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ETHNOMEDICINAL UTILIZATION OF WILD EDIBLE VEGETABLES IN DISTRICT HARNAI OF BALOCHISTAN PROVINCE-PAKISTAN

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Abstract

Wild edible plants have a tremendous influence on human being even before civilization. These plants contain considerably high nutritional value. Present survey was conducted to explore edible wild vegetables species and their ethnomedicinal uses by the inhabitants of district Harnai, Balochistan, Pakistan. Information was obtained through informed free listing interviews with randomly selected informants and field interviews with key informants selected after free listing. A total of 59 wild edible vegetables belonging to 41 genera, 59 species and 20 plant families are used not only as vegetables and salads but treatment of various diseases The most common plant families in terms of the number of species are the Brassicaceae (10 species), Apiaceae (9 species) and Asteraceae (6 species). The most common parts of the plants used as vegetables and medicine are their leaves (44.45%) and whole plant (22.22%). Plants are often used as decoction (34%), powder (26%). Highest plants species are used for gastrointestinal diseases (45 species). Highest ICF value (0.4) was recorded for dermatological disorders category. 100% fidelity level was found for two plant species i.e., *Descurainia sophia*, and *Caralluma tuberculata*. The highest use value was reported for the *Lepidium sativum* (0.63). Highest RFC value was calculated for *Caralluma tuberculata* (0.14). Highest use report was calculated for three species *Apium graveolens Lepidium sativum* and *Mentha longifolia,* (7 UR for each). The highest FIV was calculated for family Brassicaceae (14 FIV).Our study reveals that plants are still used as a major source of food like vegetables as well as medicine for the local people. Too little or no information is available on their uses, cooking methods and nutritional and physiotherapeutic values. Necessary steps should be taken to perform phytochemical and pharmacological studies to explore the potential nutritional values and herbal drug discovery of such plants.

Key words: Wild vegetables, Ethnomedicinal, Edible plants, Harnai, Informant consensus factor.

Introduction

Wild edible plants have a tremendous influence on human being even before civilization. These plants contain considerably high nutritional value (Vaishali *et al.,* 2013) and thus Millions of people in many developing countries depend on wild resources including medicinal plants and wild edible plants to meet their food needs and especially in periods of food crisis (Balemie & Kebebew, 2006 & Anon., 2004). These plants have high nutraceutical value and are used for wide range of ailments and have the potential to protect human body from cancer, diabetes, inflammatory and cardiovascular diseases) (Hussain *et al*., 2009; Abbet *et al*., 2014). The diversity in wild species offers variety in family diet and contributes to domestic food security (Anon., 2004). There has been renewed/increasing interest in consuming wild food plants both in times of surplus and food shortage (Zinyama *et al*., 1990; Shinwari, 2010).

The strong connection between nutrition and health is increasingly recognized (Etkin, 1996). Food plants especially vegetables are not solely considered from a nutritional perspective, but also as a used as traditional medicine (Adebooye & Opabode, 2004; Saqib *et al*., 2011) and factor of prevention of most prevalent life style diseases (Abbet *et al*., 2014).

However, food and medicinal uses of these plants have been two of the most relevant and consistent reasons for popular plant management, even in cultures that are increasingly losing their close relationship with nature. Therefore, ethno directed research is very useful in the discovery and development of new drug and food resources (Khafagi & Deward, 2000; Heinrich & Gibbons, 2001). It is of outmost importance to obtain data about popular uses of wild edible traditional vegetables before this knowledge disappears (Shinwari & Qaiser, 2011).

The wild vegetables are gathered from uncultivated lands and the knowledge about traditional vegetables is passed on from generation to generation as part of the indigenous knowledge system of the community (Lwoga *et al*., 2010). Traditional vegetables, which are edible plants that are used as vegetables, are part of traditional production systems and local knowledge. These plants have been used locally over a number of years, but did not necessarily originate in that particular area (Dweba & Mearns, 2011)

In many Asian countries these traditions are at risk of disappearing, and hence the crucial need to study such knowledge systems and find innovative ways of infusing them to the future generations (Pieroni *et al*., 2005; Hadjichambis *et al*., 2008). Knowledge of such foods is a part of traditional knowledge which is mainly transmitted

through contribution of individuals of households (Misra *et al*., 2008). The utilization of wild plants and animals continues to greatly benefit the society to this day, from processes mostly involving local experimentation through indigenous and local knowledge (Kristensen & Balslev, 2003; Ladio & Lozada, 2004; Scherrer *et al*., 2005).Thus traditional edible plants with favorable pharmacological or nutritional properties can offer new opportunities for the development of mountain agriculture if they can be taken into cultivation. (Pardo-de-Santayana *et al*., 2007).

During the past decade, several studies have systematically analyzed the consumption and gathering of wild edible plants in specific countries in the world e.g., Italy (Vitalini *et al*., 2013), Spain (Pieroni *et al*., 2005), Turkey (Ertug , 2000), Cyprus (Della *et al*., 2006) and in Palestine (Ali-Shtayeh *et al*., 2008) European Neolithic (Colledge & Conolly, 2014) Switzerland (Abbet *et al*., 2014) and in Asia specially in neighboring countries of Pakistan e.g., India. (Rasingam, 2012; Vaishali *et al*., 2013).

The diverse topography of Pakistan has permitted the survival of traditional knowledge related to vegetable, and fruit resources used by locals as food but very little emphasis has been paid to wild edible plants in some parts of the country (Abbasi *et al*., 2013; Shad *et al*., 2013). In District Harnai, indigenous fruits play an important role in people's diet and contribute to the economy of the area. The identity, distribution and uses of edible vegetables have not been documented in the area. This study was therefore undertaken to obtain these important data not for only the traditional use of wild edible vegetables for food sources but also medicinal uses of these vegetables and the potential for future use in district Harnai, Balochistan, Pakistan.

Study area: The surveys were carried out in District Harnai Balochistan province- Pakistan. Area wise it is the 3rd smallest district of Balochistan and has an area of 3,075 square kilometers, It lies between 67°13'12"-68°24'34" East longitudes and 29°41'59"-30°23'2" North latitudes consisting of 2 *Tehsils* and 6Union Councils. Location of Harnai is at 630 km (aerial distance) south-east (232 degrees bearing) of Pakistan's Capital City Islamabad and 90 km north-west (97 degrees bearing) from Quetta, the provincial capital of Balochistan. Harnai has been very important due to its strategic location on the map (Fig. 1). The district is surrounded by encircling Khilafat and Zarghoon hills. The Harnai valley extends from Chappar Mountain to Spintangi. The terrain elevation varies from 1923,545m above Mean Sea Level. The climate of District Harnai is akin to Sibi. The climate category can be placed in to extremely hot in summer and hot to pleasant winters. The rainy season is mostly in monsoon.

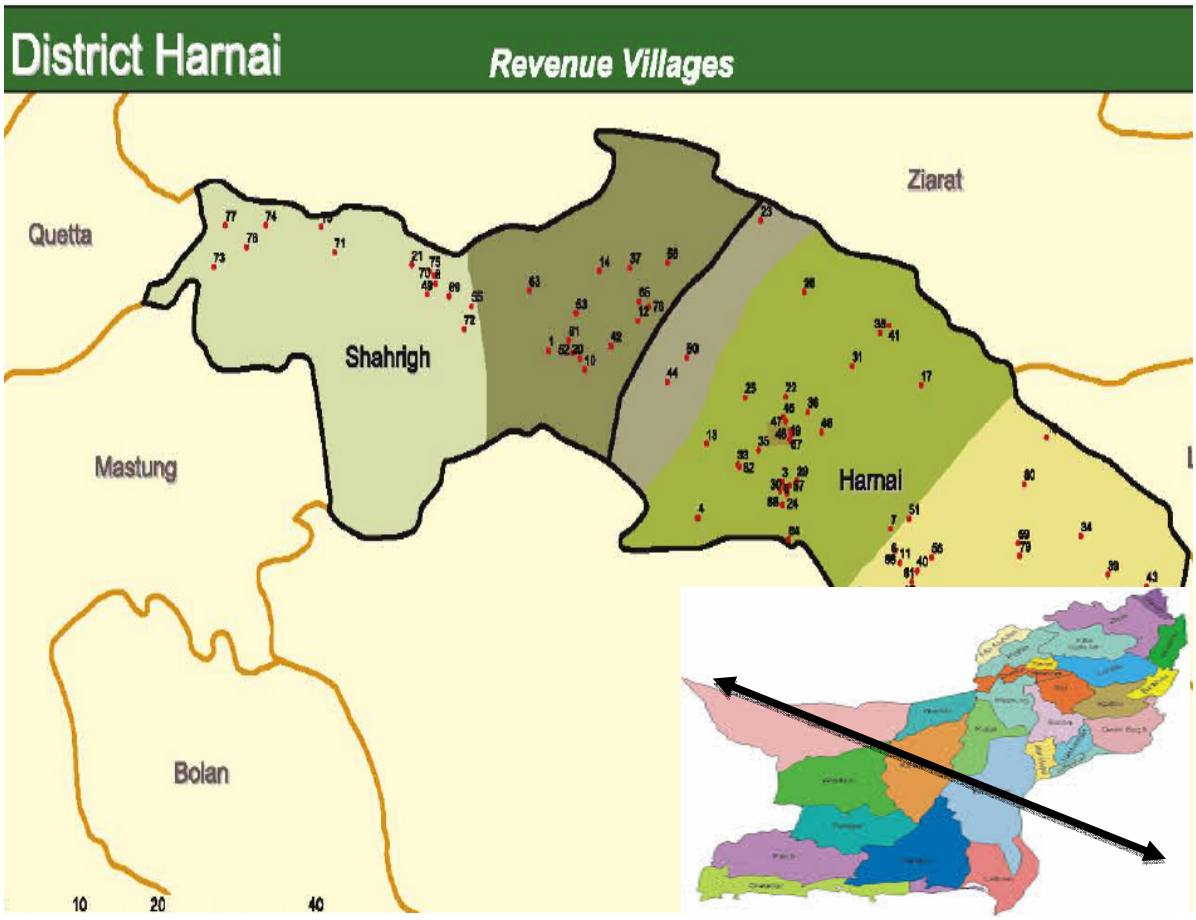

Fig. 1. Map of district Harnai, Balochistan, Pakistan.

Ethnic groups and languages: The reported population of District Harnai was 76,652 in 1998 and the projected population in 2012 (Anon., 2012) is estimated to be 121thousandMajority of the population is Pushtoon and Afghans, which belongs to Tareen tribe. Baloch tribes that live in the area are Marris and Sailachis. The major language spoken in the district is Pushto. The mode of living in rural Balochistan differs widely from urban areas. In rural areas people live under tribal system, where joint and extended family system is order of the day. If a family is living jointly their strength is appreciated and recognized by the society. The district is mostly rural where joint family system has strong roots. Family relations are highly respected and elders, especially head of the family (male member) is held in high esteem. Decisions concerning major affairs of the family are made by the elder of the family. In town of Harnai, nuclear families exist but in small number.

Forests: The district has a reasonable and diversified forest cover out of which a considerable area has been notified as State Forest; while rest of the area is unclassified wasteland (mostly community owned). Juniper forests of Thore Shore at the western areas of the district and wild olives along its northern boundary, running from Chapper Rift to Spin Thangi, are the prime ecosystems. Overall natural vegetation, including shrubs, bushes and grasses, can be classified as rangelands. These rangelands are substantially contributing to the local economy of the district as a source of forage for their livestock. Moreover, a considerable number of livestock belonging to seasonal migrants, including both Afghan Nomads and Marries from Kohlu, Kutmandai, Spin Thangi and Baber Kachh, are grazed on these rangelands. Piedmont terrains of Koh-e-Khalifat and Deng Loeghar are the favorite pastures for these grazers (Anon, 2011).

There are five notified forests in district Harnai which include Churmy, Deng Loeghar, Parn, Thangi Sar (includes Tore Manaand Wam Kachh areas), Nishpa and Khalifat measuring 41,161 hectares. Dwarf palm or Mazri has a significant presence in almost 60% area of the district and is a substantial source oflivelihood for the local inhabitants. The types of forests found in the area are: Balochistan Dry Temperate Semi-evergreen Scrub (Steppe) Forest. In its western parts, it is dry temperate climax formation of juniper and wild pistachio. Trees of juniper and wild pistachio are still present as a remnant in State Forests. In certain areas the climax formation reduced to scrub condition due to grazing and fuel wood pressures. Currently, it is with open cover and an adequate amount of grasses and herbs. Along northern boundaries, the district is characterized by dry sub-tropical and temperate semi-evergreen scrub formation (Anon., 2011).

Material and Methods

Collection of plants: Extensive field surveys were under taken during the four seasons of year. Plant specimens were collected either in flowering or fruiting stage. Further, specimens were processed as per routine herbarium techniques recommended by Jain & Rao (1977) and were deposited in Herbarium of University of Balochistan Quetta and the Herbarium of Pakistan (ISL) Quaid-i-Azam University. The specimens were identified with help of different monographs, available literatures (www.efloras.com) and regional flora (Ali & Nasir, 1989–91; Ali & Qaiser, 1993-2015; Nasir & Ali, 1970-1979, 1979-1980-1989). The plants name were corrected with the help of database "International Plant Name Index" (IPNI: http://www.ipni.org).

Informants interviews: Investigations were conducted in rural and mountainous areas of District Harnai namely Zarghoon ghar, Nasak, Babar kach, Wamtangi because of their cultural and botanical richness. In the process of recruiting informants, efforts were made to identify people regarded in their communities as particularly knowledgeable on traditional uses of plants as medicines or food. Ethnobotanical data was collected through free listing interviews with randomly selected informants and field interviews with key informants selected after free listing (Ghorbani *et al*., 2011). The questionnaire was mainly focused on the ethnobotanical claims and traditional beliefs of local communities and nearby people.

Ethnographic composition: For ethnomedicinal information a total of 220 informants 147 women, 63 men and 10men traditional healers (Pansars/ Hakims) were interviewed. The informants were divided into four age groups; 20-35, 36-45 and 46-60 and above 60 years. The ethnic composition of the valley is mixed of Baloch and Pashtoon communities, Pashtoon communities are dominant in the area. Data on vernacular names of the plants, part used, mode of preparation, administration route, and application to treat diseases was recorded.

Data analysis: The data collected was analyzed using quantitative value indices i.e. Use report (UR), Use value (UV), Informant consensus factor (ICF), relative frequency citation (RFC), Family importance value (FIV) and Fidelity level (FL), which are the most popular indices in quantitative ethnobotany.

Informant consensus factor (ICF): To calculate the Informant consensus factor (ICF), the cited species were grouped into twelve categories of medicinal uses by the following formula introduced by (Heinrich *et al*., 1998).

ICF= Nur- Nt/ Nur-1,where Nur represents the number of citations in each use category and Nt represents the number of species cited. A value close to zero indicates a high variation in the use of species (i.e. informants disagree over which species to use in the treatment within a category of illness.)

Frequency citation (FC): The FC of the species of plants being utilized was evaluated using the formula:

FC= (Number of times a particular species was mentioned/ total number of times that all species were mentioned) ×100 (Tardio & Pardo-de Santayana, 2008).

Relative frequency citation (RFC): RFC is calculated by the following formula:

RFC= FC/N (0<RFC<1)**,** it is obtained by dividing the number of informants mentioning a useful species (FC or frequency of citation), by the total number of informants in the survey (N). RFC value varies from 0-1. Zero indicates when nobody refers to a plant as a useful one and zero RFC shows when all the informants mentioning a plant as useful) (Tardio & Pardo-de Santayana, 2008; Vitalini *et al*., 2013).

Family importance value (FIV): Family importance value (FIV) was calculated by taking the percentage of informants mentioning the family.

$$FIV = FC\ (family)/N \times 100$$

where, FC is the number of informants mentioning the family while N is the total number of informants participating in the study (Vitalini *et al*., 2013).

Use report (UR) and Use value (UV): The use report (UR) is defined as the number of informants that mention a particular species during the interviews (Giovannini & Heinrich, 2009), Since an informant may mention several uses for a same species, the results should be presented together with the absolute use-reports, as exemplified by Giovannini & Heinrich, 2009; Heinrich *et al*., 2009; Abbet, 2014), while the Use value (UV) demonstrates the relative importance of plants known locally. It is applied in determining the plants with the highest use (most frequently indicated) in the treatment of an ailment. UV was calculated by using the following formula (Phillips *et al*., 1994; Savikin *et al*., 2013):

$$UV = \Sigma U/n,$$

where UV is the use value of a species, 'U' is the number of use reports cited by each informant for a given plant species and 'n' is the total number of informants interviewed for a given plant.

Fidelity level (FL): Fidelity level (FL) index is used to determine the most preferred species used in the treatment of a particular ailment as more than one plant species are used in the treatment in the same category. It was calculated by using the following formula: (Friedman *et al*., 1986).

$$FL= (Np/N \times 100)$$

where Np indicates the number of informants citing the use of the plant for a particular illness and N is the total number of informants citing the species for any illness. High FL value indicates high frequency of use of the plant species for treating a particular ailment category by the informants of the study area.

Results and Discussion

For ethnomedicinal information, a total of 220 informants 147 women (67%), 63 men (29%) and 10 men traditional healers (Pansars/ Hakims) (4%) were interviewed. The informants were divided into four age groups; 20-35, 36-45 and 46-60 and above 60 years. Most of the informants belonged to 46-60 years of age (Fig. 2). The elderly women between the ages of 46-60 years were found to be more knowledgeable about the number of traditional vegetables, their cooking recipes, which were available in the study area when compared to young women and men who participated in the study. These findings on the younger generation's knowledge of traditional vegetables corroborate previously published literatures (Odhav *et al*., 2007; Modi *et al*., 2006) while, our finding is contrary to that of a study conducted by Shava (2000) in the Eastern Cape region where the younger generation were found to have extensive knowledge of traditional vegetables. According to Vorster *et al*. (2007) the labeling of traditional vegetables as 'poverty food' and as indicative of being 'backward' is the reason why the youth are not keen to learn about these vegetables. When comparing men and women's traditional knowledge, the women are well-versed in traditional knowledge than men (Sarwat *et al*., 2012). Jamila & Mostafa, (2014) reported the similar results in Oriental Morocco to manage various ailments. The reason may be that they are more often at home during the hours of the survey (Jouad *et al*., 2001), and second reason may be that they are more involved to the cooking domestic lifestyles, and take care of children. As an added incentive, being knowledgeable in the art of healing with plants adds to the status of women, who are primarily involved in domestic lifestyles (Tahraoui *et al*., 2006).

Diversity of wild edible vegetables and their medicinal uses: A total of 59wild edible vegetables belonging to 41 genera, 59 species and 20 plant families are used not only as vegetables and salads but treatment of various diseases are reported from district Harnai Balochistan, Pakistan. The local names of the plants, family names, their uses and parts of the plants used for their medicinal values, use report, use value, frequency citation (FC) and relative frequency citation (RFC), are listed in (Table 1). The most common plant families in terms of the number of species are the Brassicaceae (10 species), Apiaceae (9 species) and Asteraceae (6 species) (Table 2). The most common parts of the plants used as vegetables and medicine are their leaves (44.45%) and whole plant (22.22%) (Fig. 3). Plants are often used as decoction (34%), powder (26%). Highest plants species are used for gastrointestinal diseases (45 species). Highest ICF value (0.4) was recorded for dermatological disorders category. 100% fidelity level was found for two plant species i.e. *Descurainia sophia*, and *Caralluma tuberculata* (Table 4) The highest use value was reported for the *Lepidium sativum* (0.63). Highest RFC value was calculated for *Caralluma tuberculata* (0.14). Highest use report was calculated for three species *Apium graveolens Lepidium sativum* and *Mentha longifolia,* (7UR for each (Table 1). The highest FIV was calculated for family Brassicaceae (14 FIV) (Fig. 7).

Table 1. List of wild edible vegetables and their medicinal used by the local people of district Harnai, Pakistan with its use values, use reports, frequency of citation and relative frequency citation.

Family	Botanical name and (Voucher specimen)	Local name	Life form	Part used	Uses	Mode of administrations	Mode of preparation	Mode of consumption of wild vegetables	FC*	RFC*	UR*	UV*
Amaranthaceae	*Amaranthus graecizans* L. (QAD-UOB.V1.V2)	Morli/ shin sag	Herb	Whole plant	Diarrhea, gonorrhea, Vermifuge	Topical	Paste	C	23	0.11	3	0.13
	Amaranthus viridis L. (QAD-UOB.V3)	Morlai	Herb	leaves	Gastric	Oral	Decoction	C	7	0.03	1	0.14
	Amaranthus hybridus L. (QAD-UOB.V4)	Azghanmorli	Herb	Leaves, roots, shoots	Gastric and ear ache	Oral	Juice, powder	C	9	0.04	2	0.22
Alliaceae	*Allium farctum* Wendelbo (QAD-UOB.V5)	Garapiaz	Herb	Leaves, bulbs	Cooling , jaundice, increase sexual power	Oral	Raw leaves, bulbs	BCS	13	0.06	3	0.23
	*Allium griffithianum*Boiss., Diagn. (QAD-UOB.V6)	Ghara piaz	Herb	Leaves, bulbs	Jaundice , increase sexual power	Oral	Raw leaves, bulbs	BCS	13	0.06	3	0.23
Apiaceae	*Apium graveolens* L. (QAD-UOB.V7)	Dania jangli	Herb	Roots, seeds, leaves	Digestion, fever, antiseptic, spleen problems, bronchitis, asthma, fever	Oral	Decoction	BCS	17	0.07	7	0.41
	Bunium cylindricum (Boiss. &Hoh.) (QAD-UOB.V8)	Spina Zera	Herb	Leaves, seeds	Flue, cough, digestion	Oral	Powder	BCS	22	0.1	3	0.14
	Bunium persicum B. Fedtsch (QAD-UOB.V9)	Torazera	Herb	Leaves, seeds	Digestion, stomachache, stimulant	Oral	Powder	BCS	21	0.09	3	0.15
	Dorema ammoniacum D. Don (QAD-UOB.V10)	Jangli sonf	Herb	Seeds, gum	Chest infections , cold, cough	Oral	Powder, decoction	BCS	9	0.04	3	0.33
	Ferula assafoetida L. (QAD-UOB.V11)	hinga	Herb	Seeds, gum	Vermifuge wound healing	Oral	Powder	C	12	0.05	2	0.17
	Peucedanum kotschyi Boiss. (QAD-UOB.V12)	Raghbol	Herb	Early young leaves, seeds	Pain killer, gastric	Oral	Raw young leaves, powder	S	24	0.11	2	0.08
Asclepiadaceae	*Caralluma tuberculata* N.E. Brown, Gardn. Chron (QAD-UOB.V13)	Pamani	Herb	Whole plant	jaundice, dysentery, high blood pressure, Vermifuge, joints pain, diabetes.	Oral	Paste, juice, Powder, raw plant	C	31	0.14	5	0.16
Asphodeloideae	*Eremurus persicus* (Jaub. & spach) Boiss. (QAD-UOB.V14)	Shezgai	Herb	Leaves	Antiseptic, burns	Topical	Gel	C	18	0.08	2	0.11
	Eremurus stenophyllus (Boiss. &Buhse) Baker (QAD-UOB.V15)	Shezgae jarh gulae	Herb	Leaves, leaves gel	Cooling	Topical	Gel	C	6	0.02	1	0.17
Asteraceae	*Koelpinia linearis* Pallas (QAD-UOB.V16)	Riza bubuzuk/ rish buzhak	Herb	Whole plant	Cough, cold, fever	Oral	Infusion	C	14	0.06	3	0.21
	Launaea intybacea (Jacq.) Beauverd (QAD-UOB.V17)	Zarkoboti pa sapasthoke	Herb	Whole plant	Burns	Topical	Decoction	S	6	0.02	1	0.17
	Launaea procumbens (Roxb.) Ramayya & Rajagopal (QAD-UOB.V18)	shantrazi	Herb	Whole plant	Fever	Oral	Decoction	S	5	0.02	1	0.2
	Lactuca serriola L. (QAD-UOB.V19)	Zarko poi boti	Herb	Whole plant	Cough, bronchitis.	Oral	Decoction	S	9	0.04	2	0.22
	Lactuca dissecta D. Don (QAD-UOB.V20)	Poi boti / zarkboti	Herb	Whole plant	Cough, whooping cough, cold, fever	Oral	Decoction	S	9	0.04	4	0.44
	Lactuca viminea J. Presl & C. Presl (QAD-UOB.V21)	Poi botinari	Herb	Whole plant	Bronchitis, diabetes	Oral	Decoction, infusion	S	10	0.04	2	0.2
	Reichardia tingitana (L.) Roth (QAD-UOB.V22)	Dodalgi/ dodalak	Herb	Leaves	Vermifuge	Oral	Decoction	S	4	0.01	1	0.25

Table 1. (Cont'd.).

Family	Botanical name and (Voucher specimen)	Local name	Life form	Part used	Uses	Mode of administrations	Mode of preparation	Mode of consumption of wild vegetables	FC*	RFC*	UR*	UV*
	Sonchus arvensis L. (QAD-UOB.V23)	Poi Botiazgan	Herb	Whole plant	Wounds, cooling of body, cough, bronchitis asthma.	Oral, topical	Paste, decoction	C	15	0.07	5	0.33
	Taraxacum neolobulatum V. Soest. (QAD-UOB.V24)	Chamanai gul	Herb	Leaves	Kidney pain, discharge of urine, skin diseases	Oral, topical	Milky latex, decoction, powder	C	17	0.08	3	0.18
Brassicaceae	*Capsella bursa- pastoris* (L.) Medik (QAD-UOB.V25)	Camarak	Herb	Leaves	Swelling of body, fever, kidney diseases, wounds	Oral	Paste, decoction, infusion	C	18	0.08	4	0.22
	Crambe cordifolia ssp. *kotschyana* Stev (Boiss.) Jafrij (QAD-UOB.V26)	Jangli siray	Herb	Leaves, root	Obesity, high blood pressure, blood purifier	Oral	Cooked	C	13	0.06	3	0.23
	Descurainia sophia (L.) Webb and Berth (QAD-UOB.V27)	Roosh	Herb	Leaves, seeds	Menstruation problems, cooling of stomach, heat stroke	Oral	Powder, infusion	C	23	0.1	3	0.13
	Goldbachia laevigata (M. Bieb.) DC (QAD-UOB.V28)	Khulaif	Herb	Leaves	Chest infections, cough	Oral	Decoction, powder	C	8	0.03	2	0.25
	Cardaria chalepensis (L.) Hand.-Mazz (QAD-UOB)	Bashki/	Herb	Seeds, leaves	Eczema, flatulency	Topical oral	Paste, powder	C	14	0.06	2	0.14
	Lepidium sativum L. (QAD-UOB.V29)	Jamboi	Herb	Leaves	Fever, dysentery, diarrhea, asthma, cough, secondary syphilis, tenesmus.	Oral	Raw leaves, powder, decoction	BCS	11	0.05	7	0.63
	Malcolmia africana (L.) R. Br. (QAD-UOB.V30)	Khatol	Herb	Leaves	Cooling stomach, stomachache.	Oral	Decoction	BCS.	11	0.05	2	0.18
	Sisymbrium irio L. (QAD-UOB.V31)	Chamarak	Herb	Leaves	Asthma, cough, fever	Oral	Powder, decoction	C	8	0.03	3	0.37
	Sisymbrium loeselii L. (QAD-UOB.V32)	Bushkai	Herb	Leaves	Constipation, dysentery	Oral	Powder, decoction	C	9	0.04	2	0.22
	Sisymbrium brassiciforme C.A. Mey (QAD-UOB.V33)	Bushkai	Herb	Leaves	Headache, fever, chest infections	Oral	Decoction	C	12	0.05	3	0.25
Caprifoliaceae	*Lonicera hypoleuca* Decne (QAD-UOB.V34)	Pushkun pulli	Shrub	Leaves	Flue, cold, cough	Oral	Decoction, powder	C	16	0.07	3	0.19
Chenopodiaceae	*Chenopodium foliosum* Asch. (QAD-UOB.V35)	Joasag	Herb	Leaves	Vermifuge, constipation	Oral	Decoction, paste	C	14	0.06	2	0.14
	Chenopodium botrys L. (QAD-UOB.V36)	Sag	Herb	Whole plant	Antiseptic, wounds healing, insect bite, Vermifuge	Oral, topical	Paste, Decoction	C	14	0.06	4	0.28
	Chenopodium album L. (QAD-UOB.V37)	Tor Sag	Herb	Leaves	Vermifuge cooling of stomach.	Oral	Decoction, infusion	C	15	0.07	2	0.13
Fabaceae	*Lathyrus erectus* Lag. (QAD-UOB.V38)	Mater koshni	Herb	Seeds	Spleen resolvent	Oral	Powder	C	9	0.04	1	0.11
	Trigonella uncata Boiss. (QAD-UOB.V39)	Methi	Herb	Seeds, leaves	Small pox, as cooling agent, dysentery.	Oral	Powder, infusion	C	12	0.05	3	0.25
	Trigonella monantha C.A. Mey. (QAD-UOB.V40)	Morghaispasthi	Herb	Leaves	dysentery	Oral	Powder	C	4	0.01	1	0.25
	Vicia sativa. L. (QAD-UOB.V41)	Kishnae matar	Herb	Whole plant, fruit	Cough, flue, eczema	Oral, topical	Powder, paste, decoction	C	9	0.04	3	0.33

Table 1. (Cont'd.).

Family	Botanical name and (Voucher specimen)	Local name	Life form	Part used	Uses	Mode of administrations	Mode of preparation	Mode of consumption of wild vegetables	FC*	RFC*	UR*	UV*
Fumariaceae	*Fumaria indica* (Hausskn.) Pugsley (QAD-UOB.V42)	Shook sag	Herb	Whole plant	Itching, blood purifier	Oral	Powder	C	7	0.03	2	0.28
Geraniaceae	*Erodium cicutarium* (L.) L. Herit. ex Aitch. (QAD-UOB.V43)	Sagdandan	Herb	Whole plant	constipation	Oral	Decoction	C	3	0.01	1	0.33
	Erodium oxyrrhynchum Boiss. ssp. *bryoniifolium* Boiss. (QAD-UOB.V44)	Bakhal saag	Herb	Whole plant	Backache, constipation	Oral	Decoction	C	5	0.02	2	0.4
Ixioliriaceae	*Ixiolirion tataricum* Pall (QAD-UOB.V45)	Hadoogai	Herb	Leaves, bulb	Digestion, smell of mouth	Oral	Raw bulbs	S	10	0.04	2	0.2
Lamiaceae	*Mentha longifolia* (L.) L. (QAD-UOB.V46)	Shamshobi/ walina	Herb	Leaves	Joints pain, stomachache, digestion, dysentery, diarrhea, blood purifier, stimulant	Oral	Powder, juice, tea	BCS	26	0.11	7	0.27
	Mentha spicata Crantz. (QAD-UOB.V47)	Podina	Herb	Leaves	stomachache antiseptic, stimulant, refrigerant, urine discharge	Oral	Powder, juice, tea	BCS	21	0.09	5	0.24
	Eremostachys vicary Benth. ex Hook. F (QAD-UOB.V48)	Stagh	Herb	Seeds	Cooling agent	Oral	Powder, decoction	S	4	0.01	1	0.25
Liliaceae	*Gagea baluchistanica* Levichev (QAD-UOB.V49)	Khokhae	Herb	Whole plant, leaves	Constipation, high blood pressure	Oral	Raw leaves	BCS	7	0.03	2	0.28
	Tulipa clusiana DC. (QAD-UOB.V50)	Spin gul	Herb	Bulbs	Joints pain	Oral	Raw bulbs	S	7	0.03	1	0.14
Oxalidaceae	*Oxalis corniculata* L. (QAD-UOB.V51)	Lewanai booti	Herb	Leaves	Kidney pain, urine discharge	Oral	Decoction, Powder	C	11	0.05	2	0.18
Polygonaceae	*Polygonum aviculare* L. (QAD-UOB.V52)	Sag	Herb	Whole plant	Stomach, cooling, pain killer..	Oral	Decoction, powder	C	15	0.07	2	0.13
	Polygonum polycnemoides Jaub. & Spach (QAD-UOB.V53)	Sag	Herb	Leaves	Chest infections, cough, blood purifier	Oral	Decoction, powder	C	12	0.05	3	0.25
	Rumex chalepensis Mill. (QAD-UOB.V54)	Turushak	Herb	Leaves, roots	cutaneous disorder	Oral	Decoction	C	9	0.04	1	0.11
	Rumex crispellus Rech. F. L. (QAD-UOB.V55)	Turushak	Herb	Roots	skin diseases	Topical	Decoction	C	10	0.04	1	0.1
	Rumex vesicarius L. (QAD-UOB.V56)	Te rshoka	Herb	Root, Leaves, seeds	snake bite, nausea cooling agent. dysentery	Oral, topical	Juice, decoction	BCS	15	0.07	4	0.26
Portulacaceae	*Portulaca oleracea* L. (QAD-UOB.V57)	Kharbari/kolfa	Herb	Whole plant, leaves	Stomach problems, constipation. Kidney diseases, lung disease, burns, skin diseases.	Oral	Juice, paste, decoction, cooked	C	17	0.08	6	0.35
Ranunculaceae	*Ranunculus afghanicus* DC. (QAD-UOB.V58)	Da obo boti jarhgul	Herb	Whole plant	Skin diseases	Oral	Decoction, infusion	BCS.	8	0.03	1	0.12
Typhaceae	*Typha domingensis* Pers. (QAD-UOB.V59)	Lookh	Herb	Young shoots and roots, latex	Skin diseases	Topical	milky latex, raw shoots	S	7	0.03	1	0.14

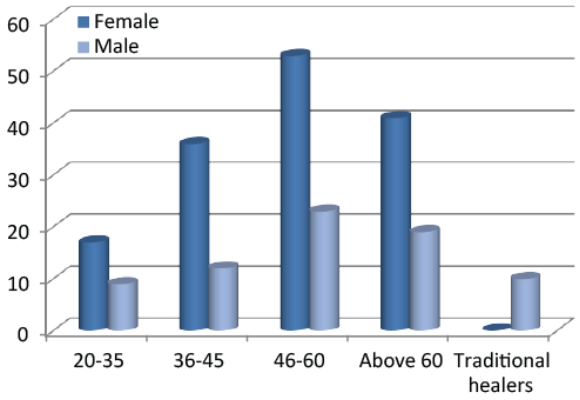

Fig. 2. Distribution of age, gender and number of informants interviewed.

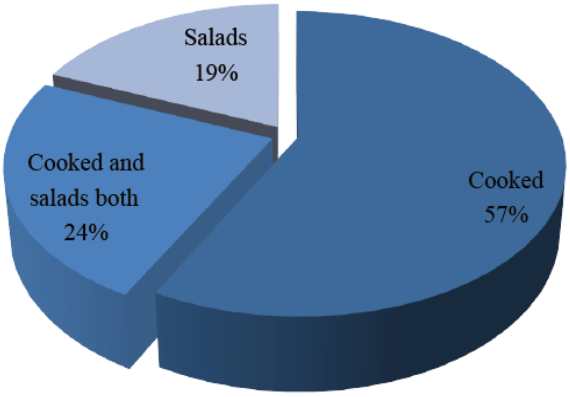

Fig. 3. Percentage of mode of consumption of wild vegetables.

Table 2. Most used families of the study area.

Family	Species
Brassicaceae	10
Asteraceae	9
Apiaceae	6
Polygonaceae	5
Fabaceae	4
Amaranthaceae	3
Chenopodiaceae	3
Lamiaceae	3
Alliaceae	2
Asphodeloideae	2

The results of this study showed that Brassicaceae is the most commonly used plant family having highest number of wild vegetable species in the area. Abbasi *et al*., (2013); reported Asteraceae and Papilionoideae as dominating wild vegetables families in Lesser Himalayas-Pakistan while according Panda, (2014) Amaranthaceae, Dioscoreaceae and Caesalpiniaceae were the most important botanical families of wild edible food in Kendrapara district, Odisha, India. All these results are contrary to our findings. The reason may be the change in geography, climate and vegetation. The other reason of predominance of the family is the wide distribution of the wild vegetables of Brassicaceae in cultivated crop fields as weed, on barren plains, hills, road sides with attractive yellow and white flowers in the months of March to May in the area. The groups of 10-12 women of the areas visit the wheat fields and plains and gather the wild vegetables mostly belongs to family Brassicaceae in large quantity as kind of enjoyment and fulfill the need of food. These women use a specific term (Alya parakawarh) in local language for vegetable collection and these vegetables are not only cooked but dried and preserved for future use.

Mode of consumption of wild vegetable: Among wild vegetables, (57%) of vegetables are cooked, (19%) are eaten raw as salads and (24%) plants are eaten in raw form as salads and in cooked form both (Table 1, Fig. 3). The traditional vegetables are cooked with many recipes, either these are boiled in fresh large quantities of water and then this excess water is drained and discarded and fried in oil with number of spices, onion, tomatoes garlic and ginger e.g.(*Amaranthus graecizans*, *Amaranthus viridis*, *Amaranthus hybridus*,*Capsella bursa-pastoris*, *Chenopodium botrys*, *Chenopodium foliosum*, *Rumex crispellus*, *Taraxacum officinale)* but this cooking method is likely to cause nutrient loss, especially where the water soluble vitamins such as vitamin B complex and vitamin C are discarded with the drained water (Den Hartog *et al*., 2006; Flyman & Afolayan, 2006). In other recipes the leaves are roasted in the bread (roti) like a sandwich (*Mentha longifolia*, *Mentha spicata, Gagea baluchistanica, Cardaria chalepensis* , *Lepidium sativum*) or cooked with pulses, (*Portulaca oleracea*, *Eremurus persicus*, *E. stenophyllus*) chicken or mutton.e.g.(*Cardaria chalepensis*, *Lepidium sativum*), or fried like potato chips e.g. *Caralluma tuberculata* which has a bitter taste, so it is cut into pieces and mixed salt in it and kept 3-4 hours in sun, than washed with fresh water and fried in oil/ ghee or mixed different spices and onion. Present findings are in agreement with previous workers (Dutta & Pant, 2003; Abbasi *et al*., 2013) regarding cooking methods of wild vegetables, while very poor families only boil these leaves without adding oil or anything else or taken in fresh and raw form as salads with bread (roti).It is noted that mostly the leaves of the plants are cooked as vegetables, while different parts of plants are eaten as salads e.g. bulbs of (*Ixiolirion tataricum*, *Tulipa clusiana*, *Allium farctum*, *Allium griffithianum*, leaves of (*Lactuca dissecta*, *Lactuca viminea*, *Mentha longifolia*, *Mentha spicata, Bunium cylindricum*, *Bunium persicum*, shoots of (*Typha domingensis*) and number of species are eaten in raw form as salads or in cooked form both (Fig. 3). All the wild vegetable are herbs in the study area except a single species i.e. *Lonicera hypoleuca* which is a shrub.

Cooking of the vegetables in combination: Number of species are cooked together in combination for example *Koelpinia linearis*, *Descurainia sophia*, *Rumex chalepensis*, *Rumex crispellus*, *Lepidium sativum*, *Goldbachia laevigata*. Sometimes all the seasonal plants are gathered together and a single dish of 10-12 species are cooked. Although there are number of recipes for cooking of vegetables in the area but still there is lack of variety in the cooking methods. This could cause traditional vegetables to be boring and consequently less appealing. Variety in the preparation of traditional vegetables is recommended. It is suggested that recipes used by different ethnic groups be made available to the women of this community, since it is believed that access to a greater variety of cooking methods would increase the inclusion of traditional vegetables in their diets, thus increasing diet diversity (Dweba & Mearns, 2011).

Table 3. Informant consensus factor, Percentage of species and citations for different use categories.

Disease category	No. of use reports	%age of use reports	No. of Taxa	%age of taxa used	Informant consensus factor (ICF)
Antidote (Snake bite, insects bite)	2	1.34	2	1.96	0
Blood circularity system disorders (Heart inflammation, High blood pressure, Blood purifiers)	7	4.69	6	5.88	0.16
Dermatological problems (Antiseptic, burns, cutaneous, Eczema, itching, ,secondary syphilis, skin diseases, wounds healing)	20	13.43	7	6.86	0.68
Ear, nose and throat diseases (ENT) (Earache)	1	0.67	1	0.99	0
Gastrointestinal diseases (cooling of stomach, constipation, digestion, diarrhea, dysentery, flatulency, gastric, nausea, smell of mouth, stomachache, stimulant, vermifuge,)	45	30.21	29	28.43	0.57
Glandular disorders (Diabetes, Jaundice, spleen problems)	7	4.69	6	5.88	0.16
Gynecological problems (menstrual problems)	1	0.67	1	0.99	0
Infectious diseases (fever, refrigerants, body cooling, small pox)	15	10.07	14	13.72	0.07
Musculoskeletal disorders (backache, headache, joints pain, as pain killer)	7	4.69	7	6.86	0
Others (Heat strokes, obesity, swelling of body)	3	2.02	3	2.94	0
Respiratory diseases (Asthma, bronchitis, chest problems, cold, cough, flue, chest infection, whooping cough, lungs diseases)	31	20.81	17	16.67	0.46
Urogenital problems (Gonorrhea, kidney pain, sexual weakness, tensmus, urine discharge,)	10	6.71	9	8.82	0.11

Table 4. Fidelity level (FL) of medicinal uses of edible vegetables of the study area.

Plant Name	No. of informants reported the taxa	No. of ailments treated	No. of use most frequently determined by informant	Fidelity level (FL)
Amaranthus graecizans	23	3	20	89.96
Eremurus persicus	18	2	15	83.33
Apium graveolens	17	7	11	64.71
Lepidium sativum	11	7	9	81.82
Mentha longifolia	26	7	22	84.61
Portulaca oleracea	17	6	12	70.59
Crambe cordifolia	13	3	10	76.92
Descurainia sophia	23	3	23	100
Peucedanum kotschyi	24	2	22	91.67
Caralluma tuberculata	31	5	31	100
Ixiolirion tataricum	10	2	9	90

Use of dried wild vegetables in winters: The vegetables are also dried in sun or sometimes in shadow in open air and preserved. In winters these dried vegetables are cooked with different recipes. In Harnai there is also limited knowledge of the cooking of dried vegetables and also lack of knowledge pertaining to the appropriate drying practices for traditional vegetables Therefore, more education on the cooking of the dried vegetables is warranted, since it could increase the general accessibility to and utilization of traditional vegetables. To prevent the loss of nutrients, proper drying practices need to be investigated so that this knowledge can be imparted to the community. In addition to that, other alternative preservation techniques need to be explored to increase availability of traditional vegetables (Dweba & Mearns, 2011). It is recommended that future research efforts include a nutritional assessment of the community's food intake to enable researchers and policy makers to recommend and design appropriate intervention strategies. The actual cooking practices with traditional vegetables need to be investigated and a nutritional analysis of a broad spectrum of uncooked, cooked and preserved traditional vegetable dishes need to be done to determine their actual nutrient contribution.

Plant parts used and mode of consumption of wild vegetables: Different parts of wild edible vegetables were consumed in diverse ways according to local traditions. The most commonly used plant parts in herbal preparations were leaves (44.45%), followed by whole plant (22%), seeds (14%) (Fig. 4) strongly agree with the results of (Abbassi *et al*., 2013). It was observed that leaves are highly utilized plant parts followed by seeds. The most important forms of preparation methods for herbal drugs were decoction (34%) followed by powder (26 records), paste (9 records) (Fig. 5). Almost all of the documented species used singly as mono herbal recipes with their specific part use for particular disease while some times the mixtures of various parts (e.g. aerial parts) with additional ingredients like green tea, brown sugar, sugar, salt, milk or honey maybe used to treat some diseases (Sadeghi *et al*., 2014).

Herbal drug preparation methods and Administration routes: In this study taking the medicinal plants orally was the most preferred administration method. (82% plant species were taken orally, while (18%) plant species were applied topically(Table 1, Fig. 6) Similar results were given for the traditional herbal remedies by number of workers in different regions of the world and in Pakistan (Mood, 2008; Brandao *et al*., 2012; Sadeghi *et al*., 2014, Bano *et al*., 2014). Orally used plant are taken in the form of decoction, powder, Infusion, Juice, Tea Cooked and Raw plant part e.g. leaves, shoot and bulbs,. The most common preparation reported local inhabitants of the area were decoction (34%) and powder (%) (Figs. 3, 5) Decoctions were the most used (34%) in preparation of plants (Fig. 5) made by boiling a specific part in one to two liter of water. The results of wide spread use of decoction and infusion agree with the results of (Gurdal & Kultur, 2013; Ahmad *et al*., 2014; Bibi *et al*., 2014) Topical mode of administration also accounts a considerable proportion of application. Latex, gel and paste are applied topically for skin diseases or in case of snake and insect bite.

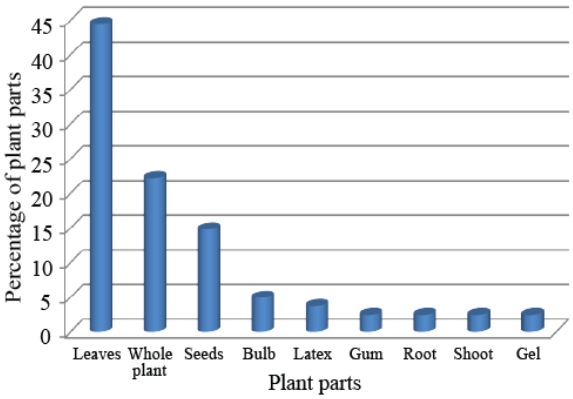

Fig. 4. Percentage of plant parts used.

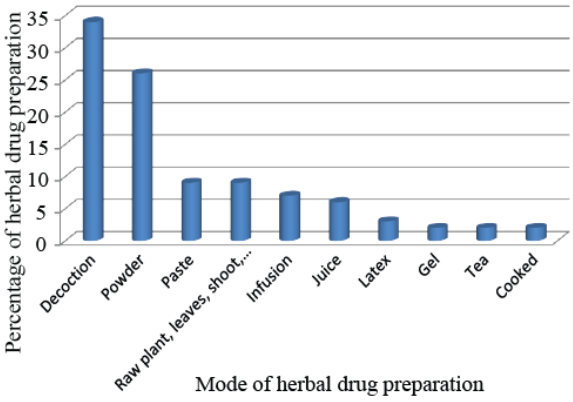

Fig. 5. Percentage of herbal drug preparation.

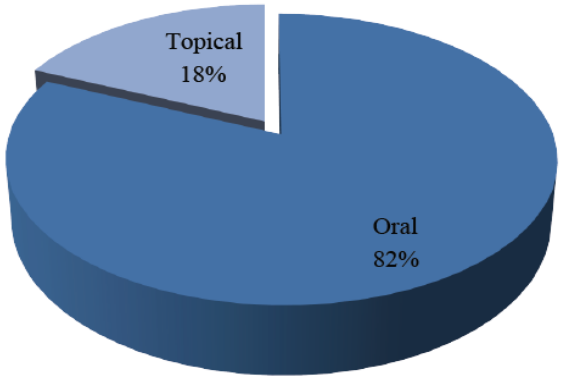

Fig. 6. Percentage of mode of administrations.

Medicinal use categories and use reports of wild edible vegetables: Wild edible vegetables are used by the local inhabitants for curing different ailments, which are categorized in twelve different illness groups. Efforts were made to organize the data on most of illness based on indigenous classifications developed by medical practitioners. These included dermatological problems, gastro-intestinal diseases, Ear Nose Throat (ENT) diseases, Muscoskeletal disorders, infectious diseases, respiratory diseases, urogenital problems, glandular disorders, antidote, blood circularity system disorders, and gynecological diseases. The highest number of species were used in the treatment of gastro-intestinal diseases (29 species, 45 use reports) followed by respiratory disorders (17 species, 31 use reports), (Table. 3). Similar results were reported by Bibi *et al*. (2014) worked in district Mastung of Balochistan, Pakistan. Ullah *et al*. (2013) conducted a similar study in Wana district in Pakistan, Nasab & Khosravi, (2014) in Iran and Sadeghi *et al*. (2014) in Saravan Baluchistan, Iran which is borderd with the Balochistan province of Pakistan. All across the globe, various type of gastro-intestinal disorders are predominant and as sizeable number of plant species have been discovered to cure such illnesses across different ethnic communities (Heinrich *et al*., 1998; Ankli *et al*., 1999; Bennett & Prance, 2000; Miraldi *et al*., 2001; Ghorbani, 2005; Ghorbani *et al*., 2011; Mosaddegh *et al*., 2012). The people of the study area are very poor, due to poor dietary conditions, and unsafe drinking water, this ailment is one of the most common problems in the area studied and infecting other parts of the world (Nasab & Khosravi, 2014), while the dominancy of respiratory diseases is because of the severe winters in the study area.

Quantitative analysis

Informant's consensus factor (ICF): ICF of wild vegetables used for twelve disease categories were calculated which ranges from ranges from (0 to 0.68) in our study area dermatological problems category has highest ICF value (0.68) followed by gastrointestinal diseases (0.57 ICF), thus high value indicating good agreement among interviewees on the knowledge and consequent use of particular plants to treat diseases, while the least ICF was calculated for three disease categories i.e. Antidote, Musculoskeletal disorders and others category (heat strokes, obesity, swelling of body) with zero ICF values (Table 3). Contrary results were recorded for least agreement between the informants was observed for plants used for Antidote category with one ICF was recorded by (Bibi *et al.,* 2014.).Unfortunately, other ethnobotanical studies conducted in Pakistan did not calculate this index and, therefore, it was not possible to compare data.

Family importance value (FIV) and fidelity level (FL): The FIV of 20 families were calculated and the most common families as depicted by its FIV were Brassicaceae as the dominant family with14 FIV followed by Apiaceae and Asteraceae (10 each), Lamiaceae (6) and least FIV were reported for nine families i.e**.** Asphodeloideae, Caprifoliaceae, Fumariaceae, Geraniaceae, Ixioliriaceae, Liliaceae, Oxalidaceae, Ranunculaceae, Typhaceae with (1 FIV each), (Fig. 7). Fidelity level (FL) of twelve wild vegetables plant species were found against a given ailment category (Table. 3). 100% fidelity level was calculated for two plant species i.e. *Descurainia Sophia* and *Caralluma tuberculata*, while least FL was calculated for *Apium graveolens* (64.71 FL), (Table. 4). High FL values indicate the prevalence of specific diseases in the area that are treated with the medicinal plants with high FL values (Bibi *et al*., 2014). It also point outs that local people still have not lost their traditions, they not only use wild plants for food but also use these wild vegetables for medicinal purposes as well.

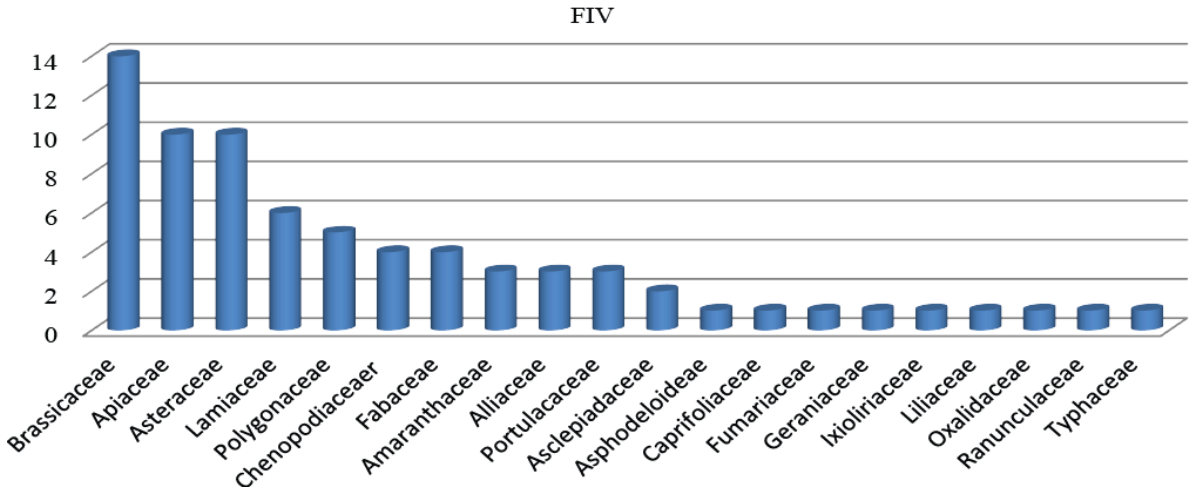

Fig. 7. Family importance value index of wild vegetables in the area

Use value (UV) and use report (UR): In the current study the highest use value was observed for the *Lepidium sativum* (0.63). *Lactuca dissecta* (0.44) *Apium graveolens* (0.41) and *Sisymbrium irio* (0.37) while, least use values were reported for *Peucedanum kotschyi* (0.08UV). The high UV of certain plants ensures versatile uses of these plant species (Ayyanar & Ignacimuthu, 2011) and also the high abundance of these species in the study area. The highest UV of these plants could be rationalized by their huge popularity regarding versatile healing power in this geographic region (Ayyanar & Ignacimuthu, 2011). On the contrary, scarcity of the certain plants in the study area leads to low UV (Rokaya *et al*., 2010, Shad *et al*., 2013). The highest use report was calculated for three species *Apium graveolens Lepidium sativum*, *Mentha longifolia,* (7UR for each) and least use report was observed for 14 species with only one use report (Table. 1) Comparing the use values and use reports of our study with other studies of regional and global we didn't find similar species to match, the differences may be due to variation in vegetation and geo-climate of the areas.

Frequency of citations (FC) and relative frequency of citation (RFC): The highest RFC value was calculated for *Caralluma tuberculata* (0.14) and the least use values were recorded for *Eremostachys vicary* and *Trigonella monantha* (0.01 each), (Table. 1). It means that *Caralluma tuberculata* is the most popular medicinal plant and vegetable agreed by the majority of the informants in District Harnai. *Caralluma tuberculata* is not common on plains, it is found on mountains and hills the local shepherds collect this plant and sale into the local vegetable shops in fresh form and herbal medicinal shops (Pansars) in dried form. This species is not only popular in the study area but it is very popular throughout the province. Bibi *et al*. (2014) reported highest use report for *Caralluma tuberculata* in district Mastung Balochistan, while Tareen *et al*. (2010) also enlisted number of uses for this plant. Because of multiple uses and high utilization of *Caralluma tuberculata* and some other species like *Lepidium sativum*, *Lactuca dissecta* and *Apium graveolens* have facing severe threats and may have great risk of extinction in near future.

Conclusion

This study first documented the information about the wild vegetables and their traditional medicinal uses in district Harnai. Our study reveals that plants are still used as a major source of food like vegetables as well as medicine for the local people living in the area. The results of the study further suggest that these findings, although directly related to the study area, but may have international relevance knowledge. Alternative systems to conserve the indigenous knowledge such as databanks, technology based repositories in the form of recordings and internet based portals have proved to be valuable in conserving indigenous knowledge. The specific contribution of this study towards the conservation of indigenous knowledge recognizes the value of the original indigenous knowledge system, namely the transfer of indigenous knowledge to the younger generation as the future custodians of the indigenous knowledge.

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References

Abbasi, A.M., M.A. Khan, N. Khan and M.H. Shah. 2013.Ethnobotanical survey of medicinally important wild edible fruits species used by tribal communities of Lesser Himalayas-Pakistan. *J. Ethnopharm,* 148: 528-536.

Abbet, C., R. Mayor, D. Roguet, R. Spichiger, M. Hamburger and O. Potterat. 2014. Ethnobotanical survey on wild alpine food plants in Lower and Central Valais (Switzerland). *J. Ethnopharm,* 151: 624-634.

Adebooye, O.C. and J.T. Opabode. 2004. Status of conservation of the indigenous leaf vegetables and fruits of Africa. *African J. Biotech*., 3(12): 700-705.

Ahmad, M., S. Shazia, S. Fazl-i-Hadi, T.B. Hadda, S. Rashid, M. Zafar, M.A. Khan, M.P.Z. Khan and G. Yaseen. 2014. An Ethnobotanical study of Medicinal Plants in high mountainous region of Chail valley (District Swat-Pakistan). *J. Ethnobiol and Ethnomed*, 10: 1-36.

Ali, S.I. and M. Qaiser. (Eds.). 1993-2015. *Flora of Pakistan*, Karachi.

Ali, S.I. and Y.J. Nasir (Eds.). 1989-91. *Flora of Pakistan*, Karachi and Islamabad, 191-193.

Ali-Shtayeh, M.S., R.M. Jamous, J.H. Al-Shafie, W.A. Elgharabah, F.A. Kherfan, K.H. Kifayeh, I.S. Khdair, M.I. Soos, A. Aseel, A.A. Musleh, A.I. Buthainah, H.M. Herzallah, R.B.M. Rasha Khlaif, M.S. Aiash, G.M. Swaiti, M.A. Abuzahra, M.M.A. Haj-Ali, N.A. Nehaya Saifi, H.K. Azem and H.A. Nasrallah. 2008. Traditional knowledge of wild edible plants used in Palestine (Northern West Bank): A comparative study. *J. Ethnobiol and Ethnomed,* 4(13): 4-13.

Ankli, A., O. Sticher and M. Heinrich. 1999. Medical ethnobotany of the Yucatec Maya: Healers consensus as a quantitative criterion. *Econ. Bot.,* 53: 144-160.

Anon. 2011. District development profile Harnai. Planning & Development Department, Government of Balochistan, Quetta.

Anonymous. 2004. Food and Agriculture Organization of the United Nations (FAO). Annual Report: The state of food insecurity in the world. Monitoring the progress towards the world food summit and mellennium development goals. Rome.

Anonymous. 2012. PDMA Balochistan (Provincial Disaster Management Authority). [http://www.pdma.gov.pk/?p=39].

Ayyanar, M. and S. Ignacimuthu. 2011. Ethnobotanical survey of medicinal plants commonly used by Kanitribalsin Tirunelveli hills of Western Ghats, India. *J. Ethnopharm*., 134: 851-864.

Balemie, K. and F. Kebebew. 2006. Ethnobotanical study of wild edible plants in Derashe and Kucha Districts, South Ethiopia. *J. Ethnobiol and Ethnomed,* 2: 53-58.

Bano, A., M. Ahmad, B.T. Khan, B.T. Hadda, M. Zafar, S. Sultana, M.P. Khan, M. Arshad and M.A. Ashraf. 2014.Quantitative ethnomedicinal study of plants used in the Skardu valley at high altitude of Karakoram himalayan range, Pakistan. *J. Ethnobiol. Ethnomed,* 10: 43-71.

Bennett, B.C. and L.T. Prance. 2000. Introduced plants in the indigenous pharmacopeia of northern South America. *Econ. Bot.,* 54: 90-102.

Bibi, T., M. Ahmad, R.B. Tareen, N.M. Tareen, R. Jabeen, S. Saeed-ur-Rehman, Shazia, M. Zafar and G. Yaseen. 2014. Ethnobotany of medicinal plants in district Mastung of Balochistan province-Pakistan. *J. Ethnopharm*, 157: 79-89.

Brandao, M.G.L., M. Pignal, S. Romaniuc, C.F.F. Grael and C.W. Fagg. 2012. Useful Brazilian plants listed in the field books of the French naturalist Augustede Saint-Hilaire (1779–1853). *J. Ethnopharm,* 143: 488-500.

Colledge, S. and J. Conolly. 2014. Wild plant use in European Neolithic subsistence economies: a formal assessment of preservation bias in archaeobotanical assemblages and the implications for understanding changes in plant diet breadth. *Quarter. Sci. Rev.,* 101: 193-206.

Della, A., D. Paraskeva-Hadjichambi and C.A. Hadjichambis. 2006. An ethnobotanical survey of wild edible plants of Paphos and Larnaca countryside of Cyprus. *J. Ethnobiol Ethnomed,* 2: 34-38.

Den Hartog, A.P., W.J. Van Staveren and I.D. Brouwer. 2006. Food habits and consumption in developing countries: Manual for field studies. Wageningen: Wageningen Academic Publishers.

Dutta, A. and K. Pant. 2003. The nutritional status of indigenous people in the Garwal Himalayas, India. *Mountain Res. Dev.,* 23(3): 278-283.

Dwebaa, T.P. and M.A. Mearns. 2011. Conserving indigenous knowledge as the key to the current and future use of traditional vegetables. *Int. J. Info. Manag.,* 31: 564-571.

Ertug, F. 2000. Wild edible plants of the Bodrum area (Mugla, Turkey). *Turk. J. Bot.,* 28: 161-174.

Etkin, N.L. 1996. Medicinal cuisines: diet and ethnopharmacology. *Int. J. Pharmacog.,* 34: 313-326.

Flyman, M.V. and A.J. Afolayan. 2006. The suitability of wild vegetables for alleviating human dietary deficiencies. *S. Afr. J. Bot*., 72: 492-497.

Friedman, J., Z. Yaniv, A. Dafni and D. Palewitch. 1986. A preliminary classification of the healing potential of medicinal plants, based on the rational analysis of an ethnopharmacological field survey among Bedouins in Negev Desert, Israel. *J. Ethnopharm,* 16: 275-287.

Ghorbani, A. 2005. Studies on pharmaceutical ethnobotany in the region of Turkmen Sahra, North of Iran (Part1): general results. *J. Ethnopharm,* 102: 8-68.

Ghorbani, A., G. Langenberger, L. Feng and J. Sauerborn. 2011.Ethnobotanical study of medicinal plants utilized by Hani ethnicity in Naban river Watershed National Nature Reserve, Yunnan, China. *J. Ethnopharm,* 134: 651-667.

Giovannini, P. and M. Heinrich. 2009. Xkiyoma (our medicine) and xkitienda (patent medicine) Interface between traditional and modern medicine among the Mazatecs of Oaxaca, Mexico. *J. Ethnopharm,* 121: 383-399.

Gurdal, B. and S. Kultur. 2013. An ethnobotanical study of medicinal plants in Marmaris (Mŭgla, Turkey). *J. Ethnopharm,* 146: 113-126.

Hadjichambis, A.C.H., D.P. Hadjichambi, A. Della, M.E. Giusti, D.C. Pasquale, C. Lenzarini, E. Censorii, M.R.G. Tejero, C.P.S. Rojas, J.R.R. Gutierrez, M. Skoula, C.H. Johnson, A. Sarpakia, M. Momouchiv, S. Jorhi, M.E. Demerdash, M. Zayat and A. Pioroni. 2008. Wild and semi domesticated food plant consumption in seven circum Mediterranean areas. *Int. J. Food Sci. Nut.,* 59: 383-414.

Heinrich, M. and S. Gibbons. 2001. Ethnopharmacology in drug discovery an analysis of its role and potential contribution. *J. Pharm. Pharmacol.,* 53: 425-432.

Heinrich, M., A. Ankli, B. Frei, C. Weimann and O. Sticher. 1998. Medicinal plants in Mexico: healers's consensus and cultural importance. *Social Sci. Med.,* 47: 1859-1871.

Heinrich, M., S. Edwards, D.E. Moerman and M. Leonti. 2009. Ethnopharmacological field studies: a critical assessment of their conceptual basis and methods. *J. Ethnopharm,* 124: 1-17.

Hussain, J., A.L. Khan, N. Rehman, M. Hamayun, Z.K. Shinwari, W. Malik and I-J. Lee. 2009. Assessment of herbal products and their composite medicinal plants through proximate and micronutrients analysis. *J. Med. Pl. Res*. 3(12): 1072-1077.

Jain, S.K. and R.R. Rao. 1977. *A Hand book of Field and Herbarium Methods*. Today and tomorrow printers and publishers, New Delhi

Jamila, F. and E. Mostafa. 2014. Ethnobotanical survey of medicinal plants used by people in Oriental Morocco to manage various ailments. *J. Ethnopharm*, 154: 76-87

Jouad, H., M. Haloui, H. Rhiouani, J. ElHilaly and M. Eddouks. 2001. Ethnobotanical survey of medicinal plants used for the treatment of diabetes, cardiac and renal diseases in the North centre region of Morocco (Fez-Boulemane). *J. Ethnopharm,* 77: 175-182.

Khafagi, I.K. and A. Deward. 2000. The efficiency of random versus ethno-directed research in the evaluation of Sinai medicinal plants for bioactive compounds. *J. Ethnopharm,* 71: 365-376.

Kristensen, M. and H. Balslev. 2003. Perceptions, use and availability of woody plants among the Gourounsi in Burkina Faso. *Biodiv Conserv.,* 12: 1715-1739.

Ladio, A.H. and M. Lozada. 2004. Patterns of use and knowledge of wild edible plants in distinct ecological environments: a case study of a Mapuche community from north western Patagonia. *Biodiv. Conserv.,* 13: 1153-1173.

Lwoga, E.T., P. Ngulube and C. Stilwell. 2010. Managing indigenous knowledge for sustainable agricultural development in developing countries: Knowledge management approaches in the social context. *The Int. Info. Lib. Rev.*, 42(3): 174-185.

Miraldi, E., S. Ferri and V. Mostaghimi. 2001. Botanical drugs and preparations in theTraditional medicine of West Azerbaijan (Iran). *J. Ethnopharm*., 75: 77-87.

Misra, S., R.K. Maikhuri, C.P. Kala, K.S. Rao K.G. Saxena. 2008. Wild leafy vegetables: a study of their subsistence dietetic support to the inhabitants of Nanda Devi biosphere reserve, India. *J. Ethnobiol and Ethnomed,* 4: 15

Modi, M., A.T. Modi and S. Hendricks. 2006. Potential role of wild vegetables in household food security: A preliminary case study in KwaZulu-Natal, South Africa. African Journal of Food, Agriculture. *Nut. Dev.*, 6(2): 1-13.

Mood, S.G. 2008. Contribution to some ethnobotanical aspects of Birjand flora (Iran*). Pak. J.Bot*., 40: 1783-1791.

Mosaddegh, M., F. Naghibi, H. Moazzeni, A. Pirani and S. Esmaeili. 2012. Ethnobotanical survey of herbal remedies traditionally used in Kohghiluyehva Boyer Ahmad province of Iran. *J. Ethnopharm,* 141: 80-95.

Nasab, K.F. and A.R. Khosravi. 2014. Ethnobotanical study of medicinal plants of Sirjan in Kerman Province, Iran. *J. Ethnopharm,* 154: 190-197.

Nasir, E. and S.I. Ali. (Eds.), 1970-1979. National Herbarium, PARC, Islamabad and Department of Botany, University of Karachi, Pakistan.

Nasir, E. and S.I. Ali. (Eds.), 1980-1989. National Herbarium, PARC, Islamabad and Department of Botany, University of Karachi, Pakistan.

Odhav, B., S. Beekrum, U.S. Akula and H. Baijnath. 2007. Preliminary assessment of nutritional value of traditional in KwaZulu-Natal, South Africa. *J. Food Com. Anal.*, 20(5): 430-435.

Panda, T. 2014. Traditional knowledge on wild edible plants as livelihood food in Odisha, India. *J. Biol and Earth Sci*., 4(2): 144-159.

Pardo-de-Santayana, M. Tardo, J. Blanco, E. Carvalho, A.M. Lastra, J.J. San, E. Miguel and R. Morales. 2007. Traditional knowledge of wild edible plants used in the northwest of the Iberian Peninsula (Spain and Portugal): a comparative study. *J. Ethnobiol and Ethnomed,* 3: 27.

Phillips, O., A.H. Gentry, C. Reynel, P. Wilkin and B.C. Galvez-Durand. 1994. Quantitative ethnobotany and Amazonian conservation. *Conser. Biol.,* 8: 225-248.

Pieroni, A., S. Nebel, R.F. Santoro and M. Heinrich. 2005. Food for two seasons: culinary uses of non-cultivated local vegetables and mushrooms in a south Italian village. *Int. J. Food Sci. Nut.,* 56: 245-272.

Rasingam, L. 2012. Ethnobotanical studies on the wild edible plants of Irula tribes of Pillur Valley, Coimbatore district, Tamil Nadu, India. *Asian Pac. J. Trop. Biomed.,* 1493-1497.

Rokaya, M.B., Z. Münzbergova and B. Timsina. 2010. Ethnobotanical study of medicinal plants from the Humla district of western Nepal. *J. Ethnopharm,* 130: 485-504.

Sadeghi, Z., K. Kuhestani, V. Abdollahi and A. Mahmood. 2014. Ethnopharmacological studies of indigenous medicinal plants of Saravan region, Baluchistan, Iran. *J. Ethnopharm.,* 153: 111-118.

Saqib, Z., R.N. Malik, M.I. Shinwari and Z.K. Shinwari. 2011. Species richness, ethnobotanical species richness and human settlements along a Himalayan altitudinal gradient: Prioritizing plant conservation in Palas Valley, Pakistan. *Pak. J. Bot*., 43(SI): 129-133.

Sarwat, Z.K. Shinwari and N. Ahmad. 2012. Screening of potential medicinal plants from district Swat specific for controlling women diseases. *Pak. J. Bot*., 44(4):1193-1198.

Savikin, K., G. Zdunic, N. Menkovic, J. Zivkovic, N. Cujic, M. Terescenko and D. Bigovic. 2013. Ethnobotanical study on traditional use of medicinal plants in south western Serbia, Zlatibor district. *J. Ethnopharm,* 146(3): 803-810.

Scherrer, A.M., R. Motti and S.S. Weckerle. 2005. Traditional plant use in the areas of Monte Vesole and Ascea, Cilento National Park (Campania, Southern Italy). *J. Ethnopharm.,* 97: 129-143.

Shad, H., U.J. Shah and J. Bakht. 2013. Ethnobotanical assessment and nutritive potential of wild food plants. *J. Animal Plant Sci.*, 23(1): 92-97.

Shava, S. 2000. The use of indigenous plants as food by rural community in the Eastern Cape: An educational exploration. Unpublished master's thesis, Rhodes University, Grahams town, South Africa.

Shinwari, Z.K. 2010. Medicinal Plants Research in Pakistan. *J. Med. Pl. Res*. 4(3): 161-176.

Shinwari, Z.K. and M. Qaiser. 2011. Efforts on conservation and sustainable use of medicinal plants of Pakistan. *Pak. J. Bot*., 43 (SI): 5-10.

Tahraoui, A., J. El-Hilaly, Z.H. Israili and B. Lyoussi. 2006. Ethnopharmacological survey of plants used in the traditional treatment of hypertension and diabetes in south-eastern Morocco (Errachidia province). *J. Ethnopharm,* 77: 175-182.

Tardio, J. and M. Pardo-de Santayana. 2008. Cultural importance indices: a comparative analysis based on the useful wild plants of southern Cantabria (Northern Spain). *Econ. Bot.,* 62: 24-39.

Tareen, R.B, T. Bibi, M.A. Khan M. Ahmad and M. Zafar. 2010. Indigenous knowledge of folk medicines by the women of Kalat and Khuzdar regions of Balochistan, Pakistan. *Pak. J. Bot*., 42(3): 1465-1485.

Ullah, M., M. Usman, Khan, A. Mahmood, M. Hussain, S. Wazir, M. Daud and Z. Shinwari. 2013. Anethnobotanical survey of indigenous medicinal plants in Wana district south Waziristan agency, Pakistan. *J. Ethnopharm,* 150: 918-924.

Vaishali, S.K. and D.J. Varsha. 2013. Traditional Leafy Vegetables: A Future Herbal Medicine. *Inter. J. Agri. Food Sci.,* 3(2): 56-58.

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

Vorster, I.H.J., W. Jansen van Rensburg, J.J.B. Van Zijl and L.S. Venter. 2007. The importance of traditional leafy vegetables in South Africa. *Afr. J. Food Agri. Nut. Dev.*, 7(4): 1-13. www.efloras.org/flora_page.aspx?flora

Zinyama, L.M., T. Matiza and D.J. Campbell. 1990. The use of wild foods during periods of food shortage in rural Zimbabwe. *Ecol. Food Nut.,* 24: 251-265.

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