK	38	14	1400	178	164	8.54
Sher and Hussain 2009	Malam Jabba Valley	KPK	50	1	100	190	189	0.53
Shuaib et al. 2014	District Dir Lower	KPK	40	4	400	180	176	2.27
Shuaib et al. 2018	Tehsil Timergara, District Dir	KPK	59	1	100	199	198	0.51

Conclusion

The study validates the existence of substantial WEPs variability in the arid-land of Balochistan. WEPs play a central role in regional biological diversity and practices of food selection and utilization. The associated local ecological knowledge with these food plants is present in all relegated societies of all ethnic groups. However, distinct difference in the knowledge volume was observed among the ethnic communities. On the other hand folk knowledge is not being transmitted effectively due to modern market, social and food trends.

Deleterious geo-ecological processes, mass displacement, outmigration and human factors strikingly affected the retention and transmission and of the folklore. These factors include persistent drought, flood hits, political uncertainty, resource scarcity, outmigration and mass displacement due to mega developmental projects. The establishment of these wild edible as crops in the region would be a game changer for food security, socioeconomic development and nutritional supplements for agro-pastoral people and far flung people.

Declarations

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Author's Contribution Shazia Kousar collected the data, compiled the data and wrote the results of the study. Zaheer Abbas wrote the whole initial manuscript, graphics and tabulation. Nidaa Harun improved the manuscript, worked on graphics and analyzed the data. Nazar Khan collected the data with first author, gathered specimens and did photography and identification of specimens. Kamran Ishaq and Tahir Khan helped in data collection. Rainer W. Bussmann improved the manuscript.

Compliance with ethical standards

Conflict of interest The authors declared that they had no conflict of interest. Study participants provided consent for the information they shared to be used for academic purpose.

Ethical statement We certify that preparation of this manuscript has been clearly described in compliance with the ethical standard section of the journal.

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Figures



Figure 1

The map of the Balochistan Province showing surveyed localities



Figure 2

Plant collection and identification in the field (author 1 and 2)

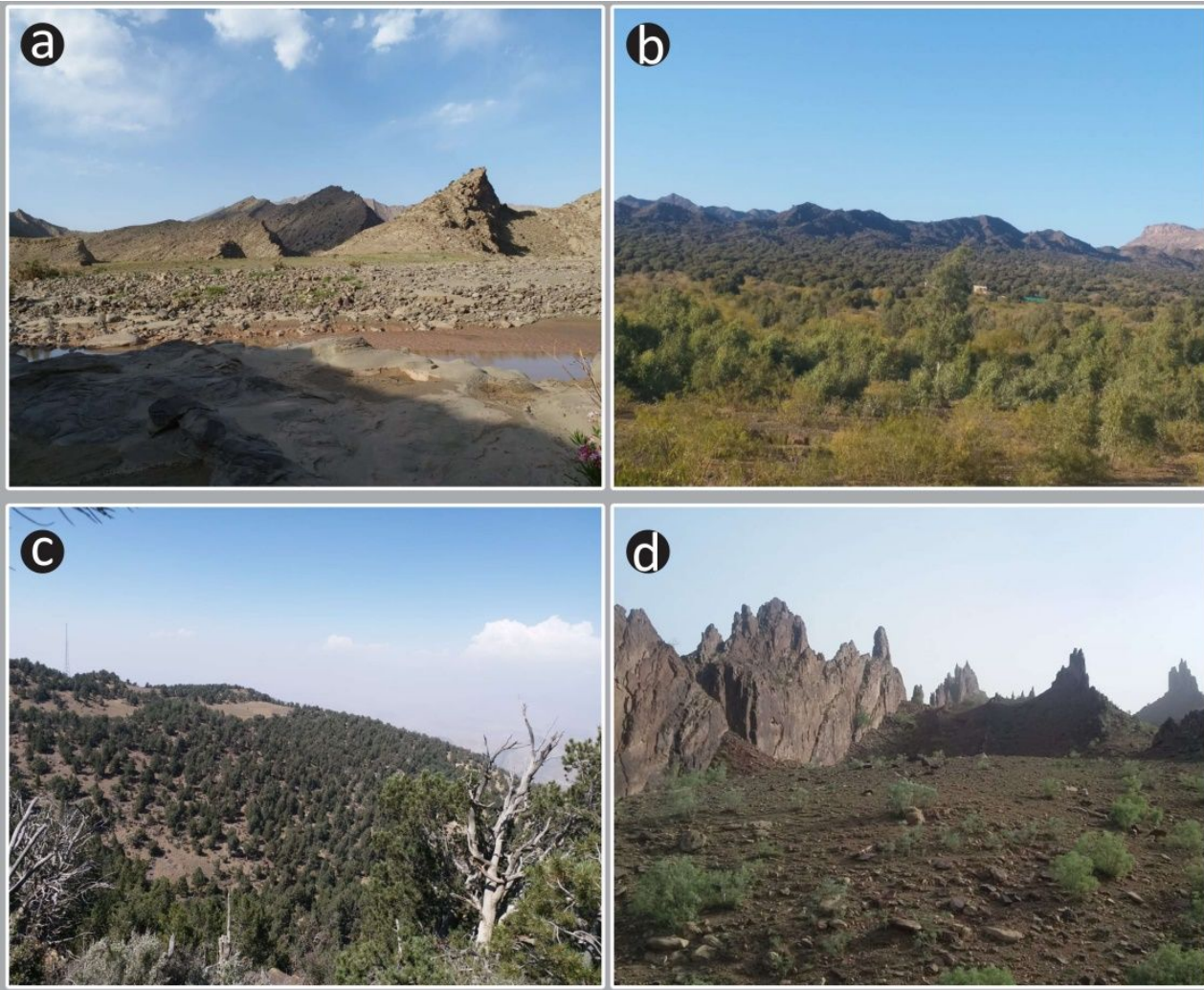


Figure 3

Views of WEPs gathering habitats in the Province.

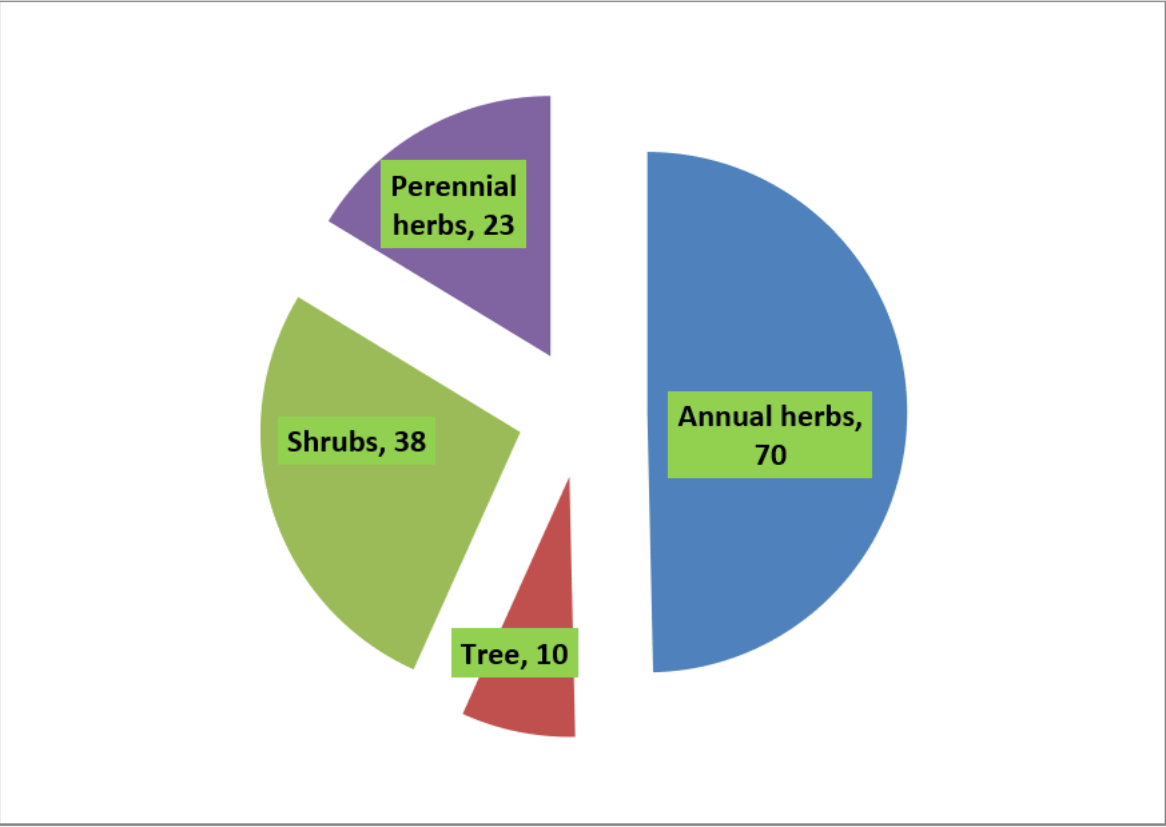


Figure 4

Habit diversity of locally using food plants

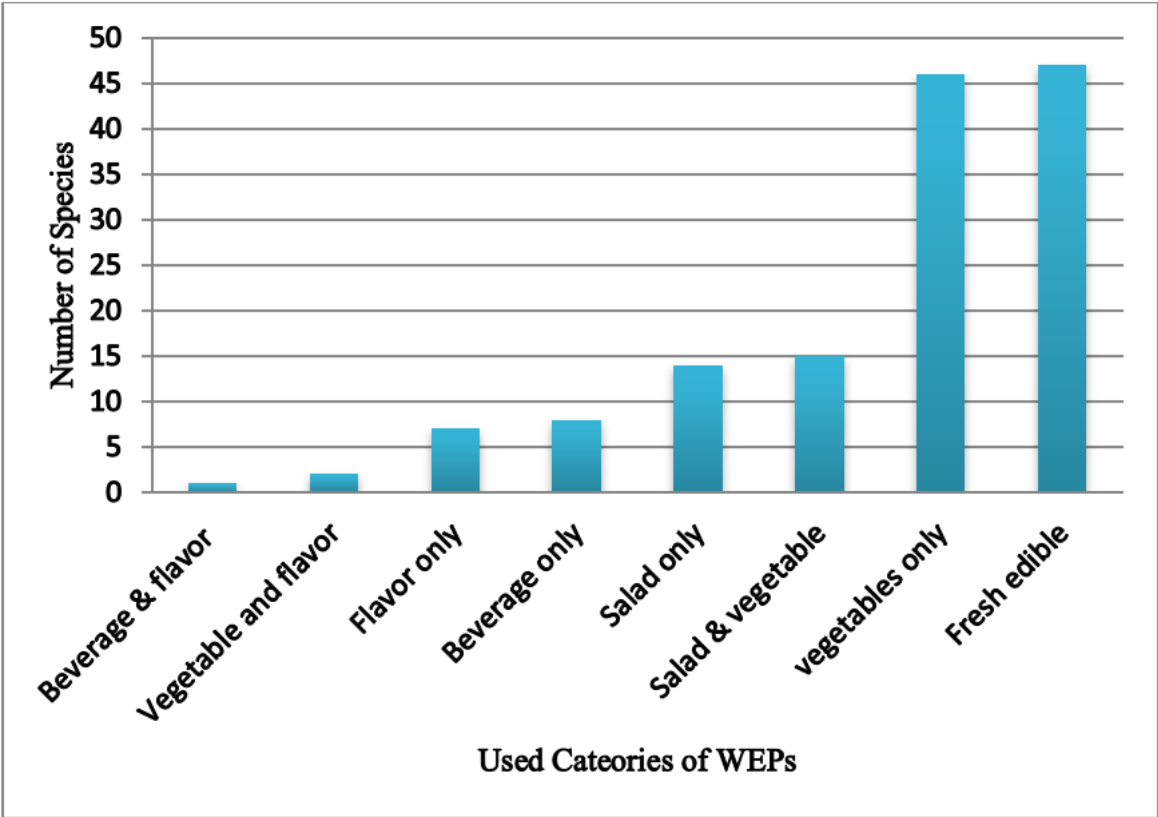


Figure 5



Figure 6

Local dishes a) Pusa; a traditional sweet dish of *Pistacia atlantica* & *Pistacia khinjuk* b) Pakhare Tarkari local dish of *Portulaca oleraceae* c) Chapati (local bread type) and d) Stone grinder.

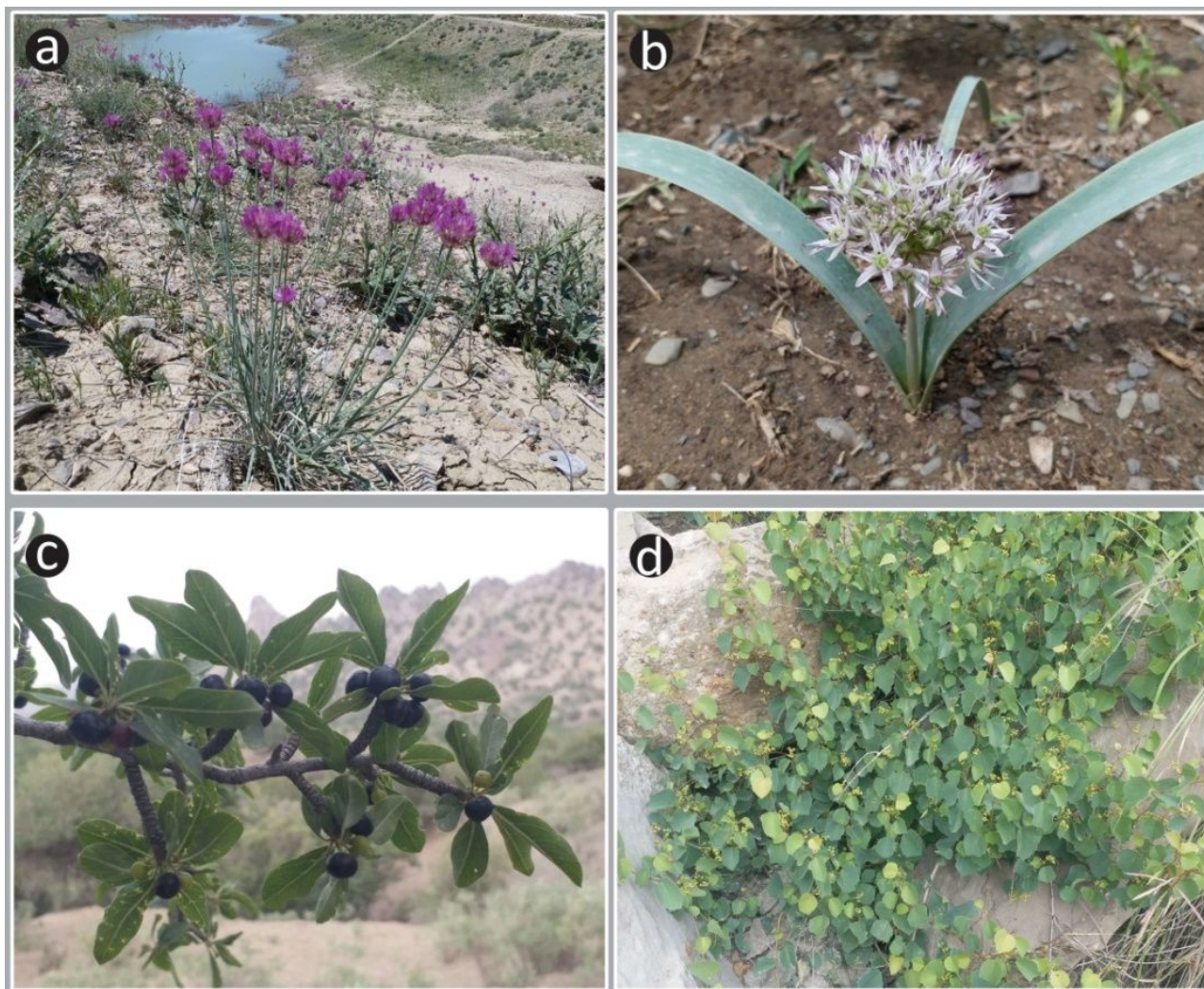


Figure 7

Representatives of WEPs a) *Allium dolichostylum* b) *Allium zhobicum*

c) *Rhamnus pentapomica* and d) *Ampelopsis vitifolia*

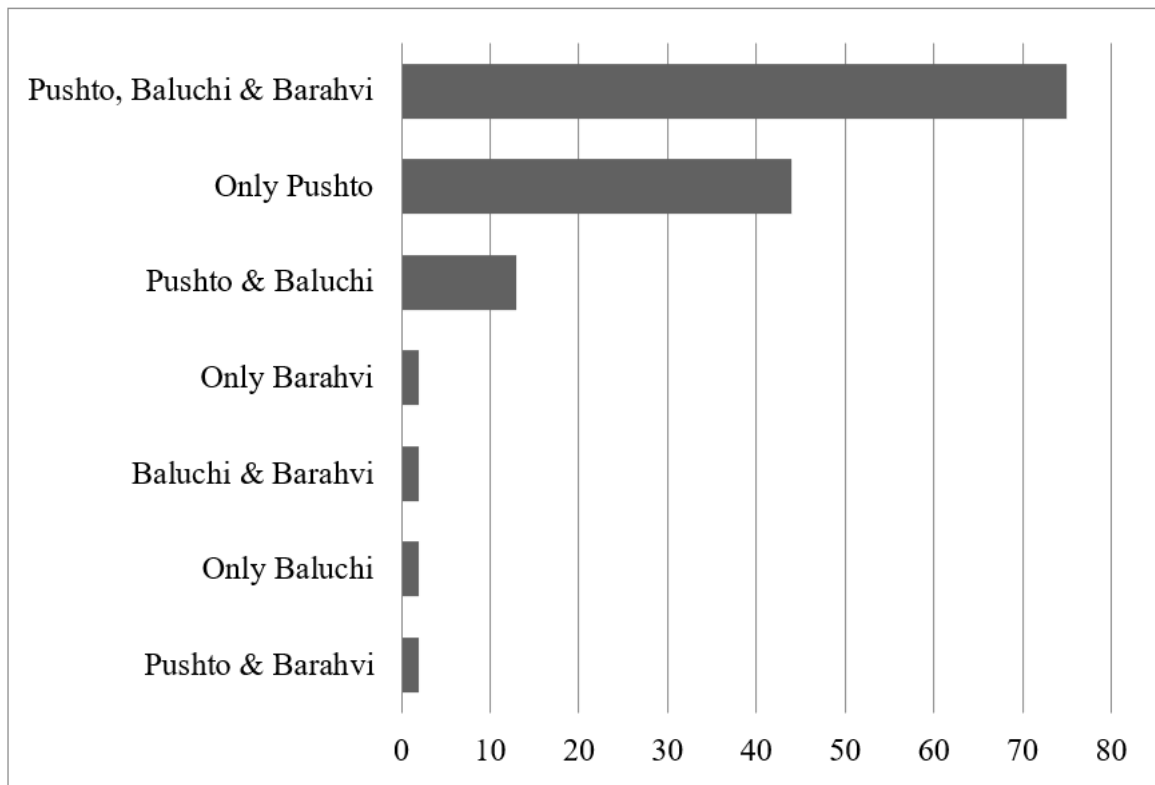


Figure 8

WEPs utilization versus ethnic groups.