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Identification and ethnomedicinal survey of profitable halophytes of District Chakwal, Pakistan

Iram Abdullah[1], Nazim Hassan*[1], Mushtaq Ahmad[2], Muhammad Zafar[2], Ling Wang[1], Tongtong Xu[1]

[1]*Institute of Grassland Science, and Key Laboratory of Vegetation Ecology, Northeast Normal University, Changchun, Jilin, China*

[2]*Department of Plant sciences, Quaid-i- Azam University Islamabad Pakistan*

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Abstract

The aim of this study was to document information on ethno medicinal uses of Halophytes used by the inhabitants of District Chakwal, Pakistan. A total of 68 plant species from 29 families and 56 genera were studied by using indices like Informant Consensus Factor (ICF), Relative frequency of citation (RFC), use value (UV), Fidelity Level (FL) and Family importance value (FIV). For the preparation of ethno medicines 95 informants including 41 males, 59 females and 15 Traditional Health Practitioners (THPs) were interviewed. Family Poaceae was the most leading family. Out of total herbs (73%), shrubs (20%) and trees (7%) were studied. Part used as Leaves (28%), roots (16%), seed (14%), stem (12%), whole plant (11%), fruit (9%), flower (5%), bark (3%) and resin. For the preparation of ethnomedicine the inhabitants mostly used decoction (36%). Diseases were grouped into 14 broad categories. High Informant Consensus Factor (ICF) observed for respiratory diseases (0.44). Fidelity level 100% (FL) for seven plant species. Highest Used Report (UR) for *Solanum incanum* (11) while highest Relative Frequency of Citation (RFC) observed for *Acacia nilotica* (0.27).

Plant species with high ICF can be used further subjected to further phytochemical studies.

***Corresponding Author:** Nazim Hassan ✉ nazimhassan890@yahoo.com

Introduction

Ethnobotanical studies not only document traditional thoughtful about medicinal plants of a locality but can also support bio- conservationists, and foresters for future planning (Hassan *et al.,* 2017). All forms of lives depend upon plant directly or indirectly which need proper attention, sustainable use and conservation. In nut shell control of unwise use of these plant species from which crude medicines obtained and supplies for marketing purpose is possible through local peoples (Hamilton, 2003). Plant species are taken as medicine and food are prevalent in majority of rural areas of the world from ancient time (Shinwari, 2010).

This old-style knowledge preserved for centuries through trial and error passed from generation to generation (Patwardhan *et al.*, 2004). It has already been observed that 442000 flowering plants are known, in which 50000 are used medicinally and 5000 examined under phytochemistry. In Pakistan, 6000 plants are found, out of them 12% are taken for medicinal use while more than 400 species of halophytes are taken to treat different health disorders (Khan and Qaiser, 2006; Shinwari *et al.*, 2011). In hilly areas about 84% people of Pakistan uses medicinal plants to cure different health disorders (Qureshi *et al.*, 2007). Because of its easy availability, economical, safety, less side-effect, plants are used as therapeutic medicine in different parts of the world (Mahmood *et al.*, 2011; Shrivastava and Kanungo, 2013). Apart from medicinal uses, the plant species also playing a vital role in the development of the economics status of the peoples (Ali *et al.,* 2011).

In Pakistan information related to medicinal plants attaining appreciation as it is important to know and identify where and in which locality medicinal plants are under practice, because such kind of knowledge is essential to classify and know about its conservation status (Qureshi, 2012).

Halophytes are plants that can tolerate and reproduce in highly concentrated salt environment (Carter *et al.*, 2012). It has been observed that a huge number of halophytes have been used as traditional medicines against different health disorders and to remove salts from soil. (Falleh *et al.*, 2011; Glenn *et al.*, 1999; Ashraf *et al.*, 2005). Salinity of soil is major factor involved in plant growth and crop production worldwide. Salt has affected about eight hundred million hectares of land (Munns and Tester, 2008). Countries like Pakistan, India, United State, Egypt Australia and Mexico are facing salinization (Lieth and Hamdy, 1999). In Pakistan, salinity in total irrigated land is about 26% (Qasim *et al.*, 2010).

With the advancement of communication systems and education facilities, the local communities are being exposed to modern facilities, and in most cases, traditional knowledge has been replaced with modern knowledge. Current research study will not only file traditional knowledge of medicinally important plant species (halophytes) of the locality, but will support taxonomists, pharmacologists, environmentalists, wild life managers, bio-conservationists ecologists and foresters for future planning.

The aim of the study was 1. To identify and document most important medicinal plants (halophytes) in District Chakwal Pakistan; 2. To know the proper use of medicinal plant species from inhabitants; 3. How inhabitants use medicinal plant species to treat different health disorders and to verify the fact of ethnobotany in the area.

Materials and methods

Study area

Chakwal is located in the south of Pakistan. It lies between 32° 56' North and 72° 54' East (Fig. 1).The climate is cool and sub humid. Almost 90% population lives in rural areas. The rainfall (350-500 mm) received mostly from the month of July to the mid of September. The mean temperature ranges from 5.9-38.4°C, while January is the coldest and June the hottest month. In summer temperature ranges from 15-40°C and in winter from 4-25°C. (Anon, 2007).

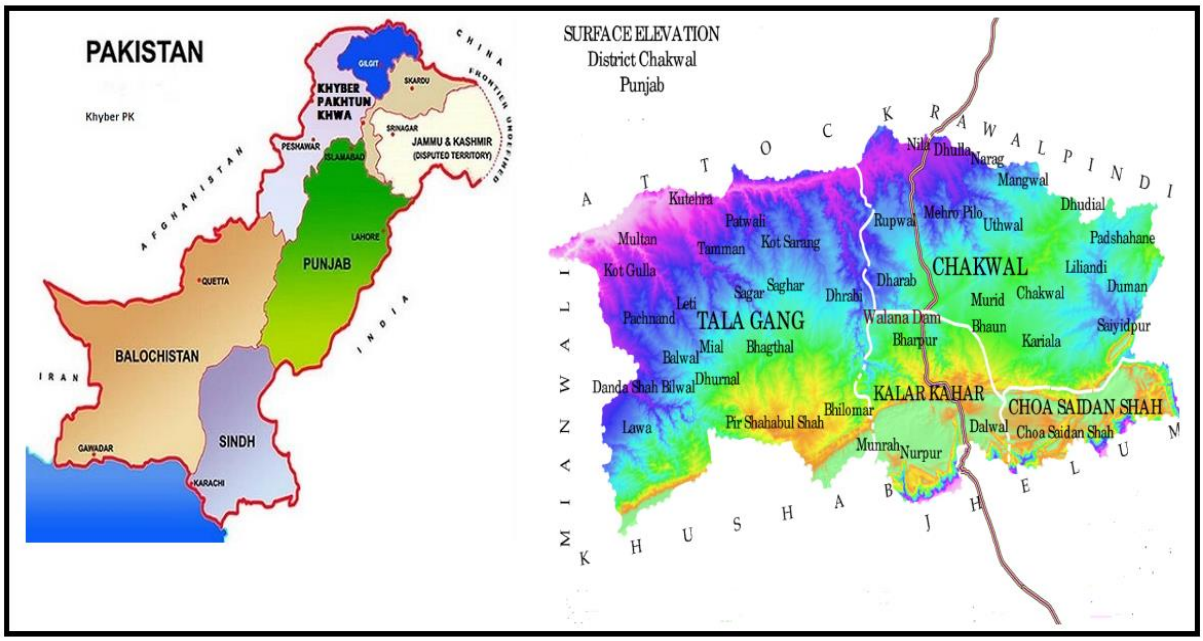

Fig. 1. Study area map.

Data collection

For data collection four plant collection trips were arranged to study area from April 2014 to November 2015. A total of halophytes from 56 genera and 29 families were observed under practice and classified into 14 disease categories (Table 1).

Total of 95 informants including 41 males, 59 females and 15 Traditional Health Practitioners (THPs) were interviewed as key informants. Data was collected from 12 localities within the district as Choa Saiden Shah, Kallar Kahar, Tala gang, Kehtas, Sadwal, Karyala, Jabair Pur, Bheen, Bhoon, Bhla, Karyala, Dhok taliyan. The method of semi structured interviews from locals of different age was applied for data collection. Ethnobotanical survey was taken to gather information on traditional plants utilized by the local healers for the treatment of human ailments in the district following standard methods of (Panhwar *et al*., 2007; Hassan *et al*., 2017).

Etnobotanical information's were collected in their local language Urdu in order to get comprehensive information about plant species. Data was organized into Excel spreadsheet 2007 and summarized by graphical statistical methods like percentage (Hassan *et al.,* 2018).

Collection, identification and preservation

The collected plant specimen were dried and mount on herbarium sheet as per rules of international herbaria and identified from Herbarium of Pakistan (ISL) through taxonomist and flora of Pakistan (Stewart, 1967; Jain and Rao, 1977; Ahmad *et al*., 2014; Hassan *et al*., 2017).

The complete herbarium specimen were preserved under voucher number (Table 1) in Herbarium of Pakistan Quaid-i-Azam University Islamabad for future references.

Relative Frequency Citation (RFC)

Relative frequency citation (RFC) shows the local importance of each plant species in the locality. 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). Relative frequency citation (RFC) can be calculated by the formula.

RFC=FC/N

Where FC is the number of informants who cited the species and N is the total number of informants contributed in the study.

The value of RFC depends on the citing proportion of informants for that particular species (Ahmad *et al.*, 2014).

Informant consensus factor (ICF)

Informant consensus factor was applied to calculate usage variability of the medicinal plants used by the local people. It was obtained by using the formula.

ICF = (Nur – Nt) / (Nur – 1).

Where N_{ur} refers to the total number of use citations for each disease category while N_t to the number of species listed in that category. ICF value ranges from 0 to 1. A high value ICF (near to 1) shows that there is a well-defined selection conditions for the medicinal plants regarding a specific disease category in the community and there is consistency of information between the informants. A low value ICF (near to 0) shows that plants are selected casually or informants do not exchange information about their use (Heinrich *et al.*, 1998).

Use Value (UV)

Use value for plants provide a quantitative measure for the relative importance of species considering the number of uses mentioned by native people.

It was calculated using the following formula.

UV = ∑U / nUV = ∑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 (Phillips *et al.*, 1994).

Fidelity level (FL)

Fidelity level (FL) was assessed to determine the most desired species used in the curing of a specific ailment as many plant species may be used in same use group. This index was calculated by using the protocol (Friedman *et al.*, 1986).

FL (%) = (Np / N) ×100.

Where N_p is the number of informants citing the use of the plant species for the cure of a particular disease and N is the total number of formants citing the species for any given disease. A high value FL (near to 100%) indicates that there is a high frequency of use of the plant species to treat a particular disease category by the indigenous people.

Family importance value (FIV)

Family importance value (FIV) gives the local importance of the families of plant species. It was calculated by taking the percentage of informants mentioning the family. It may be calculated by the formula.

FIV= ¼FC (family)/N_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).

Results and discussion

Research survey

A total of 68 salt tolerant plant species belong to 56 genera and 29 families were observed under practice which were classified into 14 disease categories. Family poaceae was found the most leading family comprises (21 species), followed by Chenopodeaceae and Amaranthaceae (5 species), Solanaceae (4 species), Leguminaceae and Asteraceae (3 species) while the other 23 families contributed one or two species each (Table 1).

The results obtained are in close connection with the study conducted by (Qasim, *et al.*, 2010) who observed that mostly halophytes were used for the preparation of herbal medicines in which family Poaceae was the most leading family. Habit wise herbs were observed dominant as (73%) followed by shrubs (20%) and trees (7%) (Fig. 2). Part used was observed as Leaves (28%), roots (16%), seed (14%), stem (12%), whole plant (11%), fruit (9%), flower (5%), bark (3%) and resin (Fig. 3).

Table 1. Different aspects of medicinal plant species used for different health disorders in Cakwal Pakistan.

Botanical name/ Family/ Local Name/V.Number	Life form	Habit	Part used	Mode of utilization	Recipes	Flowering period	Disease treated	UR	FC	RFC	UV
Abelmoschus moschatus M. Malvaceae Jangli Bhindhi /IA-1	Annual	H	Whole plant	Tea, soup	Young leaves and shoots cooked in soup and taken twice a day for 30 days.	October - April	Cancer, inflammation, Indigestion, Urinary, Gonorrhea, Dermatitis, Itch	8	24	0.25	0.33
Acacia nilotica L. Mimosaceae Kikar/IA-4	Perennial	T	Leaves	Decoction	Leaves are boiled in water for 5 minutes and taken thrice a day with little sugar.	May- October	Eczema ,Leucorrhoea, Pulmonary, Diarrhea, Nose inflammation, Dysentery, Constipation, Eye infection	8	26	0.27	0.31
Acalypha brachystachya L. Euphorbiaceae Kuppi/IA-6	Annual	H	Leaves	Paste	Powdered leaves mixed with salt and applied on scabies, mixed with turmeric used for acne problems	September	Scabies, Acne	2	1	0.01	2
Achyranthes aspera L. Amaranthaceae Bel phal/IA-8	Perennial	H	Seeds, Roots, Stem	Decoction, Juice	Powdered stem mixed with powdered leaves of Mentha longifolia and taken orally. Powdered seeds about 1 spoon it is advised in water daily.	July-September	Pneumonia, Diarrhea, Dysentery.	3	5	0.05	0.60
Aerva javanica Juss. Amaranthaceae Bui buti/IA-3	Perennial	H	Leaves	Powder, Decoction	15 g powdered leaves with equal quantity of leaves of gugal, seena,, take with water twice a day. Powder can be mix in water and take this decoction early in morning	September-December	Kidney stone, Inflammation, Wounds, Jaundice, Diabetes, Cough, Headaches	7	12	0.13	0.58
Alhagi maurorum Medik. Leguminosae Jawansa/IA-9	Perennial	S	Flowers	Decoction	The flowers are boiled in water and take this decoction twice a day	April-September	Eye infections, Asthma, Coughs, Bronchitis, Skin diseases, Piles, Urinary	7	25	0.26	0.28
Amaranthus oleraceus L. Amaranthaceae Chaulai/IA-5	Annual	H	Leaves, Stem	Decoction, Juice	Leaves and young shoots are boiled in water for half an hour and this decoction is directly used twice a day.	May-September	Dysentery	1	4	0.04	0.25
Amaranthus viridis Pollich ex Moq. Amaranthaceae Chulai/IA-7	Annual	H	Leaves, Stem	Paste	250 g of leaves and stem is used with olive oil to make paste. This paste is applied on infection daily.	May-November	Dysentery, Inflammation, Constipation	3	5	0.05	0.60
Aristida adscensionis Walter Poaceae Lamba/IA-10	Annual	H	Whole plant	Ash	Ash prepared by burning whole plant and applied externally.	March-December	Infections, Wounds	2	7	0.07	0.29
Aristida mutabilis Trin. & Rupr. Poaceae Lumb/IA-2	Annual	H	Leaves, Roots	Ash	Leaves or roots are burnt into ash and applied on wounds	July - September	Inflammation, Wounds	2	4	0.04	0.50
Asparagus officinalis L. Asparagaceae Halia/IA-13	Perennial	H	Seeds, Roots	Powder	Dried roots or seed are grinded into powder. 2 g powder can be taken orally twice a day.	May-June	Kidney stones, Lungs infection, Throat dryness, Joint pain, Constipation, Anemia	6	14	0.15	0.43
Atriplex stocksii Boiss. Chenopodiaceae Gerukh pari/IA-15	Perennial	S	Leaves	Decoction	5 to 10 leaves are boiled in water for 10 minutes, leave it for 1 night and take 1 full cup before breakfast.	December-January	Fever, Jaundice, Swelling, Liver disease	4	7	0.07	0.57
Calotropis procera W.T.Aiton Asclepiadaceae Aak/IA-12	Perennial	S	roots	Paste	1 tea spoon of root powder is mixed with mustard oil and this paste is used 3 times a day.	All the year round	Stomach inflammation, Malaria, Cholera, Asthma, Skin diseases	5	11	0.12	0.45
Capparis decidua Edgew.	Perennial	S	Fruit,	Decoction	Dry fruit ground in to powder	May - October	Ulcer, Cough, Asthma,	4	8	0.08	0.50

Capparaceae Karir, Tvakri/IA-14.			Bark		and take 2-4 g for 2 times per day. Bark is boiled in water and take 60- 90 ml for 2 times per day.		Stomach Aches			
Carthamus oxyacantha M.Bieb. Asteraceae Poli/IA-18	Annual	H	Seeds	Roasted seeds, Decoction	Seeds are collected, dried under shade, roasted and ground to obtain powder. 1 spoon taken twice a day.	April - July	Measles, Fevers, Skin problems, Colds, Cough.	5	9	0.09	0.56
Cenchrus pennisetiformis Steud. Poaceae Bhurat/IA-17	Annual	H	Fruit	Decoction	Fruit is shade dried and then boil it in water. take 1 cup of this soup once in a day	February-April and again August-October	Kidney diseases	1	4	0.04	0.25
Cenchrus setigerus Forssk. ex Steud. Poaceae Anjan, Dhaman/IA-20	Perennial	H	Whole Plant	Paste	Whole plant is dried, form powder, mixed with powdered ginger and applied on infections and wounds.	August-January and again in April	Infections	1	2	0.02	0.50
Chenopodium album Bosc. ex Moq. Chenopodiaceae Bathu/IA-16	Annual	H	Whole plant	Decoction	Plant material is boiled with solanum surretense for 1/2 an hour and is given orally once in a day	January - September	Constipation	1	3	0.03	0.33
Citrullus colocynthis L Cucurbitaceae Tumba/IA-19	Perennial	H	Fruit, Root	Powder, Juice	Powder of roots mixed with ginger and take 2 g orally with water,1 cup of Juice of fruit mixed with sugar taken early in morning.	January-April	Toothache, Constipation, Bleeding, Pile, Asthma, Leucorrhea, Diabetes	7	23	0.24	0.30
Cleome viscosa L. Capparaceae Jungli gawara/IA-21	Annual	H	Leaves	Juice	Dry leaves are grinded well into powder. This powder is mixed in water with sugar for making juice.	September-October	Ear infection, Joint Pain, Deafness	3	7	0.07	0.43
Cynanchum acutum L. Asclepiadaceae/zelai/IA-93	Perennial	H	Leaves	Decoction	Leaves are boiled in water and take this water before breakfast.	June-August	Small pox, Throat infection, Wounds	3	4	0.04	0.75
Cynodon dactylon L. Poaceae Khabbal / IA-25	Perennial	H	Whole plant	Paste	Boil about 15 gram of plant material and 4 gram of white pepper in 30 ml water. Cool it and add 2 spoon of butter, form a paste along with turmeric and rub on wound. 6-12 drops juice of the plant is inhaled to stop bleeding from the nose and cuts	All year round	Cuts, Wounds	2	4	0.04	0.50
Cyperus niveus Herb.Royle ex C.B.Clarke Cyperaceae Dilla/IA-22	Perennial	H	Roots	Paste	The roots are boiled along with equal quantity of Mint (Mintha piperata). Roots along with turmeric and curd are made into a paste to apply on pimples.	April - June	Acne, Inflammation	2	6	0.06	0.33
Cyperus rotundus Benth. Cyperaceae Delloca, /IA-29.	Perennial	H	Roots, Leaves	Paste, Decoction	Roots are crushed and mixed with mustard oil, green ginger and honey to make paste for acne and boils. Leaves are boiled and this decoction is taken thrice a day.	April - October	Acne, boils, Menstruation, Vomiting, Diarrhea, Nausea, , Fever, Inflammation	8	20	0.21	0.40
Dactyloctenium scindicum Boiss. Poaceae Madhana/IA-30	Perennial	S	Seeds	Decoction	4 g seeds are boiled in water and take 1 cup daily.	September-May	Typhoid	1	4	0.04	0.25
Datura stramonium L. Solanaceae	Annual	H	Seed, Leaves,	Juice	Leaves are crushed into a powder form with the equal	May - October	Asthma, Hallucinations, Coma, Healing, Stomach	6	17	0.18	0.35

Aam datura/IA-23			Flowers		amount of cannabis and lobelia then mixed together with potassium nitrate. This is burn in an open dish giving off dense smoke giving effective relief from asthma attack.		and Intestinal pain ,			
Desmostachya bipinnata L. Poaceae Dab/IA-24	Perennial	H	Roots	Paste, Decoction	Roots are grinded in water and added along with some amount of milk and are given 3 times a day. Roots grinded with few black pepper in water and is administered orally.	July-October or November	Muscular pains	1	3	0.03	0.33
Echinochloa colona L. Poaceae Cockspur/IA-25	Annual	H	Seeds	Powder	Powdered seeds mix with milk and sugar to form porridge. take this thrice a day.	May - September	Digestive tract diseases	1	3	0.03	0.33
Echinochloa crus-galli L.P.Beauv. Poaceae/Sanwak/IA-27	Annual	H	Leaves, Seeds, Stem	Powder	It can be cooked whole or be ground into a flour before use, The roasted seed is a coffee substitute.	June-October	Boils, Hemorrhages, Sores, Spleen trouble, Cancer, Wounds	6	10	0.11	0.60
Eucalyptus camaldulensis Dehnh.Myrtaceae/ Lhachi/IA-26	Perennial	T	Resin, Leaves	Decoction	5 to 10 leaves boiled in water and decoction is taken thrice a day. Resin is removed from the tree by making incisions in the trunk. This resin it is used internally in the treatment of diarrhea and bladder inflammation	April - October	Coughs, Colds, Sore throats, Diarrhea, Bladder inflammation	5	13	0.14	0.38
Haloxylon stocksii Hook.f. Chenopodiaceae Saxaul/IA-42	Perennial	S	Whole plant	Decoction	Leaves are grinded into powder, taken with ajwain and water.	October-December	Tooth , Stomach aches	2	6	0.06	0.33
Heliotropium curassavicum Hook. Boraginaceae/IA-43	Perennial	H	Root	Paste	Powdered roots along with sesame oil mixed to form paste and used on boils	March-April.	Boils	1	3	0.03	0.33
Heliotropium parviflorum Steven ex Boiss. Boraginaceae Hathjori/IA-71	Perennial	H	Leaves	Paste	Leaves are boiled in sesame oil and applied on skin.	April- July	Wounds	1	6	0.06	0.17
Heliotropium strigossum Willd. Boraginaceae Saloonak booti/IA-62	Perennial	H	Leaves	Paste	Paste made up of leaves is applied on wounds	July-September	Boils, Ulcer, Wounds	3	7	0.07	0.43
Hordeum murinum L. Jawo Poaceae/IA-59	Annual	H	Seeds	Decoction	120 g seeds are roasted and mixed with each of 45 g of Cicer arietinum and Elettaria cardamomum and used half teaspoon with water thrice a day to control bladder inflammations	September-February	Bladder Ailments	1	3	0.03	0.33
Hordeum vulgare L. Poaceae Jaw/IA-34	Perennial	H	Seeds, Fruits	Powder, Herbal drink (sattu)	Powder of seeds mixed with water and sugar and taken orally thrice a day for a month. Decoction of dried fruit is used orally	September-February	Blood glucose level	1	4	0.04	0.25
Imperata cylindrica L. Poaceae Pohli/IA-35	Perennial	H	Roots, Flowers,	Decoction	They are decocted by putting flowers or dried roots in water for 1 hour. Leave it for a night	April-June	Gonorrhea, Blood urine, Kidney disease, Injury, Fever, High blood pressure,	9	26	0.27	0.35

					and take half cup before breakfast.		Nerve disease, Hemorrhages, Wounds				
Lespedeza juncea Wall. Leguminosae Oormaray/IA-32	Perennial	S	Roots	Juice, Decoction	Dry roots are crushed and squeeze to get juice, powdered roots are mixed with its own juice for dysentery. Juice can also be applied on skin to get rid of ring worms.	July-September	Diarrhea, Dysentery, Skin infections (ring worm)	3	5	0.05	0.60
Medicago polymorpha L. Leguminosae Karushka/IA-40	Annual	H	Seed	Juice	Seed collected, ground into a powder and mixed with water to make a juice and take 1 full cup once in a day	March-May	Constipation	1	3	0.03	0.33
Melilotus albus Desr. Fabaceae Padena/IA-33	Annual	H	Leaves	Juice	The 2 leaves and boiled in water with some sugar and take 2 cups twice a day.	March-September	Tension, Headache Painful menstruation, Clotting of blood, Eye diseases, Muscular pain, Swollen joints, Severe bruising	8	21	0.22	0.38
Melilotus indicus L. Fabaceae Sinji/IA-44	Annual	H	Seeds	Paste	The 8 g seeds are grinded into powder mixed with 10 ml almond oil and take 1 to 6 drops twice a day.	March-August	Diarrhea, Swelling.	2	7	0.07	0.29
Panicum turgidum Hochst. ex Steud. Poaceae/Cheena/IA-72	Perennial	H	Whole plant	Smoke	Dried plant smoke is inhaled to cure throat infection. Ash is used on wound externally	April-May	Small pox, Wounds, Throat infection	3	5	0.05	0.60
Paspalum paspaloides Scribn. Poaceae/Gha/IA-71	Perennial	H	Stem, Leaves	Juice	Stem is crushed, juice is extracted take it with water.	April-May and again August-September	Dysentery, Wounds	2	4	0.04	0.50
Peganum harmala L. Zygophyllaceae Hermal/IA-87	Perennial	H	Seeds	Decoction	Its seeds along with seeds of Linum usitatisimum are ground, boil in olive oil and given with honey.	March - April	Muscular pain, Fevers, Asthma, Lice killing, Joint pain, Colic, Back pains	7	20	0.21	0.35
Phoenix sylvestris L. Arecaceae Khajoor/IA-62	Annual	T	leaves	Ash, Decoction	Leaves are burnt and soot is mixed in water with salt	March-April.	Gonorrhea, Toothache, Nervous Debility, Diarrhea, Liver Genito-urinary diseases	6	15	0.16	0.40
Phragmites karka (Retz.) Steud. Poaceae/Dila/IA-31	Perennial	H	Stem	Decoction	Young stems, dried ,ground in to powder, mixed in hot water and take 1 cup daily once in a day.	April-November	Urinary troubles, Vaginal problems, Uterine complaints, Redness of skin, Heart diseases.	5	7	0.07	0.71
Plantago major Bert. ex Barnéoud Plantaginaceae Ghatsat/ Ispaghole/IA-66	Perennial	H	Leaves, Seeds, root	Powder, Decoction	2 g of powder or fresh whole Plant (seed, root, and leaves) to 1 cup boiling water, steep it for 10 min. strain, sweeten with honey or sugar. Drink through the day.	August.-September	Respiratory diseases, digestive tract diseases	2	5	0.05	0.40
Plantago psyllium Decne. Plantaginaceae Ispagol/IA-57	Annual	H	Fruit	Juice	2 table spoon of fruit bark is dipped in 1 fourth liter water or milk and drink it	April - May	Constipation, Dysentery, Abdominal pain, Piles, Muscular pains, Cough, Cold.	7	19	0.20	0.37
Rhazya stricta Decne. Apocynaceae/Venra/IA-46	Perennial	S	Leaves	Powder	Dry leaves along with chicory plant (kasni) and bishop weed is grinded and mixed. Take it twice a day	December-March.	Blood purification, Diabetes, Skin diseases, Menstruation problems	4	6	0.06	0.67
Saccharum bengalense Retz. Poaceae/ Kana/IA-49	Perennial	H	Leaves	Decoction	The leaves of S. bengalensis are stirred in a cup containing mustard oil.This spiritual	October-January	Mouth diseases, Jaundice	2	6	0.06	0.33

					method is repeated for 4 Sunday for effective remedy						
Saccharum griffithii Boiss Poaceae.Sormal/IA-69	Perennial	H	Roots	Powder, Paste	Dry roots are grinded into powder, take 2 g of it and 2 g of ajwain along with water twice a day.	June-September	Stomach ache	1	4	0.04	0.25
Saccharum spontaneum L. Poaceae/Kahi, Kaan/IA-48	Perennial	H	Stem	Juice	Fresh stems are crushed. 1 cup of the juice are given to the patient 3 to 6 times per day for 30 days	July-September	Wounds, Joint pains	2	5	0.05	0.40
Salicornia brachiata Miq. Chenopodiaceae/Ghas IA-41	Annual	H	Whole plant	Ash	Whole plant is burnt into ash and applied on wounds and infections.	May - September	Wounds, Mouth and Throat infections	3	4	0.04	0.75
Salvadora oleoides Decne. Salvadoraceae Pelu/IA-55	Perennial	T	Stem	Powder	Stem powder is used as miswak (tooth paste) 2 times a day	March - June	Purgative, debility of sex, Diarrhea	3	6	0.06	0.50
Salvadora persica L. Salvadoraceae Pelu/IA-63	Perennial	T	Fruit, stem	Decoction, powder	A fruit or bark is boiled in water and used 1 / 2 cup of this decoction twice a day, stem powder is used as miswak 2 times a day	January - April	Asthma, Cough	2	6	0.06	0.33
Setaria viridis L. Poaceae Ban Kangni/IA-67	Annual	H	whole plant	Powder, Tea	The plant is crushed and mixed with water then applied to treat bruises. 3 leaves are mixed in hot water to make a tea with sugar and take 1 cup twice a day for relief	June - September.	Bruises	1	4	0.04	0.25
Solanum incanum Pav. ex Dunal Solanaceae Peli mohekri/IA-61	Annual	S	Roots, Fruits	Decoctions , Powder	Roots chewed or soaked in boiled water for sore throat. Make the powder of two fruits boil in water and take when pain starts.	Mostly throughout the year	Sore throat, Chest pain, Stomach-ache, Colic, Headache, Painful menstruation, Liver pain, skin infection, lungs infection, Pneumonia, muscular pain	11	21	0.22	0.52
Solanum surattense Burm.f. Solanaceae Kandiari/IA-45	Perennial	H	Fruit	Powder	Fruit is burnt and ground into powder. Take 3 g with water twice a day. Fruit is used as soup.	Mostly throughout the year.	Bronchial, Asthma, Headache, Cough, Joint pain, Chest pain, Vomiting, Burning feet	8	24	0.25	0.33
Sporobolus coromandelianus Link.Poaceae/Swag/IA-56	Annual	H	Seeds	Powder	Seed can be eaten raw or cooked. It can be ground into a flour and mixed with milk and take daily twice a day.	May-September	Anemia, Swellings, Gonorrhea	3	5	0.05	0.60
Sporobolus ioclados Nees Poaceae/Swag/IA-58	Perennial	H	Leaves	Decoction, Tea	3-6 leaves are boiled in water for hours. Leave it for 2 days and take half cup once in a day.	April - November	Kidney problems	1	3	0.03	0.33
suaeda fruticose Amaranthaceae Lani/IA-36	perennial	S	Leaves, stem	Decoction	Dry 5 g leaves and 5 g stem under shade, add 5 g sugar and grind them together, add it in 1 glass of water and drink it 3-4 times in a day.	April-September	retention of urine	1	3	0.03	0.33
Suaeda monoica Forssk. ex J.F.Gmel. Chenopodiaceae Barbara/IA-39	Perennial	S	Leaves	Juice	Fresh leaves are crushed to extract the juice, mixed 2 or 3 drops in 10 ml water, then put 1 or 2 drops in infected eyes.	August-October	Eye disease	1	3	0.03	0.33
Tamarix articulata Wall. Tamaricaceae	Perennial	S	Root, Leaves,	Decoction, Ash	The roots are burnt mixed with some honey and take 1 spoon	June-October	Diarrhea, Dysentery, Wounds, joint Pains,	5	11	0.12	0.45

Ghaz/IA-50			stem, Bark		twice a day, The root, leaves, young branches, or bark boiled in wine, and drank once for 3 days.		Muscular pains				
Trianthema portulacastrum L.Aizoaceae/Itsit/IA-51	Annual	H	whole plant	Paste	2 spoonful of whole plant paste mixed with 1 spoon of pepper powder is taken thrice a day for 1 weak.	May-October	Asthma	1	4	0.04	0.25
Tribulus terrestris L. Zygophyllaceae Bhakra/IA-52	Annual	H	Fruit, Root	Ash, Powder, Paste	30 g powder of dry fruit along with 60 g of bael fruit, mixed it with honey take 2 table spoons twice a day.	Almost throughout the year.	Muscular pain, Smallpox, Gonorrhea	3	5	0.05	0.60
Typha domingensis Pers Typhaceae. Kundar/IA-53	Perennial	H	Stem, Flower	Paste, Ash	Dried roots in powder, mixed with honey and applied on wounds properly so that the wound is fully covered with this paste .Young flowers can be ingested orally.	Most of the year.	Wounds	1	4	0.04	0.25
Verbascum thapsus Plenck Scrophulariaceae Gidder tambako/IA-54	Perennial	H	Leaves , Flowers, Seeds	Decoction,	Decoction of seeds , floral part and leaves is taken orally	March - October	Respiratory diseases	1	3	0.03	0.33
Verbena officinalis L. Verbenaceae Koso beeta/IA-65	Perennial	H	Whole plant	Juice, Decoction	Plant is crushed and make juice, bitter in taste, little sugar is added and used before meal. This can also be boiled in water and the decoction is used.	June-December	Dysentery, Headaches, Fever, insufficient lactation, Dermatitis, Eczema	6	9	0.09	0.67
Viola stocksii Boiss. Violaceae Jangli banifsha/IA-70	Annual	H	Leaves, roots	Powder, decoction	Tea of leaves is made by putting 3-4 leaves in water and take it. Roots powder is mixed with vinegar and take it for spleen disorders	February-May	Cough, Inflammations, Spleen disorders	1	3	0.03	0.33
Withania somnifera L. Dunal Solanaceae Aksun/IA-60	Perennial	S	Leaves	Decoction	3 leaves in 3 cups of water until 1 cup is left and is taken for thrice a day.	Mostly throughout the year	Pain killer, Loss of Memory, Nervous exhaustion, Cough, Cold, Leucorrhoea, Tuberculosis, Asthma, Ulcer,	10	25	0.26	0.40
Youngia japonica Asteraceae/hawkber/IA-38	Annual	H	Leaves	Paste	Leaves are crushed and mixed in honey to apply on boils and snake bite.	March-august	boils, snake bites	2	1	0.01	2
Ziziphus mauritiana Lam. Rhamnaceae Beri./IA-37	Perennial	S	Leaves, Bark	Decoction	Fresh leaves or stem bark are crushed, soaked in water for few hours, then boil to make decoction and drink twice a day.	September	Digestive, Blood purifier, Sores, Skin diseases	4	14	0.15	0.29

The results are in connection with (Bano *et al.*, 2014; Hassan *et al.*, 2018;Ullah *et al.*, 2018) who observed that about 80-84 %, 67% and 26% herbs were used for the preparation of ethno medicine.

Data documented during field studies was prepared and calculated using quantitative indices. Furthermore, collected data was compared with previously published research papers to validate and focus the plants of high value against under study disorders. Current results are in line with (Hazrat *et al.*, 2011), where the member of family Lamiaceae, Solanaceae and Chenopodiaceae are used for the preparation of ethno medicine.

Common ailments in the study area

The local inhabitants use 68 halophytes from 56 genera and 29 families for the preparation of ethno

medicines. The diseases were categorized into 14 broad groups i.e. Gynecological problems, Nervous system disorders, (ENT) Ear, Eye diseases, nose and throat diseases, Mouth diseases, Musculoskeletal disorders, Urogenital problems, Blood circularity system disorder, Glandular disorders, Infectious diseases, Gastrointestinal diseases, Respiratory diseases, Dermatological problems and others (Table. 2).

Table 2. Disease categories treated with medicinal plant species.

Disease category	NUR	%Use reports	NT	%Taxa	ICF
Gynecological problems (Leucorrhoea, menstruation problems, vaginal problems, uterine complaints)	10	4.37	9	5.03	0.11
Nervous system disorders (nervous exhaustion, loss of memory, hallucinations, coma, nervous deability, tension)	7	3.06	5	2.79	0.33
Ear,nose and throat diseases (ENT) (ear infection, deafness, nose inflammation, throat infection)	9	3.93	8	4.47	0.13
Eye diseases	4	1.75	4	2.23	0.00
Mouth diseases	2	0.87	2	1.12	0.00
Musculoskeletal disorders (muscular pains, joint pains, tooth ache, back pains)	17	7.42	15	8.38	0.13
Urogenital problems (Bladder inflammation, kidney stones, urinary inflammation, gonorrhea)	15	6.55	12	6.70	0.21
Blood circularity system disorder (Anemia, chest pains, haemorrhage, high blood pressure, heart inflammation, blood purifier)	9	3.93	8	4.47	0.13
Glandular disorders (jaundice, diabetes, liver pains, blood glucose level, spleen trouble)	10	4.37	8	4.47	0.22
Infectious diseases (Malarial fever,typhoid, measles, fever, boils, small pox, itch, sores, bruises)	21	9.17	20	11.17	0.05
Gastrointestinal diseases (ulcer, colic, constipation, indigestion, diarrhea, dysentery, gastric, piles, purgative, stomic ache, vomiting, intestinal pain, nausea)	48	20.96	29	16.20	0.40
Respiratory diseases (pulmonary, Asthma, chest problems, cold, cough, flue, bronchitis, tuberculosis, pneumonia, lungs infection)	33	14.41	19	10.61	0.44
Dermatological problems (dermatatis, burns, eczema, pimples, skin allergy, Irritation, wounds, acne, cuts, skin infections)	32	13.97	30	16.76	0.06
Others (burning feet, swelling, headache)	12	5.24	10	5.59	0.18

Family importance value (FIV) observed high (27.37) for family Mimosaceae and lowest for family Chenopodiaceae (Table 3) Highest use reports were calculated for *Solanum incanum* (11) and lowest for *Suaeda fruticosa* (1) (Table 1). Highest RFC was calculated for *Acacia nilotica* (0.27) and lowest for *Youngia japonica* (0.01) (Table 1). Highest ICF (0.44) was reported for respiratory diseases (Table 2). The results are in connection with (Bonet *et al.*, 1999; Neves *et al.*, 2009; Saqib *et al.*, 2013) who found that mostly plant species were taken to treat respiratory disorder through ethno medicine.

The inhabitants used more medicinal plant species for respiratory disorders which might be due to bad hygiene, poverty and fuel smoke. Same was also observed that plant species with high ICF, FL and FIV can be considered best for high chemical constituents which can be further analysed for fruitful results (Lulekal *et al.*, 2013; Odonne *et al.*, 2013; Vásquez *et al.*, 2013).

Preparation of ethno medicines

For the preparation of ethno medicines the inhabitants use herbs (73%) followed by shrubs (20%)

and trees (7%). Part used was observed as Leaves (28%), roots (16%), seed (14%), stem (12%), whole plant (11%), fruit (9%), flower (5%), bark (3%) (Fig. 3). The inhabitants use leaves more than other plant parts which might be due to easy collection and less side effects. The study is in connection with (Kadir *et al.*, 2013; Bibi *et al.*, 2014; Rehman *et al.*, 2015; Ngarivhume *et al.*, 2015; Hassan *et al.*, 2017) who observed that mostly leaves were used for the preparation of ethno medicine because leaves contain more bioactive compounds and are a renewable resource.

Table 3. Family importance value.

Family	FIV
Amaranthaceae	6.11
Arecaceae	15.79
Asparagaceae	14.74
Asteraceae	5.26
Boraginaceae	5.61
Chenopodiaceae	4.84
Cucurbitaceae	24.21
Cyperaceae	13.68
Leguminosae	11.58
Mimosaceae	27.37
Plantaginaceae	12.63
Poaceae	5.86
Rhamnaceae	14.74
Salvadoraceae	6.32
Solanaceae	22.89
Verbenaceae	9.47

The healers mostly favour boiling and crushing methods for recipes preparation for quick results. Most frequently used form of herbal medicine was observed (36%) as decoction.

The results are in connection with (Hassan *et al.*, 2017; Zheng *et al.*, 2013; Ngarivhume *et al.*, 2015) who noticed that the powders of the plants are soaked in hot or cold water and the water extract is taken orally as active medicine. Same results were also observed by (Vitalini *et al.*, 2013) that such kinds of techniques can be applied for active compounds extraction. Moreover, 15 indications (2.7%) were claimed to be used directly as fresh leaves and bulbs for the ailments of stomach problems or as appetizer. Remedies based on mixtures of different plants were observed common in the study area. In a few cases, different healers used different parts of the same plant. No standard criteria for dose taken was observed but the inhabitants takes ethno medicines from fingertip to half or full tea spoon.

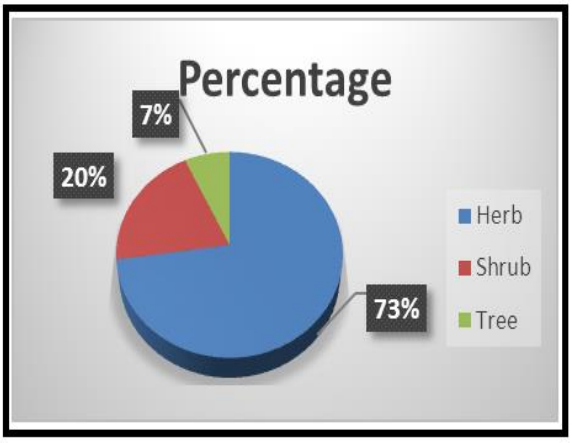

Fig.2.Percentage use of plant habit.

Demographic features of informants

A total of 95 informants including 80 local inhabitants and 15 Traditional Health Practitioners (THPs) were interviewed. Out of total local inhabitants 41% were male and 59 % are female. Females were found more knowledgeable as compared to male. It might be due to usage, interest, results and beliefs on herbal medicines then

allopathic medicines which passes from generation to generation. Mostly the age of female was observed above 50 years (23%), followed by 40–50 (21%) and 30–40 (15%). Large number of males were in the age group of 40-50 years (19%), followed by age group of above 50 (13%) and 30-40 (9%) (Table 3).

It was observed that old aged informants have more knowledge about use of plants in treating different diseases while young were less informed about it. Young people do not depend upon plants as they prefer modern drugs.

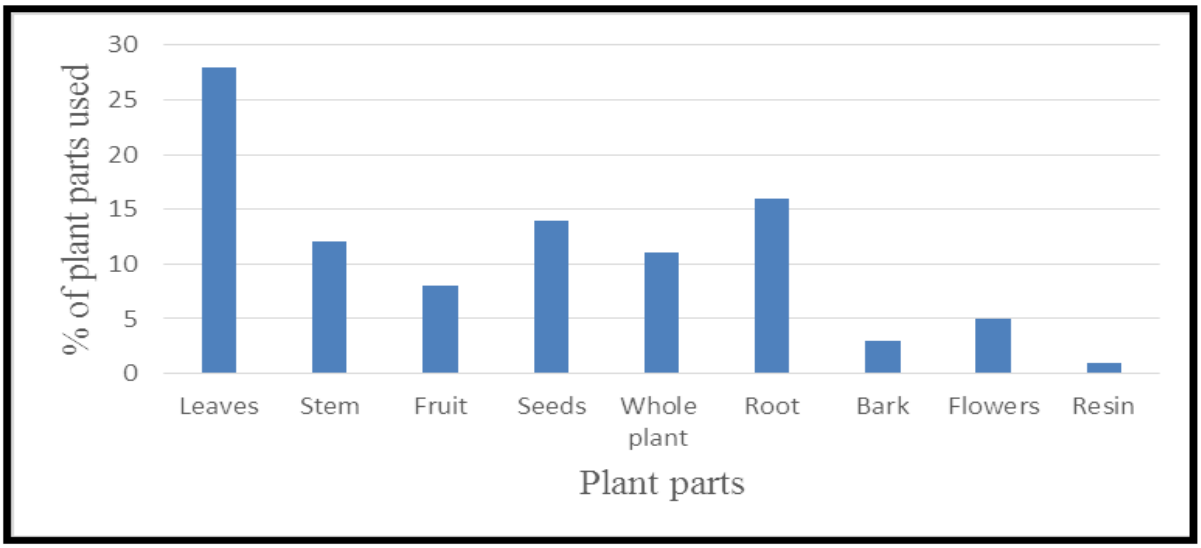

Fig. 3. Percentage use of plant parts.

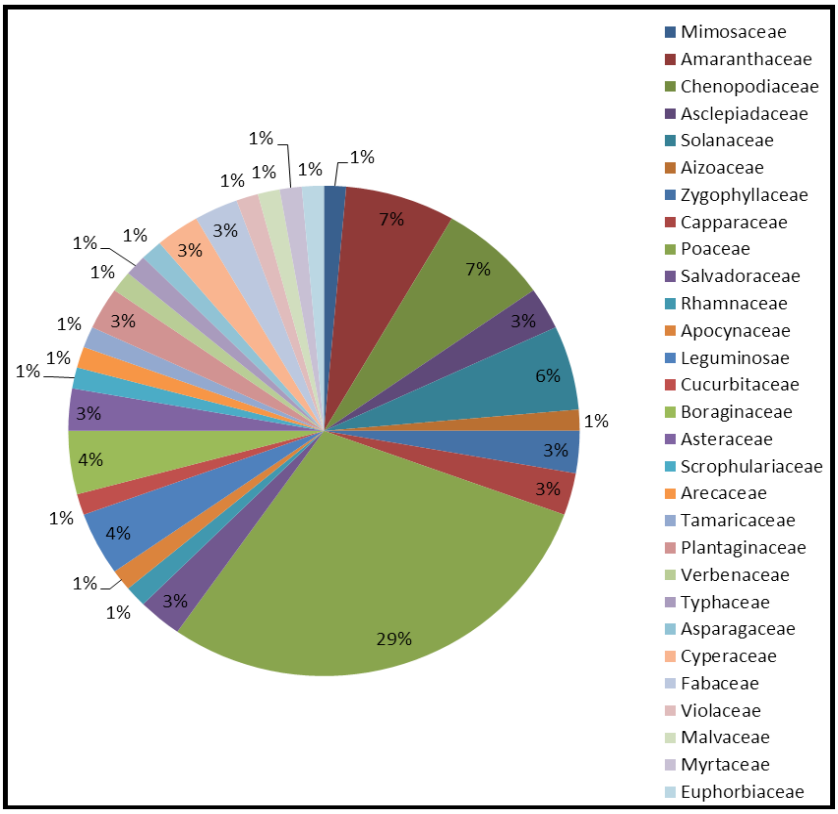

Fig. 4. Family Percentage.

This may be reason that less information about plants was available. The informants were mostly Illiterate (56%), matric (21%), graduate (14%) while (9%) were masters level qualifications (Table 3). The THPs of remote areas have more experience about halophytes used for the treatment of diseases (Table 3). The study is in connection with (Bano *et al.*, 2014; Hassan *et al.*, 2017; Poonam *et al.*, 2009; Singh *et al.*, 2009) who described ethno medicinal knowledge with respect to literacy level, conservation status, age factor and future planning.

Conclusion

Present survey revealed that the locals depend on medicinal plants species to cure health disorders although modern health care services are available which shows the importance and effectiveness of traditional medicines. Harvesting of medicinal plant species for fuel, wood and medicinal purpose were observed common in study area. The inhabitants are unaware regarding the sustainable use of these resources which needs proper protection otherwise it will be a huge loss to biodiversity. Therefore, the study suggests that the members of salt loving plants could be potential candidate for discovery of new drugs and improvement of conventional medicines. Plant species with high ICF,UV and FL can be used further pharmacological and phytochemical studies. Further exploratory trips, conservative strategies, Joint collaboration and wise use of resources are highly recommended.

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