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Medicinal plants used against epilepsy by the local communities of Sargodha region, Pakistan

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Key words: Medicinal plants, Ethnic communities, Frequency citation (FC), Mirgi, Asteraceae

Abstract

Many plants are claimed to be effective to treat epilepsy, but very little knowledge is available about such plants used by various ethnic communities in Pakistan. This study presents the first report on the ethnobomedicinal knowledge among the local communities of Sargodha region, Pakistan in this regards by using quantitative ethnobotanical approaches. 84 aboriginal households (house-to-house interviews) including 10 traditional healers who still practiced their aboriginal system of medicine were interviewed to collect information on the herbal preparations used by them to treat epilepsy. Data were documented by using semi-structured questionnaires to consult the residents about their awareness of plant used against epilepsy. Documented data was assessed using frequency of citation (FC) preference ranking (PR), percentage of respondents having knowledge about the use of species (PRK) and Relative Frequency Citation (RFC). A total of 49 plant species belonging to 45 genera and 34 families were reported to cure epilepsy. The highest percentage of life form was found to be the herbs (63.2%). The Leaves were the dominant plant part with 29.4% and most of the herbal medicines were prepared in the form of decoction (54%). Plants with the highest RFC values were *Bacopa monnieri* (0.61) followed by *Xanthium strumarium* (0.57), *Achyranthes aspera* (0.51) and *Citrus maxima* (0.44). High proportion of respondents (PRK) was found for *Bacopa monnieri* (61.2%) followed by *Xanthium strumarium* (57.1%), *Achyranthes aspera* (51.0%) and *Citrus maxima* (44.8%). The study will be used as baseline data for analysing phytochemical constituents and bioactive compounds of these promising medicinal plants.

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Introduction

Epilepsy is a chronic and often progressive group of disorders characterized by frequent and spontaneous seizures that deceivingly result from complex processes including various neurotransmitter systems such as glutamatergic, cholinergic, and gabaergic system (Löscher, 1998; Almeida *et al.*, 2011). Epilepsy is locally known as 'Mirgi' in the studied area is one of the most common chronic neurological disorders which have no age, race, social class or geographical boundaries. It is reported to be one of the world's oldest recognized health disorders, with written records dating back to 4000 BC. The disease is one of the utmost common neural sicknesses universally , which is included among the most complicated and least understood disorder throughout the world (Kobau and Price, 2003).

About 50 million people are known to be affected worldwide from this miraculous disorder (Scheuer and Pedley, 1990). The disease is not curable but can normally be controlled with modern anti-convulsants, which prevent the seizures or diminish their intensity empowering a less delimited life. However, over 30% of people with epilepsy have uncontrolled seizures even with the best existing drugs (Engel, 1996). In established States where treatments are easily manageable, epilepsy responds to treatment in up to 70% of the patients, but in emerging States 75-90% of patients with epilepsy do not receive operative medication (WHO, 2003; Kumar *et al.*, 2012).

The mortality rate is two to three times higher and the risk of sudden death with epilepsy is twenty four times greater than that of the general diseases (Ficker, 2000). A trivial lessening in occurrence is eminent between the ages of 40 and 59. Greater incidence is perceived in rural populace. It has been estimated that approximately 2.5 million people are suffering from epilepsy in Pakistan (WPD, 2015), representing nearly 1% in the overall Pakistani populace, and majority of patients are below 19 years of age. The rate of age specific frequency is 14.8 per 1000 in rural areas and 7.4 per 1000 in urban areas (Aziz *et al.*, 1994). Nearly 90% these patients do not get proper treatment. A decline in rate is noted between the ages of 40 to 59. Etiology of this disorder is clearly identified in pediatric population (Khatri *et al.*, 2004). Pakistan has wide variations in geographic regions and the ethnic diversity of Pakistan is more visible along cultural differences and ethnobotanical knowledge of herbal medicine (Shah *et al.*, 2012). Sargodha Region of Pakistan is gifted with a very rich biodiversity like Sakesar, Soon Valley, Namal Valley, Kala Bagh, Makerwal, Gulla Khel, Amb Sharif etc. and is home of indigenous communities.

These communities have a long history of traditions and are totally dependent on natural resources for their daily needs. Documentation of indigenous knowledge about ethnbotanically important flora add value to the biodiversity of the region and if this recording and documenting is not practiced then the precious knowledge will be lost for ever. Therefore, it is the dire need to document this precious indigenous knowledge for the future generations. The current research was carried out with an intention to document the information concerning traditional herbal medications used for the treatment of epilepsy, as there was no comprehensive study conducted about anti-epileptic plants in the area. Furthermore our aim was also to preserve valued and fast vanishing aboriginal knowledge on the use of medicinal plants of the area, based on standard ethnomedicinal survey. Information gathered will be serve as baseline data for analysing phytochemical constituents and bioactive compounds of these promising medicinal plants.

Materials and methods

Study area description

Sargodha is a division of Punjab province, Pakistan. It is the second order administrative division and the approximate landscape elevation above sea level is 166 meters. It is located in north east of Pakistan (Fig. 1). The region of Sargodha is famous for its exceptional natural biodiversity and in ethnic culture mainly in the mountainous areas like Sakesar, Makerwal, Kala Bagh, Kundal and Gulla Khel. The known local communities of the area are Awans,

Aarain, Syeds, Rajputs, Hashmi, Gujjar, and Sheikhs etc. Majority parts of the study area are remote, isolated and yet remained understudied. The inhabitants are quite familiar with the use of medicinal plants as they are using these plants since generations and also because of their intimate relationship with nature. They rely on natural wealth also because of their least access to hospitals and allopathic treatment. And so their dependence on nature is inevitable. That's why people mostly use natural products (locally known as desi totky) to cure various ailments and diseases.

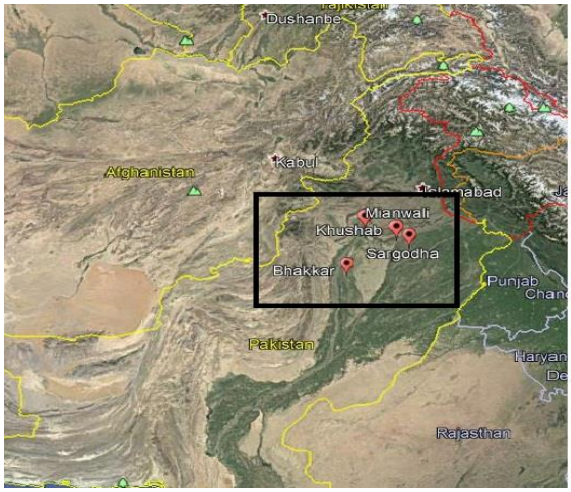

Fig. 1. Map of the study sites.

Ethnobotanical data collection

Ethnobotanical information on the treatment of epilepsy in the study area was collected from various localities of Sargodha: Kot Momin, Silanwali, Bhalwal, Shah Pur, Mianwali, Isa Khel, Piplan, Khushab, Nur Pur Thal, Quaid Abad, Bhakkar, Mansehra and Darya Khan, those representing the four districts of Sargodha Division: Sargodha, Mainwail, Bhakkar and Khushab (Fig.1). The study was carried out from March 2013 to January 2015. Data were collected by using semi-structured questionnaires to interview the inhabitants about their knowledge of plant use against epilepsy. Mostly traditional knowledge was owned by elders and traditional Hakims (traditional herbal healers) living in remote areas. Demographic structure of the studied population was gathered and respondents were chosen to conduct survey and ask questions about medicinal plants, parts used in the treatment of epilepsy and mode of utilization. The questionnaire was designed so as to estimate ethnobotanical indices and score properly. After getting information from respondents, they were requested to show or get plant from the study site for voucher specimen preparation.

The demographic information of informants is presented in (Table 1).

Table 1. Demographics characteristics of informants. (n= 84).

Demographical characteristics	Number	%age
Age		
25-34	5	5.95
35-44	10	11.9
45-54	17	20.2
55-64	12	14.2
65-74	18	21.4
75 and above	22	26.1
Gender		
Male	34	46.7
Female	50	53.2
Education		
Illiterate	22	26.1
Primary	20	23.8
Middle	18	21.4
Matric	10	11.9
Inter	8	9.52
Graduate and above	6	7.14

Plants described by respondents were collected with their assistance from fallows, field, mountains, deserts and home gardens in Sargodha Division and nearby areas. Voucher specimens were properly pressed, dried and mounted on standard herbarium sheets. Mounted specimens were deposited at the herbarium of University of Sargodha, Pakistan.

Taxonomic identification of collected vouchers was carried out using Flora of Pakistan (Stewart, 1972) and verified from the International Plant Names Index (IPNI).

Collected information was compiled on the spread sheet and analysed with following parameters and indices:

1. Taxonomic diversity, mode of utilization and plant part used.

2. The proportion of respondent who have information concerning the use of a plant in the treatment of epilepsy was estimated using the formula.

$$PRK = \frac{\text{Number of people interviewed citing species}}{\text{Total number of interviewed people using plants}} \times 100$$

3. Preference ranking (PR), by using preference ranking (PR) plants were ranked consistent with their level of efficiency in the treatment of epilepsy by the local people and every rank is given the numeral (1, 2 or 3), with the highly effective plants assigned a value of 3 (Al-Adhroey *et al.*, 2010).
4. Relative frequency citation (RFC) was calculated using standard method of Vitalini *et al.* (2013), which is

RFC=FC/N (O<RFC<1)

The value of RFC (relative frequency citation) for species and families of medicinal plants is based on the citing percentage of informants for that particular species and family. FC is the number of informants who mentioned the species while N is the total number of informants participating in the study.

Results and discussion

A total of 84 informants including 10 traditional healers were interviewed to collect ethnobotamical information related to the treatment of epilepsy. Respondents could readily differentiate epilepsy on the basis of described signs and symptoms. The disease is commonly known as "Mirji" or "Mirgi" and the most common indication of disease is fits and unconsciousness, The perceived severity of this disease is underlined by the fact that mostly people said that epilepsy could be fatal. Some people believe that epilepsy is not a disease but it is phenomenon prompts by mysterious creature locally called as *jinns* or *fiends*. The lack of awareness and misconcepts are the key factors that are forcing the patients to live without the required treatment of this disorder. In spite of all these stories, there is enough indigenous ethno-medicinal knowledge that is frequently used by these people to cope with this nervous disorder. The majority of the medicinal knowledge was confined to the elder members living in remote areas called Paharri, Kacha and Thal. Least interest was observed among youngsters. This may be related to the younger generation who spend most of the time away from their homes for seeking higher education. Majority of elder informants mentioned that the finest means of shifting this precious knowledge happens at the domestic level. The knowledge has been verbally passed down from family members.

Table 2. Anti-epileptic plants of Sargodha Region along with FC, RFC and PRK values.

S.No	Plant name	Family	Local name	Reporting study site	Habit	Part (s) used	Mode of utilization	FC	RFC	PR	PRK
1	*Achillea millefolium* Ledeb. SAS-E-0010	Asteraceae	Yarrow	S	Herb	Flower	Half cup of decoction of flower is given orally	1	0.02	2	2.04
2	*Achyranthes aspera* Duss. SAS-E- 0033	Amaranthaceae	Puth kanda	B, K, M, S	Herb	Roots	1 teaspoon of root powder is taken thrice a day	25	0.51	2	51.02
3	*Acorus calamus* L. SAS-E-0025	Acoraceae	Acorus	B, K, M, S	Herb	Whole plant	Decoction of whole plant is used twice a day	7	0.14	3	14.28
4	*Albizia lebbeck* Benth. SAS-E- 0028	Leguminosae	Siris	B, K, M, S	Tree	Leaves	Decoction of leaves about half cup is taken orally	13	0.26	1	26.53
5	*Allium cepa* L. SAS-E- 0040	Liliaceae	Piaz	B, K, M, S	Herb	Bulb	a fine paste or decoction of bulb mixed with salt and black pepper is taken once a day	8	0.16	2	16.32
6	*Allium sativum* L. SAS-E-0014	Alliaceae	Lehsan	B, K, M, S	Herb	Bulb	Similar as above in *Allium cepa* L.	8	0.16	3	16.32
7	*Anagallis arvensis* L. SAS-E- 0020	Primulaceae	Billi booti	B, K, M, S	Herb	Whole plant	1 cup decoction of whole plant is taken orally	19	0.38	3	38.77
8	*Anthemis nobilis* L. SAS-E- 0043	Asteraceae	Sada bahar	B, K, M, S	Herb	Stem, leaves	Infusion of fresh stem and leaves is taken thrice a day	3	0.06	1	6.12
9	*Apium graveolens* L. SAS-E-0038	Apiaceae	Soya	B, K, M, S	Herb	Seeds, leaves	Seeds and leaves are boiled together and 1 cup is taken orally	9	0.18	1	18.36
10	*Azadirachta indica* A.Juss. SAS-E- 0030	Meliaceae	Neem	B, K, M, S	Tree	Bark	Half cup decoction of bark mixed with t teaspoon of water is taken twice a day	2	0.04	2	4.08
11	*Bacopa monnieri* (L.) Pennell SAS-E-0021	Scrophulariaceae	Barhami booti	B, K, M, S	Herb	Leaves	Infusion of fresh leaves is taken orally once a day for 15 days	30	0.61	2	61.22
12	*Bassella alba* L. SAS-E-0047	Basellaceae	Vine spinach	K, M, S	Herb	Leaves	Used internally in cooked form once in a week	6	0.12	2	12.24
13	*Boerhavia diffusa* L. SAS-E-0019	Nyctaginaceae	Hog weed	B, K, M, S	Herb	Leaves, flowers	Infusion of fresh leaves and flowers is used twice a day	2	0.04	3	4.08

S.No	Plant name	Family	Local name	Reporting study site	Habit	Part (s) used	Mode of utilization	FC	RFC	PR	PRK
14	*Brassica nigra* (L.) Andrz. SAS-E-003	Brassicaceae	Kali sarson	B, K, M, S	Herb	Seeds	Half teaspoon of powdered form of seeds are used in morning before breakfast	1	0.02	2	2.04
15	*Brassica oleracea* Lour. SAS-E-008	Brassicaceae	Jangli gobi	B, K, M, S	Herb	Whole pant	Used in cooked form once in a week	1	0.02	1	2.04
16	*Buxus sempervirens* Thunb. SAS-E-0024	Buxaceae	Shamshad	S	Shrub	Stem bark	Half cup of decoction is taken once a day	4	0.08	3	8.16
17	*Calotropis procera* (Aiton) W.T. Aiton SAS-E-0032	Asclepiadaceae		B, K, M, S	Shrub	Leaves	Infusion of leaves is used daily in morning before breakfast	12	0.24	1	24.48
18	*Cassia fistula* Herbb. ex. Oliv. SAS-E-0037	Leguminosae/ Fabaceae	Amaltas	B, K, M, S	Tree	Bark	1 cup decoction is used once a day	9	0.18	1	18.36
19	*Cedrus deodara* (Roxb. ex. D.Don) G.Don SAS-E-0048	Pinaceae	Diar	S	Tree	Bark	Gum is used to make a fine sweet (halwa) using sugar and used once a day	2	0.04	1	4.08
20	*Cichorium intybus* L. SAS-E-0044	Asteraceae	Kasni	B, K, M, S	Herb	Leaves	Decoction of leaves about half cup is taken orally	1	0.02	1	2.04
21	*Citrus maxima* (Burm.) Merr. SAS-E-0016	Rutaceae	Chakotra	B, S	Shrub	Fruit	Fruit is eaten in raw form	22	0.44	2	44.89
22	*Cupressus sempervirens* L. SAS-E-0018	Cupressaceae	Saroo	B, K, M, S	Tree	Seeds	1 teaspoon of powder form of seeds is used thrice a day	7	0.14	2	14.28
23	*Datura stramonium* Thunb. SAS-E-0036	Solanaceae	Dhatura	B, K, M, S	Herb	Leaves	1 cup of leaves decoction is used daily	16	0.32	2	32.65
24	*Eruca sativa* Mill. SAS-E-007	Brassicaceae	Jhamaon	B, K, M, S	Herb	Leaves	Used in cooked form	5	0.10	2	10.20
25	*Ferula asafoetida* Spreng. SAS-E-0035	Apiaceae	Hing	S	Herb	Root	Decoction of dried roots is taken once a day	3	0.06	2	6.12
26	*Ficus carica* L. SAS-E-0045	Moraceae	Papeeeta	S	Tree	Fruit	Eaten in raw form	11	0.22	2	22.44
27	*Hedera helix* L. SAS-E-0015	Araliaceae	Ishq-e-pechan	K, S	Herb	Leaves	1 cup infusion of leaves is taken daily	6	0.12	1	12.24
28	*Ipomoea batatas* (L.) Lam. Poir SAS-E-005	Convolvulaceae	Shakar qandi	S	Herb	Root	Used in cooked or boiled form	1	0.02	2	2.04
29	*Juniperus communis* Thunb. SAS-E-009	Cupressaceae	Sanobar	S	Shrub	Fruit	Decoction of fruit is given orally once a day	2	0.04	1	4.08
30	*Lawsonia inermis* L. SAS-E-0027	Lythraceae	Hinna	B, K, M, S	Shrub	Flower	1 tea spoon of sugar is mixed in half cup of flower infusion and taken once a week	4	0.08	1	8.16
31	*Malva sylvestris* L SAS-E-0046	Malvaceae	Pochki	B, K, M, S	Herb	Whole plant	Decoction of whole plant is recommended orally once a day	2	0.04	1	4.08
32	*Musa paradisiaca* L. SAS-E-0049	Musaceae	Kela	B, K, M, S	Herb	Fruit	Used in raw form	4	0.08	1	8.16
33	*Oxalis corniculata* L. SAS-E-001	Oxalidaceae	Khatti booti	B, K, M, S	Herb	Whole plant	Whole plant decoction with 1 teaspoon of sugar is given orally	5	0.10	3	10.20
34	*Parkinsonia aculeata* L. SAS-E-0013	Leguminosae	Walayeti kikar	B, K, M, S	Tree	Flower	Half cup of flower infusion is given twice a day	9	0.18	2	18.36
35	*Peganum harmala* L. SAS-E-0022	Zygophyllaceae	Harmal	B, K, M,	Herb	Seeds	1 teaspoon of powdered form of seeds is taken early in the morning before breakfast	21	0.42	2	42.85
36	*Plantago lanceolata* L. SAS-E-0029	Plantaginaceae	Isab gol	B, K, M, S	Herb	Leaves	Decoction of leaves is given once a day	7	0.14	3	14.28
37	*Plantago major* Bert. ex Barneoud SAS-E-0039	Plantaginaceae	Isab gol	B, K, M, S	Herb	Whole plant	Decoction of whole plant is given once a day	8	0.16	1	16.32
38	*Polygala vulgaris* Thunb. SAS-E-0034	Polygalaceae	Jangli booti	B, K, M, S	Herb	Leaves	Half cup of decoction of leaves is recommended once a day	20	0.40	2	40.81
39	*Populus alba* L. SAS-E-0042	Salicaceae	Poplar	B, K, M, S	Tree	Bark	1 cup of bark decoction is used in morning after the interval of 1 day	2	0.04	3	4.08
40	*Populus nigra* Mill. SAS-E-0012	Salicaceae	Popular	B, K, M, S	Tree	Bark	Half cup of bark decoction is taken orally once a week	3	0.06	2	6.12
41	*Punica granatum* L. SAS-E-0031	Lythraceae	Anar	B, K, M, S	Tree	Fruit	Used in raw form and sometime juice is used also	14	0.28	3	28.57
42	*Ricinus communis* L. SAS-E-0023	Euphorbiaceae	Arind	B, K, M, S	Shrub	Seed	Half teaspoon of seed oil is mixed in milk and taken orally once in a week	9	0.18	3	18.36
43	*Ruta graveolens* L. SAS-E-17	Rutaceae	Saddab	M	Herb	Aerial parts	Decoction of aerial part is given orally	6	0.12	2	12.24
44	*Sapindus trifoliatus* Turcz. SAS-E-0026	Sapindaceae,	Raitha	S	Tree	Seeds	Half cup of infusion of seeds is taken orally once a day	3	0.06	3	6.12
45	*Stellaria media* (L.) Vill. SAS-E-006	Caryophyllaceae	Chick weed	S	Herb	Leaves	1 cup of leaves decoction is given thrice a day	5	0.10	1	10.20
46	*Taraxacum officinale* F. H. Wigg SAS-E-0041	Asteraceae	Kakronda	B, K, M, S	Herb	Leaves	Decoction of leaves is used twice a day	9	0.18	3	18.36
47	*Vitex negundo* Noronha SAS-E-0011	Lamiaceae	Sambhalu	S	Shrub	Aerial parts	Decoction of aerial part is given at regular intervals to reduce the risk of fits	17	0.34	2	34.69
48	*Xanthium strumarium* L. SAS-E-002	Asteraceae	Konjel	B, K, M, S	Herb	Root	Decoction of root is given orally once a day	28	0.57	3	57.14
49	*Ziziphus mauritiana* Lam. SAS-E-004	Rhamnaceae	Beri	B, K, M, S	Tree	Bark	Decoction of bark about half cup is taken orally once a day	15	0.30	3	30.61

FC; frequency of citation, RFC; Relative Frequency Citation , PR; Preference Ranking, PRK; Percentage of Respondents having Knowledge about the use of medicinal plant against epilepsy

B; Bhakkar, K; Khushab, M; Mianwali, S; Sargodha

A total of 49 plant species belonging to 45 genera and 34 families were reported to cure epilepsy. The species, their families, habit, common name, mode of utilization, percentage of people interviewed with knowledge about their use to treat epilepsy, relative frequency of citation and the preference ranking of the species are presented in Table 2. Analysis on the medicinal plant diversity shows that highest number of species belong to family Asteraceae represented by (5 species) followed by Fabaceae and Brassicaceae each represented by (3 species). Alliaceae, Apiaceae, Rutaceae, Cupressaceae, Lythraceae, Plantaginaceae and Salicaceae are represented by 2 plant species each. The rest are represented by 1 species each (24 families) (Fig. 2). The reason for dominance of family Asteraceae could be the presence of large number of bioactive compounds in this family (Thomas *et al.*, 2009). Alkaloids, lipids, terpenes, triterpenoids, flavonoids and coumarins are the major phytoconstituents which have been reported to retain anticonvulsant activity (Kumar *et al.*, 2012). Most of plants of family Asteraceae have many phytoconstituents related to aforementioned classes of phytoconstituents. Yet, further studies are necessary to isolate and characterise phytoconstituents responsible for anti-epileptic activity of the documented plants.

The highest percentage of life form was found to be herbs (63.2%) used against epilepsy followed by trees (22.4%) and shrubs (14.2%). (Fig.3). The reason for dominance of herbs could be their better abundance in the study area as compared to shrubs and trees (Giday *et al.*, 2003; Mesfin *et al.*, 2012). As mostly used part of plants in the study were leaves, it is easy to collect them from herbs rather than aerial parts of trees moreover herbs can grow on roadside, home garden, farmland and in wild habitats) were common in the study area compared with other species such as trees, shrubs and climbers (Moa *et al.*, 2013).

Different plant parts used for the treatment of epilepsy were roots, leaves, bulb, seeds, fruit, flowers, whole plant, aerial parts, bark and stem (Fig. 4). The Leaves were the dominant plant part with (29.4%), followed by bark (13.7%), whole plant (11.7%), fruit and seeds (9.8%) each (Fig.4). The vital position of leaves may be concerning with the fact that this part of plant is home of photosynthates or exudates which surely enrich in secondary metabolites and that are probably main source of medicine for humans (Balick and Cox, 1996; Bhattarai *et al.*, 2006). Moreover, the use of leaves are more clean and clear part of plant than lower or underground (root, stem, root etc.) parts that are suspected to be more contaminated (Giday *et al.*, 2003; Zheng and Xing, 2009). The use of bark as medicine is related to rich source of secondary metabolites (Bhattarai *et al.*, 2006).

Highly used mode of utilization of herbal medications was decoction (54%) followed by infusion (16%), powder, raw and cooked form (8%) each, paste (4%) and gum (2%) (Fig.5). Boiling the plant material and then drinking the extract is preferred (Al-Adhroey *et al.*, 2010) because mostly dried plant material is used for herbal medicines in study area and duration of boiling ranged from 1-2 hours on fire wood or cooking stove till a change in colour of the solvent is observed indicating “full dissolution of active ingredients into the solvents”. The high percentage of infusion is in case of fresh leaves material when method was preferred by its users as they believe that the ingredients will be extracted without the “ingredients” from the plant been exposed to heat which they believe could somehow have effect on the efficacy of the herbal recipes (Idowu *et al.*,2010 ; Dike *et al.*, 2012). However, none of the people interviewed provided any information about how they might “standardize” treatments and the amounts used were generally vague. (Asase *et al.*, 2005). Sometimes salt, milk and sugar is also added to folk remedies and the dosage mostly depend on age, gender and the stage of the disease.

For quantitative ethnobotanical indices, Relative frequency citation was deliberated to determine the most common occurring medicinal plants used for epilepsy. On the basis of RFC values, number of informants who cited the species for epilepsy at various localities include; *Bacopa monnieri* (0.61) followed by *Xanthium strumarium* (0.57) (Table 2).

The highest value of RFC narrates the fact that these plants were well known to maximum number of the informants. Percentage of respondents interviewed with knowledge (PRK) about medicinal flora used to treat epilepsy and the preference ranking (PR) of the botanical taxa are presented in Table 2. *Bacopa monnieri* (61.2%) exhibited upper most frequency of encounter followed by *Xanthium strumarium* (57.1%). A total of 14 plant species i.e. *Xanthium strumarium*, *Anagallis arvensis*, *Ziziphus mauritiana*, *Punica granatum*, *Ricinus communis*, *Taraxacum officinale*, *Allium sativum*, *Acorus calamus*, *Plantago lanceolata*, *Oxalis corniculata*, *Buxus sempervirens*, *Sapindus trifoliatus*, *Boerhavia diffusa* and *Populus alba* have highest PR level (3) showing that these plants are most effective in curing epilepsy and rest of 15 plant species were those having lowest PR level 1.

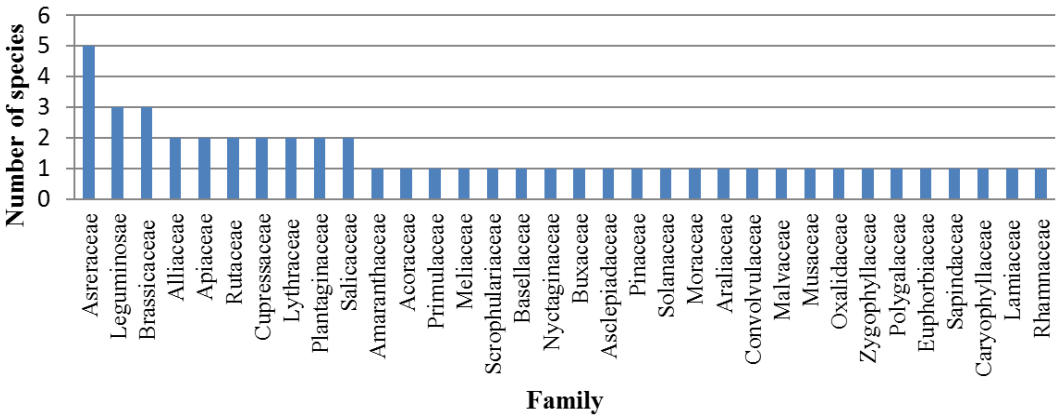

Fig. 2. Number of cited plants from respective plant families.

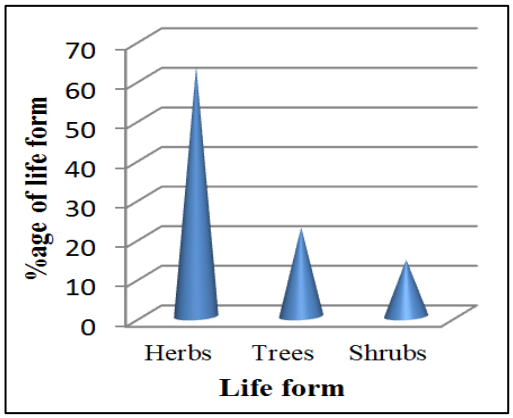

Fig. 3. Life form of medicinal plants.

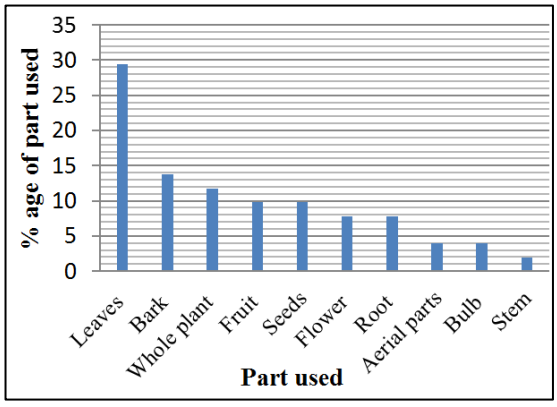

Fig. 4. Part used of medicinal plants.

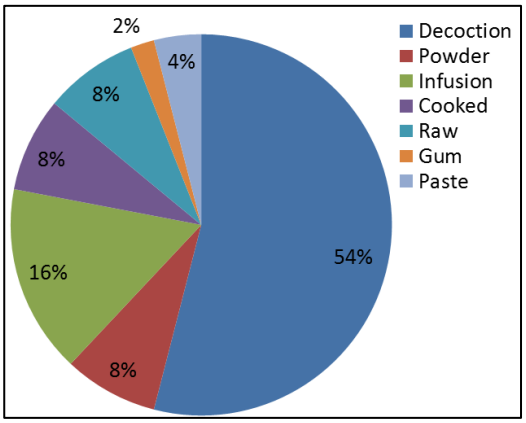

Fig. 5. Mode of utilization of medicinal plants.

A literature survey revealed that only 18 out of 49 reported plants from the study area have earlier been evaluated for anticonvulsant activities and shown positive results in different animal models. These include methanolic extract of *Achyranthes aspera* (Alam *et al.*, 2008); neutral and aromatic essential oils of *Acorus calamus* (Chauhan *et al.*, 1988; Vohora *et al.*, 1990) and leaves and roots of *Albizia lebbeck* (Kasture *et al.*, 1996; Adesina, 1982); alcoholic extract of bulb of *Allium cepa* and *Allium sativum*

(Adesina, 1982), *Apium graveolens* (Chauhan *et al*., 1988), *Azadirachta indica* (Kumar and Rai 2008); ethanolic extract of leaves and aqueous extract of whole plant of *Bacopa monnieri (*Kaushik *et al*., 2009; Krishnakumar *et al*., 2009) and aerial pats of *Bassella alba* (Anandarajagopal *et al*., 2011); methanolic extract of root *Boerhavia diffusa* (Kaur and Goel, 2011); methanolic extract of seeds of *Cassia fistula* (Mazumder *et al*., 1998); alcoholic extract of heart wood of *Cedrus deodara* (Dhayabaran *et al*., 2010) and fluid extracts of *Datura stramonium* (Peredery and Persinger, 2004). Similarly hydro alcoholic extract of leaves of *Lawsonia inermis*; methanolic extract of leaves of *Oxalis corniculata* (Kumar and Rajkapoor, 2010); ethanolic extract of seeds of *Ricinus communis* (Tripathi *et al*., 2011) and *Ruta graveolens* (Atanassova-Shopova *et al*., 1969) and methanolic, ethanolic and petroleum ether extract of leaves of *Vitex negundo* has shown positive anticonvulsant activity (Gupta *et al*., 1999; Tandon and Gupta, 2005; Gupta *et al*., 1997). The other plant species reported in the area should also be studied in this contest to discover new antiepileptic drugs.

Conclusions and future prospects

Prior to the present study knowledge about plants used to treat epilepsy in the local communities of Sargodha region was almost absent. It has been revealed in this study, that a number of the plants are actively in use in the treatment of epilepsy in different areas of Pakistan.

The pharmacological, phytochemical and toxicological properties of the plants reported are required to be examined in order to verify the positive and negative effects of these anti-epileptic species. This information will also serve as a guideline for appropriate assortment of active plants for agronomy and in turn their maintenance in the study area. Furthermore it is also necessary to explore anti-epileptic plants used by diverse ethnic populations from other areas of Pakistan so that such valuable collected data may serve as a treasure for future generations. This study will also serve as an appealing documentation for the scientific communities, chemists and pharmacologist. Finding of this survey might be useful to assist in the expansion of effective management strategies for epilepsy control exclusively in areas where medical facilities are very poor. Moreover, the survey also shows that plants are used by the local people unscientifically and there is risk of decline in the number of such valuable medicinal plants. So importance of biodiversity conservation can be emphasized and plants should be harvested in a sustainable way from wild and semi-cultivated sites.

Observed indication of this connotation is required to support measures in conserving this valuable and precious traditional knowledge, cultural and medicinal heritage and declining biodiversity.

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