

Nutraceutical Exploration of Wild Edible Fruits of District Tor Ghar, Northern Pakistan

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Abstract

The present study deals with the exploration of wild edible fruits consumed by indigenous tribes in district Tor Ghar for curing different ailments. Wild edible fruits are potential source of nutrition and medicine. This is the first ethno-nutraceutical investigation of wild edible fruits of Tor Ghar. Local wisdom was interrogated by group discussions and semi structured interviews to assess the role of wild fruits in healthcare system of the region. Informants were randomly selected from five tribes of the district. It was found that the wild fruits have a great socioeconomic significance owing to their high nutritional and medicinal values. In the current study thirty eight wild edible fruits belonging to 29 genera and 22 families were documented for their ethno-nutraceutical importance. The study also revealed that general body weakness and digestive disorders are mostly cured by consuming wild edible fruits. The highest number of wild edible fruits belong to family Rosaceae (8 plant species). Popularity of wild edible plants among different tribes of Tor Ghar was assessed quantitatively by a statistical relation Fidelity level %age. Fidelity level index shows values for each species in descending order from *Jugalans regia* (74.4%) to *Buxus wallichiana* (17.4%). The most popular wild edible fruit species was found *Jugalans regia* that scores highest fidelity level value.

Keywords: Ethno-nutraceutical, Fidelity level, Tor Ghar

Introduction

The nature has blessed wild edible plants with potential nutritional and medicinal properties. When a food has medicinal value, it gains popularity among the inhabitants. This nutraceutical significance of the flora attracts the researchers to conduct extensive studies. There has been renewed or increasing interest in consuming wild food plants (Nebel *et al.*, 2006; Delang, 2006). Despite agricultural societies primary reliance on crop plants, the tradition of eating wild plants has not completely disappeared, their nutritional and medicinal role for health care benefits being reported through many surveys worldwide (Ertug *et al.*, 2004, Kuhnlein *et al.*, 2006, Luczaj and Szymanski, 2007).

According to Shava, (2005) the term wild plants refers to both indigenous and naturalized exotic plants occurring in the natural environment. While wild edible plants are such wild plants with one or more parts that can be used for food if gathered at the appropriate stage of growth. Edible wild plants could be weeds growing in urban areas of native plants growing in deep wilderness (Kallas, 1996). The documentation of local perception about wild edible plants is a crucial step for evaluating nutraceutical importance of wild edible fruits on scientific grounds. Unfortunately, most of the ethno-botanical surveys conducted in Pakistan merely provide inventories of medicinal plants

(Ali and Qaisar, 2009). Wild edible plants especially wild edible fruits could not be highlighted nutraceutically by many researchers. However a limited number of studies have also been conducted time to time in Pakistan such as Haq and Hussain (1993) studied local medicinal and other traditional uses of plants including edible fruits of Mansehra. Zahoor (2007) mentioned 42 species as minor fruit crop resources of the Pakistan mountains. Shah (2007) reported 32 species of wild edible fruits of Siran valley. Matin *et al.*; (2001) documented seven wild edible fruits from Shogran valley and stressed upon their in situ conservation for their future germ plasm source. Awan *et al.*, (2011) listed 13 wild edible fruits from Kaghan valley. Abbasi *et al.*; (2013) surveyed 14 wild edible fruits from Lesser Himalayas. Thirty eight wild edible fruits were first time reported from district Tor Ghar (Shah *et al.*, 2014). None of these investigations explore the ethno nutraceutical significance of wild edible fruits.

The present study is first ever attempt to survey the diversity of wild edible fruits consumed for health care system of district Tor Ghar. The district lies between 34°-32' and 34°-50' N, and 72°-48' and 72°-58'E. It shares borders on the south by Tanawal; on the west by district Buner; on the east by Agrore valley of tehsil Oghi. To the northeast it is bounded by borders of district Battagram. Across the river Indus, Tor Ghar touches its border with tehsil Martang of district Shangla.



Figure 1 Map of district Tor Ghar showing different tribal belts

Major portion of Tor Ghar is located on the eastern bank of the Indus River in the watershed of the mountain range. While the smaller part lies on the western bank of the river in the watershed of the mountain range that separates the Gadoon Ahmazai from the Indus basin. Torghar is rugged mountainous area of about 800 sq. Km. The highest peak of the mountain range is ‘‘Machisyer.’ There are three main types of forests viz. Montane Subtropical forests, Montane Temperate forests and Subalpine forests (Champion *et al.*, 1965). These forests are not owned by the government even

after the creation of new governmental unit. However, forest department facilitates the inhabitants to look after forests and raise nurseries. Area of agriculture land is approximately 75,000 acres. The agriculture is mainly rain-fed but also irrigated. According to Mehmood *et al.*, (2014) most of the area of Tor Ghar consists of range lands with diversity of grasses.

The five main tribes of Torghar namely Basikhel, Nusratkhel, Akazai, Hassanzai and Me-dakhel inhabit 228 villages consisting of 29,139 houses. The total estimated population of Tor Ghar is 338,013 (English R, 1991)

The study area is an important part of the internationally recognized Western Himalayan province (Takhtajan, 1988) and shows rich floristic diversity. Mehmood *et al.*, (2015) also mentioned rich floristic diversity of the region. It is dominated by Sino- Japanese type of vegetation.

As a lot of traditional knowledge is confined to tribal communities, the area under investigation has long established tribal cultural values, customs and traditions. Thus there is a dire need of documenting wild edible fruits and traditional knowledge is also disappearing from rural communities. Secondly, wild edible plants are facing threats in their natural habitats from various human activities such as overstocking, selective cuttings, agricultural land expansion, fuel wood collection and uncontrolled fire setting (Balemine and Kebebew, 2006). Moreover, the documented information on the wild edible plants may serve as baseline data for future studies on nutritional values and possible side effects and identify plants that may improve nutrition and increase dietary diversity. Some of wild edible fruits may have the potential to be a valuable food source and could be part of a strategy in tackling food insecurity (Teklehaymanot and Giday, 2010). The main objective of the study was to assess the ethno-nutraceutical significance of the diversity of wild edible fruits gathered and consumed by local community not only as food but also for curing different ailments.

Materials and Methods

The area under investigation was extensively surveyed from April 2014 to March 2015 in flowering and fruiting seasons. The study was conducted by using semi-structured interviews, field trips and group discussions. Specimens of wild edible plants were collected, pressed, mounted on standard sized herbarium sheets and identified with the help of different Herbaria such as National Herbarium Islamabad, QAU Herbarium, PMNH Herbarium and flora of Pakistan (Ali and Qaisar, 1998-2005). Five percent villages of each tribal belt, were randomly selected by table number method. The houses of each village were allotted numbers and then 5 % houses randomly selected by the same method. The available members of each selected house were interviewed on their willingness basis. The primary data was cross checked by group discussions. One hundred and ten informants, including males and females of all age groups shared their local wisdom about 38 wild edible fruits. The informants were facilitated with the help of preserved specimens, photographs and local names for getting more specific responses. Photographs were also taken during surveys. An observatory walk was arranged to each sort of habitat under the supervision of one or two volunteer local informants to observe the species in its habitat.

Data recorded on questionnaires was shifted on Microsoft Excel data sheet. Botanical names, local names, family, habit and uses were entered. The data sheet was analysed for number of species, genera, families and uses. The Microsoft Excel sheet was also used for basic graphs and charts. A quantitative ethno-botanical technique Fidelity level (FL) was applied to assess the most popularly used wild edible fruits among different tribes of Torghar. Fidelity level is determined by the following statistical relation

$$FL (\%) = NP/N \times 100$$

Where NP is the number of informants that mention the main use (first option) of a plant species, whereas N is the number of informants cite additional uses of that species. FL index also gives the idea of the main use of a plant species.

Results

Thirty eight (38) wild edible fruits of 29 genera and 22 families were documented for ethnobotanical assessment. Majority families (20) belong to angiosperms whereas two (2) families belong to gymnosperms (Table 1).

Table 1. Nutraceutical assessment of wild edible fruits of district Tor Ghar

S.N	Botanical Name	Local Name	Family	Habit	First Choice	Second Choice	Medicinal Uses
1	<i>Juglans regia</i> L.	Ghuz	Juglandaceae	Tree	Food	Medicine	Brain Tonic
2	<i>Moras nigra</i> L.	Tor toot	Moraceae	Tree	Food	Medicine	Sore Throat
3	<i>Ficus palmata</i> Forsk.	Inzar	Moraceae	Tree	Food	Medicine	Laxative
4	<i>Olea ferruginea</i> Royle	Khoona	Oleaceae	Tree	Medicine	Food	General body tonic
5	<i>Zanthoxylum armatum</i> DC.	Dambara	Rutaceae	Shrub	Medicine	Food	Digestive disorders
6	<i>Pyrus pashia</i> Ham ex D. Don.	Tangai	Rosaceae	Tree	Food	Medicine	Liver Tonic
7	<i>Berberis lycium</i> Royle.	Kwaray	Berberidaceae	Shrub	Food	Medicine	Cure oral infection
8	<i>Diospyrus lotus</i> L.	Tor Amlok	Ebenaceae	Tree	Food	Medicine	Anti allergic
9	<i>Solanum nigrum</i> L.	Karmacho	Solanaceae	Herb	Food	Medicine	Digestive disorder
10	<i>Morus alba</i> L.	Spin Toot	Moraceae	Tree	Food	Medicine	Laxative, sore throat
11	<i>Amaranthus viridis</i> L.	Ganhar	Amaranthaceae	Herb	Food	Medicine	Cure heart burn
12	<i>Ficus racemosa</i> L.	Armol	Moraceae	Tree	Food	Medicine	Improves skin rashes
13	<i>Ficus carica</i> Forsk.	Inzar	Moraceae	Tree	Food	Medicine	Body tonic, Laxative
14	<i>Amaranthus viridis</i> L.	Ganhar	Amaranthaceae	Herb	Food	Medicine	Stop gum bleeding
15	<i>Pyrus communis</i> L.	Nashpati	Rosaceae	Tree	Food	Medicine	Digestive
16	<i>Vitis parvifolia</i> Roxb.	Tor kwar	Vitaceae	Shrub	Food	Medicine	Coolent
17	<i>Punica granatum</i> L.	Narsaw-ay	Punicaceae	Tree	Medicine	Food	Digestive
18	<i>Ziziphus jujuba</i> Mill.	Sezen	Rhamnaceae	Tree	Food	Medicine	Anti flu

S.N	Botanical Name	Local Name	Family	Habit	First Choice	Second Choice	Medicinal Uses
19	<i>Vitis jacquemontii</i> Parker	Zangli Kwar	Vitaceae	Shrub	Food	Medicine	Hair tonic
20	<i>Fragaria nubicola</i> (Hook.f.) Lindl. ex Lacaita	Da zima-kaytoot	Rosaceae	Herb	Food	Medicine	Anti gastric
21	<i>Grewia optiva</i> Drummond .ex Burret	Pastawoney	Tiliaceae	Tree	Medicine	Food	Laxative
22	<i>Celtis australis</i> L.	Taghagaha / Batkar	Ulma-ceae	Tree	Medicine	Food	Nervous tonic
23	<i>Debregeasia salicifolia</i> (D.Don) Rendle	Chewr	Utrica-ceae	Shrub	Food	Medicine	Sedative
24	<i>Duchesnea indica</i> (Andr.)Focke	Mewa	Rosaceae	Herb	Food	Medicine	Antigastric
25	<i>Rubus ellipticus</i> Smith.	Karwara	Rosaceae	Shrub	Food	Medicine	Antidi-herrial
26	<i>Rubus fruticosus</i> Hook .f	Karwara	Rosa-ceae	Shrub	Food	Medicine	Diuretic
27	<i>Pinus roxburghii</i> Sargent	Nakhtar	Pinaceae	Tree	Food	Medicine	Strengthen muscles
28	<i>Ziziphus nummularia</i> (Burm. f.) Wight & Arn.,	Karkanda	Rhamna-ceae	Shrub	Food	Medicine	Cure headache
29	<i>Zizyphus oxyphylla</i> Edgew.	Elanai	Rhamna-ceae	Shrub	Food	Medicine	Improves vision
30	<i>Myrsine africana</i> L.	Khukhar	Myrsina-ceae	Shrub	Medicine	Food	Vermifuge
31	<i>Viburnum cotinifolium</i> D. Don	Ghanpmzewa	Caprifoliaceae	Shrub	Food	Medicine	Emetic
32	<i>Cotoneaster nummularia</i> Fish & Mey	Mamana	Rosaceae	Shrub	Medicine	Food	Anti di-uretic
33	<i>Viburnum grandiflorum</i> Wall. ex DC.	Chamiaray	Caprifoliaceae	Shrub	Food	Medicine	Anti cancer
34	<i>Carissa opaca</i> Stapf. en Haines	Granda	Apocynaceae	Shrub	Medicine	Food	Heart tonic
35	<i>Cydonia oblonga</i> Miller	Pub	Rosaceae	Tree	Food	Medicine	Body tonic
36	<i>Opuntia dillenii</i> Haw.	Zakoom	Cacta-ceae	Herb	Food	edicine	Cure snake bite
37	<i>Taxus wallichiana</i> (Zucc.)Pilger	Bunya	Taxaceae	Tree	Medicine	Food	Diaphoretic
38	<i>Buxus wallichiana</i> Bill		Bux-aceae	Shrub	Medicine	Food	Anti cough

Habit wise categorization of plants shows 45% trees, 39% shrubs and 16% herbs (Figure 2).

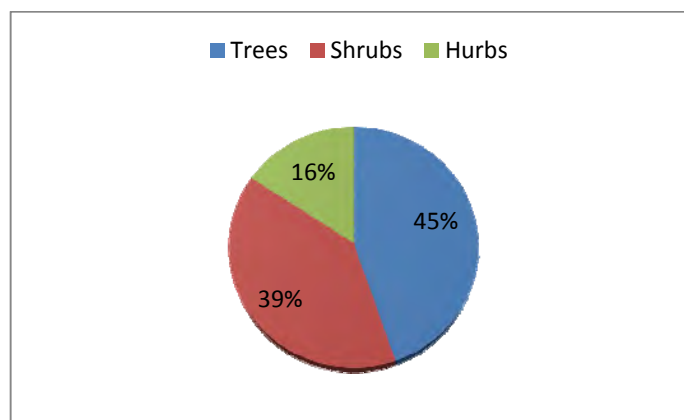


Figure 2. Habit wise Percentage of wild edible plants

The number of plants recorded for family Rosaceae (8 spp.), Moraceae (5 spp.), Rhamaceae (3 spp.), Amaranthaceae, Caprifoliaceae and Vitaceae have 2 species each whereas Punicaceae, Apocynaceae, Ebenaceae, Jugulandaceae, Oleaceae, Rutaceae, Solanaceae, Tiliaceae, Ulmaceae, Utricaceae, Cactaceae, Myrsinaceae, Taxaceae, Berberidaceae, Pinaceae and Buxaceae contain 1 species each. The family Rosaceae was found dominant having 8 species. The fruits of twenty plants used for food as a first choice and medicine as a second choice by five indigenous tribes of the area under investigation. Likewise fruits of ten plants are used for medicines as first choice and food as a second choice. Fidelity level index shows values for each species in descending order from *Juglans regia*, 74.4% to *Buxus wallichiana* 17.4% (Table 2).

Table 2. Fidelity level %ages of wild edible fruits among different tribes of Tor Ghar

	Botanical Name	Basikhel	Nustrat Khel	Akazai	Hassan-zai	Me-dakhel	Total %age
1	<i>Juglans regia</i> Linn	83	75	69	78	67	74.4
2	<i>Moras nigra</i> L.	79	81	76	59	67	72.4
3	<i>Ficus palmata</i> Forsk.	80	74	69	65	70	71.6
4	<i>Olea ferruginea</i> Royle	72	71	65	75	73	71.2
5	<i>Zanthoxylum armatum</i> DC.	50	57	68	54	70	59.8
6	<i>Pyrus pashia</i> Ham ex D. Don.	70	64	55	49	58	59.2
7	<i>Berberis lycium</i> Royle.	53	48	55	65	72	58.6
8	<i>Diospyrus lotus</i> L.	70	60	65	40	54	57.8
9	<i>Solanum nigrum</i> L.	63	58	62	40	61	56.8
10	<i>Morus alba</i> L.	56	53	45	56	71	56.2
11	<i>Amaranthus viridis</i> L.	65	60	45	40	70	56
12	<i>Ficus racemosa</i> L.	50	39	48	62	70	53.8
13	<i>Ficus carica</i> Forsk.	56	63	47	49	50	53
14	<i>Amaranthus viridis</i> L.	40	50	53	54	65	52.4

	Botanical Name	Basikhel	Nustrat Khel	Akazai	Hassan- zai	Me- dakhel	Total %age
15	<i>Pyrus communis</i> L.	60	57	48	42	51	51.6
16	<i>Vitis parvifolia</i> Roxb.	45	49	58	62	43	51.4
17	<i>Punica granatum</i> L.	50	45	47	51	52	49
18	<i>Ziziphus jujuba</i> Mill.	40	44	50	56	43	46.6
19	<i>Vitis jacquemontii</i> Parker	47	61	34	45	38	45
20	<i>Fragaria nubicola</i> (Hook.f.) Lindl. ex La- caita	40	56	37	38	47	43.6
21	<i>Grewia optiva</i> Drum- mond .ex Burret	40	47	51	36	29	40.6
22	<i>Celtis australis</i> L.	30	37	42	52	39	40
23	<i>Debregeasia salicifolia</i> (D.Don) Rendle	41	38	35	40	43	39.4
24	<i>Duchesnea indica</i> (Andr.)Focke	28	34	45	39	50	39.2
25	<i>Rubus ellipticus</i> Smith.	40	37	32	36	45	38
26	<i>Rubus fruticosus</i> Hook .f	36	30	40	35	43	36.8
27	<i>Pinus roxburghii</i> Sar- gent	30	32	40	25	51	35.6
28	<i>Ziziphus nummularia</i> (Burm. f.) Wight & Arn.,	39	30	34	45	29	35.4
29	<i>Zizyphus oxyphylla</i> Ed- gew.	31	30	33	36	37	33.4
30	<i>Myrsine africana</i> L.	20	31	12	30	27	24
31	<i>Viburnum cotinifo- lium</i> D. Don	35	20	17	23	20	23
32	<i>Cotoneaster nummula- ria</i> Fish & Mey	23	32	20	10	30	23
33	<i>Viburnum grandiflorum</i> Wall. ex DC.	30	25	20	22	12	21.8
34	<i>Carissa opaca</i> Stapf. en Haines	20	30	15	20	18	20.6
35	<i>Cydonia oblonga</i> Mil- ler	13	20	18	18	27	19.2
36	<i>Opuntia dillenii</i> Haw.	10	13	19	23	25	18
37	<i>Taxus wallichiana</i> (Zucc.)Pilger	15	28	22	10	13	17.6
38	<i>Buxes wallichiana</i> Bill	17	21	12	19	18	17.4

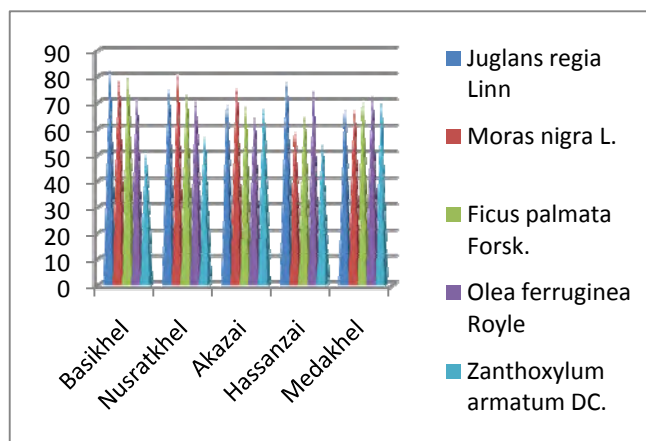


Figure 3. Fidelity level of the most popular wild edible fruits among different tribes of district Tor Ghar

The data revealed that nutraceutical importance of wild edible fruits curing twenty seven ailments of the area. The most important of which are general body weakness and gastrointestinal disorders.

Discussion

The ethno nutraceutical studies exploring potential plant resources for food and medicines round the globe. The indigenous tribes of district Tor Ghar consume 38 wild edible fruits as food as well as medicine. This common cultural practice may be attributed to shortage of staple food and lack of modern health facilities. The study area is remote, inaccessible and has limited consumer cultural activity. Ultimately the inhabitants accomplish their nutritional and medicinal needs from their plant resources especially wild edible fruits. Indigenous peoples use food also as medicine and have rich traditional practices of using food in the management of various health problems. In a study by Payam *et al.*, (2014) thirty six wild edible plants were documented as “medical food” or nutraceuticals folk food plants. Marwat *et al.*; (2011) also mentioned medicinal importance of wild edible fruits of Laki Marwat district of Pakistan. Similarly the investigation of Rehman *et al.*, (2012) explored twenty fruits as remedy for different diseases of Koikuri village of Dinajpur district of Bangladesh. Shah *et al.*, (2015) mentioned 57 wild edible plants from Basikhel tribe of district Tor Ghar majority of which are also used as nutraceutically.

Popularity of wild edible fruits was assessed on the basis of Fidelity level %age. *Juglans regia* is the most popular wild edible fruit plant in the study area. It shows 74.4 % FL. The other plant species which show more than 70% FL are *Morus nigra* (72.4%), *Ficus palmata* (71.6%) and *Olea ferruginea* (71.2%). Popular fruits plant species range between 20% to 70% FL values, 30 species fall in this category. Least popular wild edible fruits of the area show less than 20% FL values. These are *Cydonia oblonga* (19.2%), *Opuntia dillenii* (18%), *Taxus wallichiana* (17.6%) and *Buxus wallichiana* (17.4%). Similarly the findings of Abbasi *et al.*; (2013) also showed *Morus nigra*, *Ficus palmata* and *Olea ferruginea* as significant wild fruits of the Lesser Himalayas. However in our study *Juglans regia* was found the most popular plant species. The study of Taj *et al.*, (2018) is also in close agreement with our findings. They reported *Juglans regia* was the most cited species in Tarnawi area of district Abbottabad with a use value $U_{vi}=0.98$ and relative frequency citation $RFCs=0.46$. In the study area *Juglans regia* occurs wild, semi wild and cultivated. Its fruits have

considerable storage life and are available round the year. It is commercially exploited for its valuable fruits as food and medicine. Its conservation status is secure in the region due to cultivation and protection by locals. It is excessively used for general body weakness and brain tonic in the study area.

Conclusion

The current investigation revealed thirty eight wild edible fruits consumed by indigenous tribes nutraceutically for twenty seven ailments. According to local perception these are potential source of nutrition and medicine and therefore, recommended for pharmacognostic and nutritional evaluation. Wild edible fruits are used successfully for curing general body weakness and gastrointestinal disorders. Peoples of all age groups especially children utilize wild fruits frequently owing to good taste and odour. The most popular fruit recorded in the region was *Juglans regia*. The use of wild edible fruits is an integral part of health care system of Tor ghar

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