Ethnopharmacological analysis of medicinal plants in Jech Doab, Pakistan

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Research

Abstract

Background: The main purpose of this study was to evaluate the aboriginal knowledge regarding use of medicinally important plant species from Tehsil Malakwal, District Mandi Bahauddin, Pakistan.

Methodology: A total of 120 inhabitants (75women and 45 men) were interviewed for by using semi structured questionnaire. Data was analyzed qualitatively as well as by using quantitative indices of Relative Frequency of Citation (RFC), Use Value (UV), Fidelity Level (FL), Informant Consensus Factor (ICF) and Jaccard Index (JI).

Results: A total of 60 medicinally important plant species belonging to 35 families were reported from study area. Plant diversity showed that Fabaceae (20%) was dominating family. Herb (55%) was leading life form of plants and leaves (31.03%) showed maximum usage for medicinal purpose. Decoction (20.92%) was most common mode of utilization. RFC and UV ranged from 0.16-0.90 and 0.02 to 1, respectively. 9 plant species showed 100% fidelity level. The highest ICF value was recorded for gastrointestinal disorders (0.96). The value of Jaccard Index ranged from 0.54 to 28.24%. Some of medicinal plants showed new medicinal uses not reported in previous studies.

Conclusion: Study concludes that local inhabitants still prefer medicinal plants over allopathic medicine for treating various ailments. But this precious knowledge is restricted to old age people. So, awareness is necessary to conserve this knowledge.

Keywords: Ethnomedicine, Malakwal, Mandi Bahauddin, Indigenous people, Medicinal plants

Background

Plants are serving human beings to fulfill various necessities of life (Munawar *et al.* 2021). These not only provide food, fodder, shelter and fuel to human beings but also are a good source of herbal medicine for treating various diseases (Ishtiaq *et al.* 2021). Many ethnic communities depend on natural resources especially medicinal plants. Since ancient times, herbal remedy is being used for treatment, mitigation, prevention and management of various ailments all over the world (Ahmad & Sharma 2020). This usage of herbal medicine through traditional methods is gaining popularity day by day (Awan *et al.* 2021). It is believed by ancient herbalists that there is no body part without its corresponding plant part (Baquar, 2001). This concept leads our mind toward ethnobotany. Ethnobotany

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is defined as "study of relationships among plants and human beings". It is the study of those plants which are used by the indigenous inhabitants of an area (Hussain *et al.* 2021). Out of 422,000 flowering plants, 50000 plants have been used for medicinal purposes in various parts of world (Umair *et al.* 2017). Majority of people inhabiting in rural areas still use medicinal plants as alternative of allopathic medicine (Birjees *et al.* 2021). Although, allopathic medicines are more effective and show rapid results for treating various diseases, but these medicines may result side effects, if improperly used. Herbal medicines are preferable because of low cost, easily accessibility with no side effects (Ishtiaq *et al.* 2021). Pakistan is blessed with variety of medicinal plants due to its various climatic and ecological zones. Floral diversity covers about 803,940 km^2 of land area of Pakistan (Sharif *et al. 2018).* In Pakistan, the concept of ethnobotany is gaining popularity day by day. Six thousand flowering plant species have been reported in Pakistan. Around, six to seven hundred plant species have medicinal importance (Muhammad *et al.* 2019). From Pakistan, ethnomedicinal work has been done from various regions (Ishtiaq *et al.* 2021; Hussain *et al.* 2021, Iqbal *et al.* 2011, Iqbal *et al.* 2019, Parvaiz 2014, Rashid *et al.* 2015). Malakwal is a Tehsil of District Mandi Bahauddin which is located between two main rivers of Punjab. Herbal practitioners in study area have sufficient knowledge about the usage of medicinal plants but they are reluctant to share their knowledge with other people. But this valuable knowledge is at risk of being disappeared among young generation. Ethnomedicinal work has been done in nearby areas of Malakwal in previous literature (Hanif *et al.* 2013, Nisar *et al.* 2011) but this area was still unexplored. Hence, study was planned with the objective to explore medicinal plants of Tehsil Malakwal.

Materials and Methods

Study area

Present study has been conducted in Tehsil Malakwal, District Mandi Bahauddin. It is located at the boundary line of three Districts i.e. Sargodha, Jhelum and Mandi Bahauddin (Fig 1). It is found at elevation of 205m. It is located at Latitude of 32° 33' 17.71" North and Longitude of 73° 12' 43.92" East. Temperature may rise to 48 °C (118 °F) during the peak of summer while minimum temperature may fall below 3 °C (37 °F) during winter. The average rainfall lies at 388 millimeters (15.3 inches). Majority of people depend on agricultural crops.

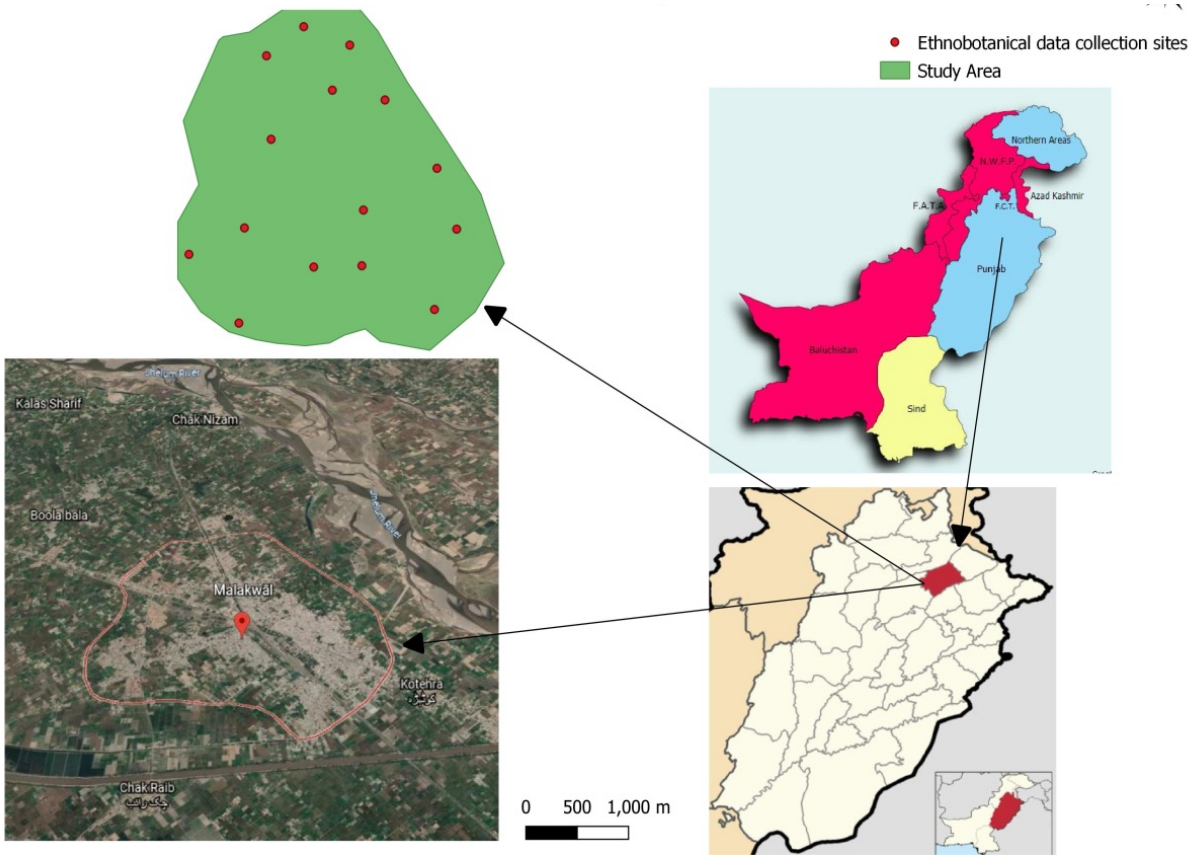

Figure 1. Map of study area

Qualitative Data collection

Different field visits were made to collect folklore data about use of medicinal plants among local communities. This survey was carried out from October 2020 to March 2021. Field interviews were conducted from local inhabitants including old, aged people, herbal practitioners (Hakeems), midwives (Daai) and young people. Total 120 people were interviewed belonging to different age. Data related to medicinal uses of plants was collected by using semi structured questionnaire. The questionnaire had two sections. The first section consists of demographical data of informants including names, gender, age, main occupation, and experience of using medicinal plants. The second portion of questionnaire was comprised of ethnomedicinal information about plant. It includes plant local name, family, plant part used, mode of utilization, disease cured and additional supplements.

Taxonomical identification and preservation of plants

The collected plant species were identified by Prof. Dr. Rahmatullah Qureshi and also verified through flora of Pakistan and The Plant List. Each collected sample was kept in the herbarium of Pir Mehr Ali Shah – Arid Agriculture University Rawalpindi for future references.

Quantitative data analysis

Analyzing the quantitative information about medicinal plants increases the probability of finding pharmacologically important plant species. Ethnomedicinal data was analyzed through following indices.

Use value (UV)

UV of any species was calculated by using the formula used by (Khan & Razzaq 2018).

$$UV = \Sigma Ui / N$$

Where ΣUi' is the sum of all uses mentioned by each informant. N indicates the total number of participants.

Relative Frequency of Citation (RFC)

The RFC of medicinally important plants of study area was calculated by using following formula:

$$RFC = FC/N \ (0 < RFC < 1)$$

Where FC is indicating the number of participants that report the uses of specific species and N indicates the total informants who are involved in the study (Birjees *et al.* 2021).

Fidelity Level (FL)

Fidelity level was calculated by using following formula (Friedman *et al.* 1986)).

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

Where Np is demonstrating the number of those contributors that specify the use of species for particular illness category and N designates number of those informants that use them for any type of disease category.

Informant Consensus Factor (ICF)

ICF was calculated by using following formula (Umair *et al.* 2017).

$$ICF = Nur_{-} Nt / Nur_1$$

Where Nur represents the number use reports of a specific plant for a particular ailment and Nt indicates the total species that are used by all participants for this ailment category.

Jaccard Index (JI)

Jaccard Index was calculated for making comparison of reported research species with the previous published data by following formula (Kidane *et al.* 2018).

$$Jaccard\ Index = c / (a + b + c)$$

Where a is the No of species found only in adjoining area. 'b' is the No of species found only in study area. While c is the number of species common to both area A and B.

Results and Discussion

Demographic data of the informants

Data related to ethnomedicinal plants was recorded from 120 inhabitants through face-to-face interviews as well as by the use of semi structured questionnaires **(**Fig 2). With regards to gender**,** 75 females (62.50%) and 45 male (37.50%) participated in this study. The high number of female informants is due to fact that it was much easier to get information from women than from men due to same gender. It was also noticed during the survey that females have enough knowledge about the preparation and use of medicinal plants. Our study agreed with (Birjees *et al.* 2021, Rashid *et al.* 2018). But it was contrary to study of (Amjad, 2020; Malik *et al.* 2018) where male were major informants. Similarly, 29.17% informants were traditional health practitioners (THPs) and 70.83% belong to indigenous people of study area. These results were also reported by (Ahmad *et al.* 2018; Fatima *et al.* 2018). Age data showed that major traditional medicinal awareness comes from individuals in the age range of 50-80 years (54.17%), followed by 35–50 years (29.17%) and above 80 (16.67%)**.** Similar results have been documented by Shah *et al.* (2018).

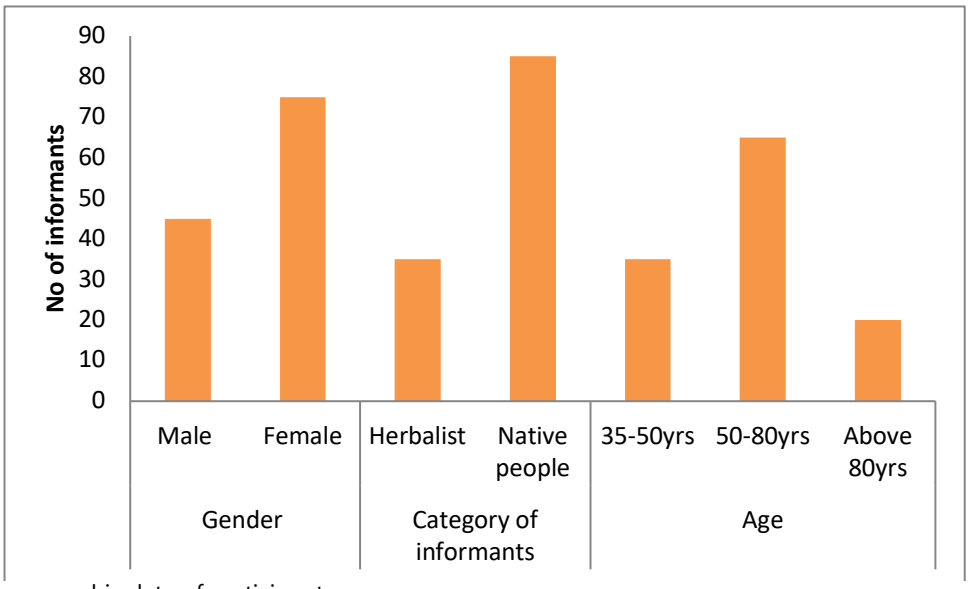

Figure 2. Demographic data of participants

Diversity of medicinal plants

Total 60 medicinal plants species belonging to 35 families were reported from study area. Ethnomedicinal flora showed that largest family of study area was Fabaceae (Fig 3) contributing 7 plant species followed by Asteraceae, Apiaceae, and Solanaceae (4 species each) as well as Moraceae, Myrtaceae (3 species). The dominance of Fabaceae family was due to its abundance in study area. The Fabaceae family has also been dominant in previous findings of (Kadir *et al.* 2014).

The life forms of reported plant species are shown in (Table 1). Four different growth forms were recorded during survey, and it was concluded, that herbs dominate the area by contributing 33 species, followed by trees (19 species), shrubs (6 species) and climbers (2 species). These results agreed with results of (Shah *et al.* 2018; Amjad *et al.* 2020). Use of herbs was dominating because of their high availability in study area.

Plant part used and mode of utilization

Different plant parts are being used by different people for treating various diseases. The use of any plant part mostly depends upon its availability. Results of this study indicate that leaves (Fig 4) have maximum usage for medicinal purpose with percentage (31.03%). It was followed by Seed, fruits, and roots. The maximum usage of leaves for herbal disease is also in accordance with the studies of (Ijaz *et al.* 2015; Leto *et al.* 2013). Leaves are key photosynthetic organ of plants containing maximum amounts of secondary metabolites. The maximum usage of leaves in most of cases is also due to fact that phytochemicals present in leaves are easily extractable. Leaves are also preferred over other plants parts (roots, whole plant) to ensure plant's existence in an area for longer period of time.

Table 1. Ethnomedicinal plant species of Tehsil Malakwal, District Mandi Bahauddin

Scientific name	Voucher No	Wild (Wd) / Cultivated (Cl)	Common name	Life form	Family	Plant part used	Mode of utilization	Medicinal uses	Comparison with previous studies
Acacia nilotica (L.) Delile	MAL-17	Wd	Kikar	Tree	Fabaceae	Gum	Dried powder	Lung and intestinal Infections	1Δ,2©,3●,4©,5●,6Δ,7●,8©,9Δ,10©,11Δ,12©,13©,14Δ,15Δ,16Δ,17Δ
						Leaves	Grinded with water	Diarrhea	
						Flowers	Powder	Cure leucorrhea and sexual diseases	
						Root	Powder	Strengthening gums and teeth, cure bleeding gums	
						Legumes	Powder	Excessive urination during Diabetes	
Achyranthes aspera L.	MAL-01	Wd	Puthkanda	Herb	Amaranthaceae	Leaves	Poultice	**Insects bite**	1●,2●,3©,4Δ,5Δ,6Δ,7Δ,8©,9Δ,10Δ,11Δ,12©,13©,14Δ,15Δ,16●,17Δ
							Ash	Cough and sore throat	
							Juice	Piles	
						Root	Powder	**Cholera**	
Albizia lebbeck (L.) Benth.	MAL-21	Wd	Shireen, Sars	Tree	Fabaceae	Bark	Powder	**Sprinkled on flowing wounds and abscesses**	1©,2●,3Δ,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10●,11Δ,12Δ,13©,14Δ,15Δ,16Δ,17Δ
						Leaves	Juice	Eye infection, teeth and swollen gums	
Alhagi maurorum Medik.	MAL-54	Wd	Jawahn, Jousa	Herb	Fabaceae	Whole plant	Decoction	**Improves liver diseases, laxative**	1Δ,2Δ,3Δ,4©,5●,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15©,16Δ,17Δ
							Poultice	Treats piles	
Allium cepa L.	MAL-16	Wd	Pyaz	Herb	Amaryllidaceae	Bulb	Juice mixed with olive and coconut oil	**Rapid hair growth, curing baldness, treating deep and hard abscesses and** insect bite	1●,2Δ,3Δ,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14©,15Δ,16Δ,17Δ
Allium sativum L.	MAL-31	Wd	Thom	Herb	Amaryllidaceae	Bulb	Eaten as raw	**Remove waste material from body,** stabilizes high blood pressure, **open cardiac vessels and strengthen heart**	1●,2Δ,3Δ,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14©,15Δ,16Δ,17Δ
							Directly rubbed	Insect bite	
Aloe barbadensis Mill.	MAL-06	Cl	Aloe vera, Gwalkandal	Herb	Asphodelaceae	Leaves	Cooked Pulp	Treat constipation**, typhoid,** joint pain, digestive problems, **redness of eye,** acne, **strengthen hairs , appetizer**	1Δ,2Δ,3©,4Δ,5Δ,6©,7Δ,8©,9Δ,10Δ,11Δ,12©,13Δ,14Δ,15Δ,16●,17●
Anethum graveolens L.	MAL-29	Cl	Soye	Herb	Apiaceae	Seeds	Eaten as raw	**Cure obesity and reduces weight**	1●,2Δ,3Δ,4Δ,5●,6●,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
							Decoction	**Reduces menstrual pain**	

Azadirachta indica A. Juss.	MAL-04	Wd	Neem	Tree	Meliaceae	Leaves	Juice	**Lowering blood pressure,** blood purification and curing diabetes, insect repellent	1Δ,2©,3Δ,4Δ,5Δ,6Δ,7©,8©,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16●,17©
						Bark	Paste	Skin diseases	
							Decoction	**Toothache and irregular menstrual cycle**	
						Twigs	Directly used	**Miswak**	
						Fruit	Eaten as raw	**Piles**	
Bambusa bambos (L.) Voss	MAL-48	Cl	Bans	Shrub	Poaceae	Root	Ash	**Used as manjan for toothache**	1Δ,2Δ,3Δ,4Δ,5Δ,6Δ,7Δ,8●,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
						Leaves	Decoction with honey	**Regulates menstrual cycle, eliminates intestinal worm and cure respiratory diseases**	
						Gum	Powder	**Fluid filled pustules and blisters in mouth**	
Bauhinia variegata L.	MAL-24	Wd	Kachnar	Tree	Fabaceae	Bark	Powder	Stabilizes hormonal imbalance in men and women	1Δ,2Δ,3Δ,4Δ,5Δ,6●,7●,8Δ,9Δ,10©,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
						Leaves	Extract	Liver disorders and jaundice	
						Floral buds	Cooked	Nervous weakness, blood purification, bleeding piles, flu and cough	
Brassica campestris L.	MAL-20	Wd	Sarson	Herb	Brassicaceae	Seed	Oil	Healing pain on joints, strengthening hairs	1©,2Δ,3Δ,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12●,13Δ,14©,15Δ,16Δ,17Δ
						leaves	Decoction	**Against stomach acidity**	
Bryophyllum pinnatum (Lam.) Oken	MAL-33	Cl	Pathar chat	Herb	Crassulaceae	Leaves	Directly chewed	Remove kidney stone	1Δ,2Δ,3Δ,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12●,13©,14Δ,15Δ,16Δ,17Δ
Calotropis procera (Aiton) Dryand.	MAL-02	Wd	Ak	Shrub	Asclepiadaceae	Leaves	Poultice	Rheumatic/ body pain and backache	1©,2©,3©,4©,5●,6,7©,8Δ,9Δ,10Δ,11Δ,12©,13Δ,14Δ,15Δ,16Δ,17Δ
							Dried and smell paste	Asthma	
						Twigs	Latex	Healing wounds and internal injuries	
						Roots	Decoction	Cough, toothache	
								Liver diseases	
						Floral parts	Dried	**Jaundice and** joint pain	
Cannabis sativa L.	MAL-22	Wd	Bhang	Herb	Cannabaceae	Leaves	Juice	**Cure menstrual pain, kills lice and curing dandruff,** narcotic	1Δ,2●,3Δ,4●,5©,6Δ,7Δ,8Δ,9Δ,10Δ,11©,12Δ,13Δ,14©,15●,16Δ,17©
							Poultice	Heals wounds	
							Paste	**Phlegmatic fever and malaria**	
						Seeds	Powder	Treat diarrhea	
Capsicum annuum L.	MAL-39	Cl	Sabz mirch	Herb	Solanaceae	Fruit	Eaten as raw	**Constipation**	1Δ,2Δ,3Δ,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14●,15Δ,16Δ,17Δ

Carica papaya L.	MAL-27	Cl	Papeeta	Tree	Caricaceae	Seeds	Powder along with oil	**Itching**	1Δ,2Δ,3Δ,4Δ,5Δ,6Δ,7●,8©,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16©,17●
							Powder	Indigestion, cholera, **abdominal pain and removing intestinal worms**	
						Fruit	Eaten as raw	Treat constipation, **good appetizer**	
Carthamus oxyacantha M.Bieb.	MAL-59	Wd	Pohli	Herb	Asteraceae	Seeds	Oil	Skin diseases/itching	1Δ,2©,3Δ,4Δ,5Δ,6Δ,7©,8Δ,9Δ,10Δ,11Δ,12Δ,13©,14Δ,15Δ,16Δ,17Δ
							Powder	Liver diseases	
Cassia fistula L.	MAL-25	Wd	Amaltas	Tree	Fabaceae	Fruit pulp	Extract	Constipation	1©,2©,3Δ,4Δ,5Δ,6Δ,7Δ,8●,9Δ,10©,11Δ,12©,13Δ,14Δ,15Δ,16●,17Δ
						Roots	Smoke of burnt roots is smelled	**Treats flowing nose,** fever **and malaria**	
						Leaves	Rubbed	Swollen joints **and paralysis**	
Chenopodium album L.	MAL-49	Wd	Bathua	Herb	Chenopdiaceae	Seeds	Oil	Kills intestinal worms	1●,2Δ,3●,4Δ,5●,6●,7Δ,8Δ,9●,10Δ,11©,12Δ,13Δ,14●,15©,16Δ,17Δ
Cichorium intybus L.	MAL-50	Wd	Kasini	Herb	Asteraceae	Leaves and flowers	Decoction	Treats jaundice and liver diseases, **constipation**	1©,2Δ,3Δ,4Δ,5Δ,6Δ,7©,8©,9Δ,10Δ,11Δ,12Δ,13Δ,14●,15©,16Δ,17Δ
						Roots	Powder	**Bronchitis**	
Convolvulus arvensis L.	MAL-03	Wd	Lehli	Climber	Convolvulaceae	Leaves	Directly chewed	Treat Constipation, anthelmintic	1●,2©,3©,4©,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11©,12©,13Δ,14©,15©.16Δ,17Δ
							Decoction	Killing intestinal worms	
							Paste	Itching and leprosy	
						Root	Juice	**Urinary problems**	
Coriandrum sativum L.	MAL-23	Cl	Dhaniya	Herb	Apiaceae	Seeds	Decoction	Fever, **lowering cholesterol level**	1●,2Δ,3Δ,4Δ,5Δ,6●,7Δ,8●,9Δ,10Δ,11Δ,12Δ,13Δ,14©,15©,16Δ,17Δ
						Leaves	Paste	**Treat acne**	
Cucurbita maxima Duchesne	MAL-37	Wd	Kado	Climber	Cucurbitaceae	Seeds	Oil	**Useful for brain**	1Δ,2Δ,3Δ,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17●
						Fruit	Boiled with salt and pepper	**Weight loss**	
							Juice	**Soothing effect,**	
							Directly rubbed	**Fever**	
Cymbopogon citratus (DC.) Stapf	MAL-53	Cl	Lemon grass	Grass	Poaceae	Leaves	Decoction	Stomach diseases, indigestion, and acidity problems**, weight loss**	1Δ,2©,3Δ,4Δ,5Δ,6Δ,7Δ,8●,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17©
Cyperus rotundus L.	MAL-45	Wd	Murak	Herb	Cyperaceae	roots	Poultice	Increase milk production	1●,2Δ,3©,4Δ,5Δ,6Δ,7●,8Δ,9Δ,10Δ,11Δ,12Δ,13©,14Δ,15Δ,16Δ,17Δ
						Whole plant	Decoction	Cholera, **menstrual problems**	
Dalbergia sissoo DC.	MAL-13	Cl	Tali/ Sheesham	Tree	Fabaceae	Bark	Powder	Gonorrhea	
						Root	Powder	**Reduce the effect of alcohol**	

						Leaves	Decoction	Increasing length of hairs, **eyelids infection**	1●,2©,3●,4Δ,5●,6Δ,7●,8Δ,9Δ,10©,11Δ,12©,13Δ,14Δ,15Δ,16Δ,17Δ
Datura stramonium L.	MAL-19	Wd	Datura	Herb	Solanaceae	Leaves	Directly smelled	Treat phlegmatic asthma and **throat diseases**	1Δ,2Δ,3Δ,4©,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14©,15●,16Δ,17Δ
							Burnt with oil	Joint pain	
						Fruit and seeds	Powder burnt with oil	**Decrease baldness** and reduce dandruff	
						Seed	Powder	**Fever**	
Euclyptus globulens L.	MAL-12	Cl	Safaida	Tree	Myrtaceae	Leaves	Decoction	Cough, flu, sore throat	1Δ,2Δ,3Δ,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
							Directly smelled	To open nasal cavities during cough	
							Oil	Joint pains	
Euphorbia hirta L.	MAL-56	Wd	Dhodak	Herb	Euphorbiaceae	Whole plant	Decoction	**Asthma**	1Δ,2●,3Δ,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
Ficus benghalensis L.	MAL-08	Wd	Bohar	Tree	Moraceae	Leaves	Latex	Sexual diseases**, toothache.**	1©,2©,3©,4Δ,5©,6Δ,7©,8Δ,9Δ,10©,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
							Poultice	Restrict pus formation in abscesses	
						Adventitious roots	Powder	**Backache** and gout	
								Killing intestinal worms	
						Twigs	Directly used	**Miswak**	
Ficus religiosa L.	MAL-09	Wd	Peepal	Tree	Moraceae	Bark	Powder	**Make teeth and gum strong, stomach diseases,** diarrhea	1Δ,2©,3●,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10●,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
							Extract	**Cure consistent urination in jaundice patients**	
						Leaves	Decoction	**For treating abscesses**	
							Powder	For treating constipation	
Foeniculum vulgare Mill.	MAL-60	Cl	Sunf	Herb	Apiaceae	Seeds	Decoction	Flatulence, stomach diseases	1Δ,2Δ,3Δ,4©,5Δ,6©,7©,8©,9Δ,10Δ,11Δ,12●,13Δ,14●,15Δ,16Δ,17Δ
							Roasted in oil	Eyesight	
Grewia asiatica L.	MAL-14	Wd/Cl	Falsa	Tree	Malvaceae	Fruit	Eaten as raw	Appetizer	1Δ,2Δ,3Δ,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
							Juice	Alleviate warmth, effective for stomach, vomiting and diarrhea	
Helianthus annuus L.	MAL-40	Cl	Soraj mukhi	Herb	Asteraceae	Seeds	Powder	**Mediates child birth,** eliminates intestinal worms	1Δ,2Δ,3Δ,4Δ,5Δ,6Δ,7©,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
						Leaves	Heated with sesame seeds in oil	**Cure flowing ear**	
Malvastrum coromandelianum L.	MAL-58	Wd		Herb	Malvaceae	Leaves	Paste	**Anti-inflammation**	1Δ,2Δ,3Δ,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11●,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ

Mangifera indica L.	MAL-34	Cl	Mango	Tree	Anacardiaceae	Unripen fruit	Syrup	**Relieve heat stroke**	1●,2Δ,3●,4Δ,5●,6Δ,7Δ,8©,9Δ,10Δ,11Δ,12●,13Δ,14Δ,15Δ,16●,17●
							Eaten as raw	Constipation and liver diseases	
						Leaves and bark	Decoction	**Inflammation** and intestinal worms	
Melia azedarach L.	MAL-11	Wd	Dhareek	Tree	Meliaceae	Leaves	Paste	Relieving pain	1●,2©,3●,4©,5Δ,6Δ,7●,8Δ,9Δ,10©,11Δ,12Δ,13Δ,14©,15Δ,16Δ,17●
							Juice	**Removing waste material from body** and for blood purification	
							Extract	**Jaundice,** typhoid, fever	
Mentha longifolia (L.) L.	MAL-26	Cl	Podina	Herb	Lamiaceae	Leave	Juice	Decrease thirst and warmness, **appetizer**	1Δ,2●,3Δ,4Δ,5Δ,6©,7©,8Δ,9Δ,10Δ,11Δ,12©,13Δ,14Δ,15©,16Δ,17Δ
							Paste	Abdominal pain, desentery and gastric problems	
							Eaten as raw	**Removing bad odour from mouth**	
							Decoction	Vomiting**,** diarrhea, cholera	
Moringa oleifera Lam.	MAL-43	Cl	Suhanjana	Tree	Moringaceae	Bark	Decoction	**Cardiac functions, body inflammation, anthelmintic**	1Δ,2Δ,3Δ,4Δ,5Δ,6●,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16●,17Δ
Morus alba L.	MAL-47	Cl	Toot	Tree	Moraceae	Fruit	Syrup	Sore throat, throat inflammation, diarrhea, constipation	1Δ,2●,3Δ,4Δ,5●,6Δ,7Δ,8Δ,9Δ,10©,11©,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
Musa paradisiaca L.	MAL-35	Cl	Keela	Herb	Musaceae	Fruit	Paste	**Healing burning sensation and inflammation**	1Δ,2Δ,3Δ,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16●,17●
							Eaten as raw	**Decrease acidity**	
Ocimum basilicum L.	MAL-30	Cl	Niazbo	Herb	Labiatae	Leaves	Paste along with mint	Stomach problem and digestive disorders	1©,2©,3Δ,4Δ,5Δ,6●,7●,8Δ,9Δ,10Δ,11Δ,12©,13Δ,14Δ,15Δ,16Δ,17©
						Seeds	Soaked in water	Enhances soothing effect	
Oxalis corniculata L.	MAL-41	Wd	Loonki, Khati booti	Herb	Oxalidaceae	Leaves	Rubbed	Treat insect bite	1Δ,2©,3Δ,4©,5●,6●,7Δ,8Δ,9Δ,10●,11©,12Δ,13©,14©,15©,16Δ,17Δ
						Whole plant	Directly Dried powder	Stomach illness, gas troubles	
Parthenium hysterophorus L.	MAL-57	Wd	Gajar boti	Herb	Asteraceae	Leaves	Decoction	Stomach diseases and diabetes	1●,2Δ,3Δ,4Δ,5Δ,6Δ,7●,8Δ,9Δ,10Δ,11●,12Δ,13©,14Δ,15Δ,16Δ,17Δ
Peganum harmala L.	MAL-52	Wd	Hermal	Herb	Nitrariaceae	Roots	Paste Burnt in oil	**Anti-lice**	1Δ,2Δ,3Δ,4●,5Δ,6Δ,7Δ,8●,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15©,16Δ,17Δ
						Seeds	Powder	**Regulate menstrual cycle,** killing intestinal worms, **fever**	
Pongamia pinnata (L.) Pierress.	MAL-18	Wd	Sukh chain	Tree	Fabaceae	Twigs	Miswak	Removes bad odour of mouth	1Δ,2●,3Δ,4Δ,5●,6Δ,7●,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
Psidium guajava L.	MAL-28	Cl	Amrood	Tree	Myrtaceae	Leaves	Decoction	**Treating toothache, gum problems,** throat diseases	

						Fruit	Eaten as raw	Improves digestion, treats bloody piles, **liver** and kidney Inflammation	1©,2Δ,3©,4Δ,5●,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12©,13Δ,14Δ,15Δ,16©,17●
						Seeds	Eaten as raw	**Kill intestinal worms**	
Punica granatum L.	MAL-36	Cl	Anaar	Tree	Lythraceae	Seeds	Eaten as raw	**Abdominal pain**	1Δ,2Δ,3Δ,4Δ,5Δ,6©,7Δ,8Δ,9Δ,10©,11Δ,12©,13Δ,14©,15©,16©,17Δ
						Fruit	Peel soaked in water	Curing diarrhea and intestinal worms	
							Juice	Dysentery	
							Eaten as raw	Blood production, improves heart functions	
						Root bark	Decoction	Cure old fever, anthelmintic	
Ricinus communis L.	MAL-05	Wd	Arandi, Arand	Shrub	Euophorbiaceae	Seeds	Decoction	Constipation in newly born babies	1©,2©,3©,4©,5Δ,6Δ,7Δ,8●,9Δ,10●,11●,12©,13Δ,14©,15Δ,16Δ,17●
							Oil	**Hair loss**	
						Floral buds	Powder	**Snake bite**	
						Leaves	Bandage	To remove pus from wounds	
Rosa indica L.	MAL-42	Cl	Gulab	Shrub	Rosaceae	Flower	Gulkand	Alleviate body warmness, constipation	1©,2Δ,3Δ,4Δ,5Δ,6Δ,7©,8Δ,9Δ,10Δ,11Δ,12©,13Δ,14Δ,15Δ,16Δ,17Δ
							Extract/ Rose water	Treats eye pain or eye infections and liver diseases, **decrease menstrual pain**	
Solanum nigrum	MAL-07	Wd	Kaich maich, Mako	Herb	Solanaceae	Fruit	Eaten as raw	**Killing intestinal worms** and liver diseases	1©,2●,3©,4Δ,5Δ,6●,7©,8Δ,9Δ,10Δ,11©,12©,13©,14●15●,16Δ,17Δ
						Leaves	Decoction	Gynecological diseases and stomach problems	
							Burnt in oil	Healing burnt wounds	
							Extract	Earache	
						Root	Decoction	**Induces sleep**	
Stellaria media (L.) Vill.	MAL-51	Wd	Ladro	Herb	Caryophyllaceae	Whole plant	Decoction	**Menstrual discomfort**	1Δ,2Δ,3Δ,4Δ,5●,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14●,15Δ,16Δ,17Δ
Syzygium cumini (L.) Skeels,	MAL-10	Cl	Jamun	Tree	Myrtaceae	Fruit	Eaten as raw	**Good appetizer and improves digestion.**	1©,2©,3Δ,4Δ,5Δ,6©,7Δ,8●,9Δ,10Δ,11Δ,12©,13Δ,14Δ,15Δ,16©,17Δ
						Leaves	Decoction	**Gargling**	
						Bark	Ash	**Effective for teeth**	
						Seeds	Powder	Lower high sugar level, diarrhea and dysentery	
Tinospora cordifolia (Willd.) Miers	MAL-32	Cl	Gilo	Herb	Menispermaceae	Twigs	Juice with carom seeds	Curing old fever, **malaria, typhoid, blood purification and curing skin diseases**	1Δ,2Δ,3Δ,4©,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
Trachyspermum ammi (L.) Sprague	MAL-55	Cl	Ajwain	Herb	Apiaceae	Seeds	Decoction	Cholera, indigestion, flatulence, dysentery, menstrual pain	1©,2Δ,3Δ,4©,5Δ,6Δ,7Δ,8©,9Δ,10Δ,11Δ,12●,13Δ,14Δ,15Δ,16Δ,17Δ
							Extract/juice	**Prevent vomit,** old fever, **typhoid**	
							Eaten as raw	Abdominal pain, **reduce obesity**	

Tribulus terrestris L.	MAL-38	Wd	Bhakra	Herb	Zygophyllaceae	Fruit	Powder	Cures joint pain, backache and urinary bladder disorders, removes kidney stones	1Δ,2Δ,3©,4©,5Δ,6Δ,7,8©,9Δ,10Δ,11©,12©,13©,14Δ,15©,16Δ,17Δ
Trigonella foenum-graecum L.	MAL-46	Cl	Meethi	Herb	Fabaceae	Leaves	Cooked	**For making saagh**	1●,2Δ,3Δ,4Δ,5Δ,6Δ,7Δ,8Δ,9Δ,10Δ,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
							Poultice	**Decrease inflammation and stiffness from abscesses**	
							Decoction	**Cure phlegmatic cough**	
Withania somnifera L. Dund.	MAL-15	Wd	Aksen, Asgand	Shrub	Solanaceae	Fruit	Boiled with oil and applied directly	**Hair growth and control of dandruff**	1●,2●,3©,4©,5●,6Δ,7©,8●,9Δ,10©,11●,12●,13©,14●,15Δ,16Δ,17Δ
							Powder	Treat constipation **and kills intestinal worms**	
							Decoction	Strengthens sexual organs and cures leachorea	
Ziziphus nummularia (Burm.f.) Wight & Arn.	MAL-44	Cl	Bair	Shrub	Rhamnaceae	Fruit	Eaten as raw	Blood purification and **constipation**	1●,2Δ,3Δ,4Δ,5●,6Δ,7Δ,8●,9Δ,10©,11Δ,12Δ,13Δ,14Δ,15Δ,16Δ,17Δ
						Leaves	Decoction	**Cure swelling in mouth, sore throat, bleeding gums, treat** skin diseases**, Washing hairs**	

(©) = Similar use to previous report: (●)= Dissimilar use to previous reports: (Δ)= Use not reported in previous report
1= (Qureshi *et al.* 2012), 2= (Khan *et al.* 2016), 3= (Nisar *et al.* 2011), 4= Iqbal *et al.* 2011), 5= (Hanif *et al.* 2013), 6= (Iqbal *et al.* 2019), 7= (Parvaiz, 2014), 8= (Ahmad *et al.* 2018), 9= (Kayani *et al.* 2015), 10= (Rashid *et al.* 2015), 11= (Qureshi *et al.* 2009), 12= (Naseer *et al.* 2020), 13= (Ishtiaq *et al.* 2021), 14= (Akhtar *et al.* 2013), 15= (Aziz *et al.* 2016),16= (Khan *et al.* 2015), 17= (Panmei *et al.* 2019); Bold text in column 9 shows medicinal uses not reported in previous compared studies

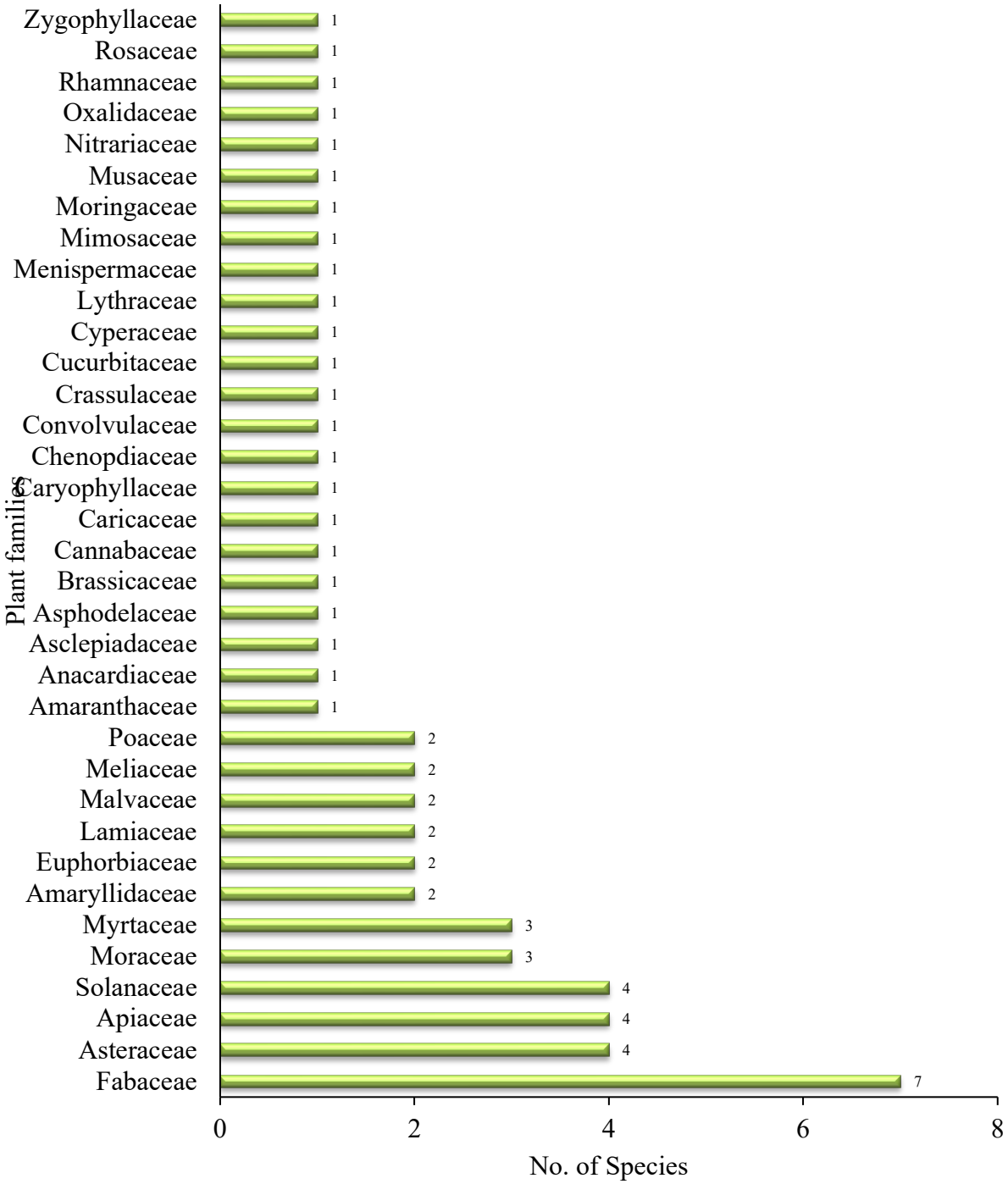

Figure 0. Family wise species distribution of medicinal plants

Different parts of plants were used by indigenous people in different ways like decoction, juice, extract, and powder (Fig 5). The use of decoction is preferred over other modes of utilization because it is easier to make only by mixing plant part with water, tea, soup or milk. It is also due to fact that heating plant parts in form of decoction increases the rapid availability of active phytochemicals (Zhang *et al.* 2005). In Pakistan, the use of plant parts in form of decoction is always preferred supported by the previous documentation of (Ahmad *et al.* 2014; Bibi *et al.* 2014; Tariq *et al.* 2020).

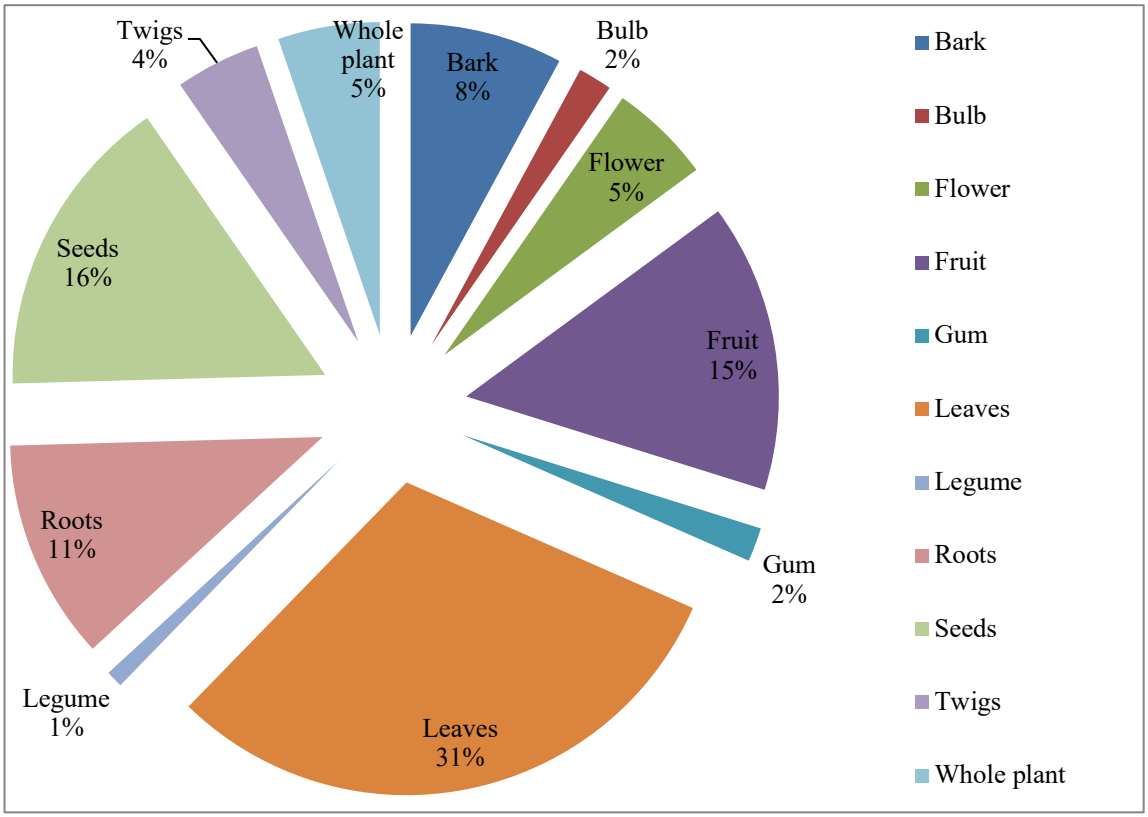

Figure 4. Percentages of plant parts used.

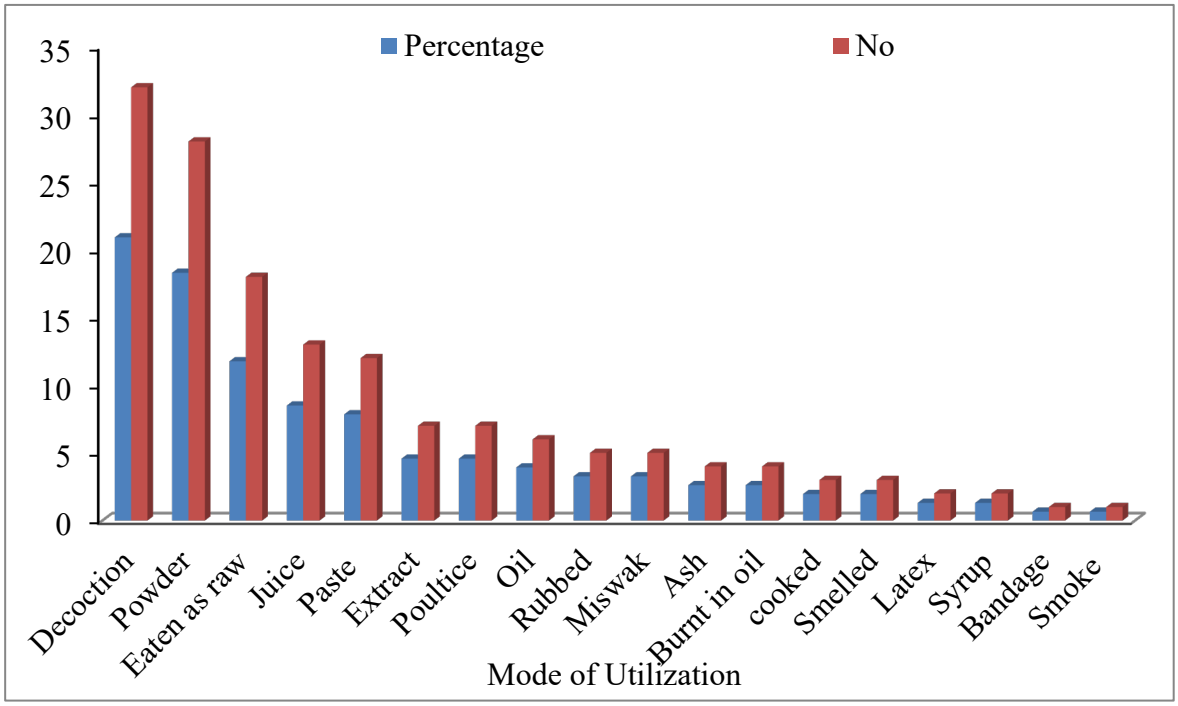

Figure 5. Percentages of modes of utilization

Relative Frequency of Citation (RFC) and Use Value (UV)

RFC value of any species explains the popularity level of any plant species among local inhabitant in the study area. Our RFC values ranged from 0.16–0.90 (Table 2). The highest RFC value was recorded for *Mentha longifolia* with RFC 0.90. The plants with high RFC values were very common in the study area and people are familiar with them. So their medicinal uses have become very popular among people of study area. Lowest RFC was reported for *Malvastrum coromandelianum* (RFC: 0.01). In this study, UV value ranged from 0.02 to 1 (Table 2). The highest use

value was reported for *Mentha longifolia* with (UV=1) also in agreement with (Amjad *et al.* 2020; Thakur 2020). It was followed by *Trachyspermum ammi* with (UV=0.97) and *Azadirachta indica* (UV=0.94), respectively. According to Yaseen (2019) ethnomedicinal species having high UVs and RFCs values should be checked to evaluate and demonstrate their pharmacological activity. A plant with low values of RFC and UV does not mean that plant is of less importance. It can be due to little familiarity of indigenous people of an area.

Table 2. RFC and UV values of medicinal plants

Scientific name	**FC**	**RFC**	**UV**
Mentha longifolia (L.) L.	108	0.90	1
Trachyspermum ammi (L.) Sprague	98	0.82	0.97
Azadirachta indica A. Juss.	94	0.78	0.82
Aloe barbadensis Mill.	90	0.75	0.89
Calotropis procera (Aiton) Dryand.	88	0.73	0.77
Achyranthes aspera L.	87	0.73	0.58
Foeniculum vulgare Mill.	85	0.71	0.94
Solanum nigrum	85	0.71	0.49
Syzygium cumini (L.) Skeels,	84	0.70	0.95
Euclyptus globulens L.	82	0.68	0.68
Acacia nilotica (L.) Delile	80	0.67	0.8
Rosa indica L.	79	0.66	0.88
Cassia fistula L.	78	0.65	0.57
Ficus benghalensis L.	77	0.64	0.75
Tinospora cordifolia (Willd.) Miers	75	0.63	0.78
Ricinus communis L.	72	0.60	0.6
Tribulus terrestris L.	71	0.59	0.6
Punica granatum L.	69	0.58	0.8
Psidium guajava L.	65	0.54	0.57
Ficus religiosa L.	60	0.50	0.65
Allium sativum L.	59	0.49	0.82
Allium cepa L.	57	0.48	0.83
Melia azedarach L.	56	0.47	0.75
Cannabis sativa L.	45	0.38	0.66
Cymbopogon citratus (DC.) Stapf	45	0.38	0.71
Cichorium intybus L.	42	0.35	0.51
Ocimum basilicum L.	40	0.33	0.58
Bryophyllum pinnatum (Lam.) Oken	40	0.33	0.31
Anethum graveolens L.	31	0.26	0.68
Coriandrum sativum L.	30	0.25	0.72
Mangifera indica L.	29	0.24	0.55
Peganum harmala L.	28	0.23	0.69
Albizia lebbeck (L.) Benth.	26	0.22	0.6
Musa paradisiaca L.	21	0.18	0.43
Trigonella foenum-graecum L.	19	0.16	0.35
Dalbergia sissoo DC.	19	0.16	0.48
Bambusa bambos (L.) Voss	19	0.16	0.46
Withania somnifera L. Dund.	18	0.15	0.49
Pongamia pinnata (L.) Pierress.	18	0.15	0.18
Brassica campestris L.	17	0.14	0.49
Ziziphus nummularia (Burm.f.) Wight & Arn.	16	0.13	0.32
Cucurbita maxima Duchesne	15	0.13	0.6
Convolvulus arvensis L.	14	0.12	0.45
Grewia asiatica L.	14	0.12	0.43
Chenopodium album L.	13	0.11	0.38
Morus alba L.	12	0.10	0.25

Capsicum annuum L.	11	0.09	0.4
Carica papaya L.	10	0.08	0.34
Helianthus annuus L.	9	0.08	0.12
Euphorbia hirta L.	4	0.06	0.08
Datura stramonium L.	6	0.05	0.2
Bauhinia variegata L.	6	0.05	0.18
Oxalis corniculata L.	6	0.05	0.2
Moringa oleifera Lam.	5	0.04	0.12
Alhagi maurorum Medik.	5	0.04	0.15
Cyperus rotundus L.	4	0.03	0.14
Parthenium hysterophorus L.	4	0.03	0.14
Carthamus oxyacantha M.Bieb.	3	0.03	0.06
Stellaria media (L.) Vill.	2	0.02	0.06
Malvastrum coromandelianum L.	1	0.01	0.02

Fidelity Level (FL)

The specificity of a plant species for treating a specific disease highlights its use over other plants species for same disease. Fidelity level ranged from 33.33% to 100% in this study (Fig 6). High fidelity shows plant specificity for specific disease while low fidelity level show random treatment. There were 9 plant species with 100% fidelity level which confirmed the popularity of these plants among people of study area. These plants species were *Acacia nilotica*, *Bryophyllum pinnatum, Brassica campestris, Cannabis sativa*, *Cichorium intybus, Mentha longifolia*, *Ficus benghalensis*, *Trachyspermum ammi* and *Punica granatum*. Plants with 100% FL were used for leachhorea, kidney stones, strengthening hairs, narcotic, jaundice, gastric problems, sexual diseases, abdominal pain, and blood production respectively. High FL shows the uniqueness and high usage of a plant species for a particular disease (Shil 2014).

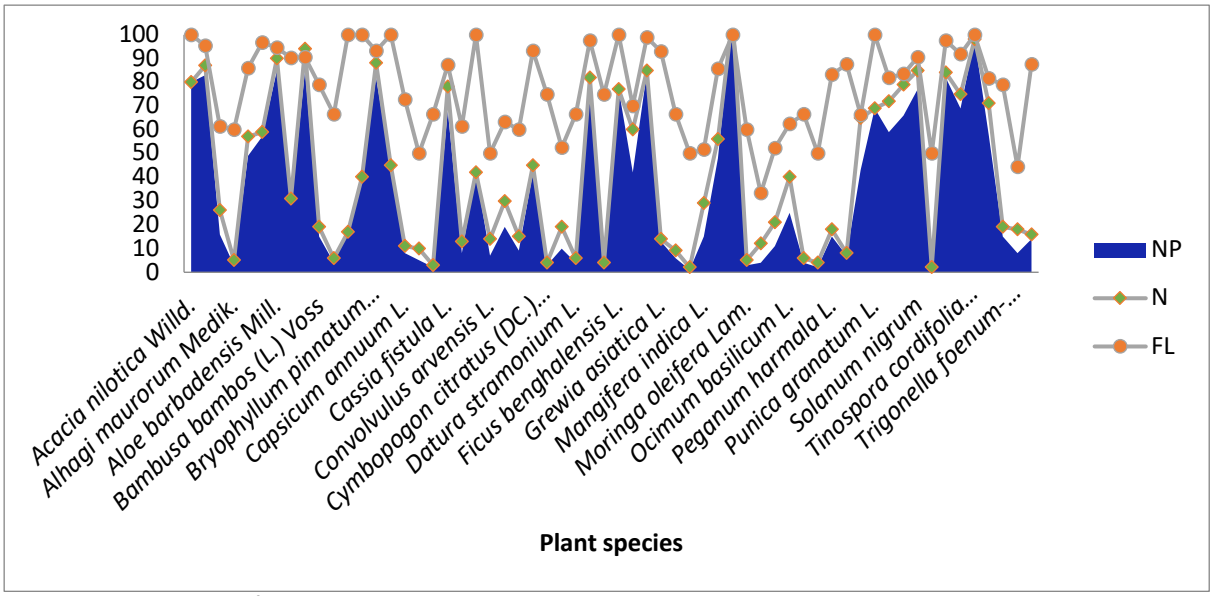

Figure 6. Fidelity level of medicinal plants

Informant Consensus Factor (ICF)

ICF was calculated to find out the consent of informants regarding the use of plant against specific disease (Ishtiaq *et al.* 2021). The inhabitants of the study area use medicinal plants for treating 40 different types of health disorders. During this work, a total of 15 diseases groups were made on basis of ICF data (Table 3)**.** ICF value of plants ranged from 0.87 to 0.96 (Fig 7). The highest ICF value (0.96) was achieved by gastrointestinal disorders. It is also found by ethnopharmacological studies (Birjees *et al.* 2021;Yaseen 2019) that gastrointestinal disease is first use category by most of traditional healers. The high ICF value for gastrointestinal disease shows that people highly prefer medicinal plants for treating these diseases. It is also cited in literature that if plants are effective for treating a disease then their ICF value will be high (Yaseen 2019). Lowest ICF value (0.87) was found for treating hair diseases. Lowest ICF value means that there is less consistency among number of people regarding the use of particular plant against

specific disease. One other reason for low value of ICF is that people don't want to share their hidden knowledge about medicinal plants usage to others, hence showing less consent.

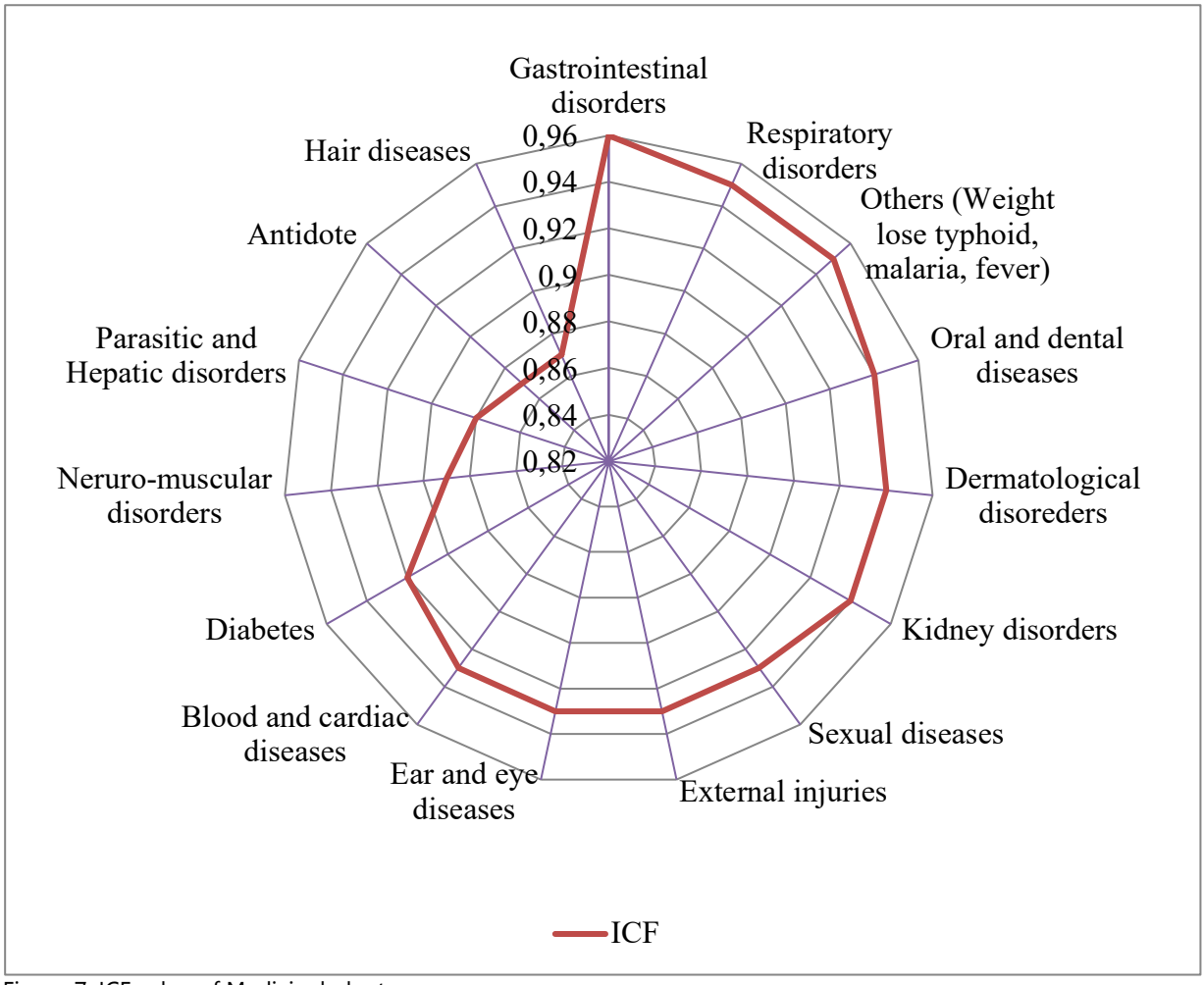

Figure 7. ICF value of Medicinal plants.

Jaccard Index

Ethnobotanists use Jaccard Index for making comparison of reported research species with the previous published data gathered from adjoining areas (Yaseen *et al.* 2015). Regarding this, 17 published research papers were reviewed published from areas in vicinity to study area and other parts of Pakistan. Results were also compared with ethnobotanical studies published from India and Bangladesh. Results of our study showed that similarity percentage ranges from 0.00% to 32.65% while dissimilarity percentage ranges from 0.00% to 29.63%.The value of Jaccard Index ranged from 0.54 to 28.24% (Table 4). The highest degree of Jaccard index was calculated for (Khan *et al* 2016 Naseer *et al.* 2020, Parvaiz 2014) with JI values of 28.24, 25.29, 25.00 respectively. These all studies are conducted from nearby areas of study area and have similar cultural and ecological norms. There is also same vegetation in these areas increasing the possibility of exchange of indigenous knowledge about use of medicinal plants. Lowest values of JI were calculated for the studies of (Kayani *et al.* 2015, Khan *et al,* 2015, Panmei *et al.* 2019) with JI values 0.54, 6.22, 9.17 respectively. The reason for low JI is the difference in cultural values, species diversity and ecological factors. It may be due to large distance from study area reducing the exchange of ethnobotanical knowledge among people.

By comparing the medicinal uses of our study with previous studies, some of new plant uses are found not published before. Plants with novel medicinal uses are shown in (Table 1) with bold medicinal uses.

Table 3. ICF value of medicinal plants for different disease categories

Ailment categories	Symptoms	Ntax	Nur	ICF	Most Commonly Used Plants
Gastrointestinal disorders	Cholera, gas troubles, diarrhea, Flatulence, stomachache, improper digestion, loss of Appetite, dysentery, piles, constipation	30	674	0.96	*Trachyspermum ammi* (L.) Sprague, *Mentha longifolia* (L.) L., *Syzygium cumini* (L.) Skeels., *Ocimum basilicum* L., *Ricinus communis* L., *Cassia fistula* L., *Capsicum annuum* L.
Respiratory disorders	Cough, asthma, sore throat, Flue, lung diseases	9	168	0.95	*Achyranthes aspera* L., *Euclyptus globulens* L., *Tinospora cordifolia* (Willd.)Miers., *Trachyspermum ammi* (L.) Sprague., *Trigonella foenum-graecum* L., *Morus alba* L.
Neuro-muscular disorders	Paralysis, nervous weakness, sedative	6	45	0.89	*Cassia fistula* L., *Bauhinia variegata* L., *Musa paradisiaca* L., *Cannabis sativa* L.
Kidney disorders	kidney stone, irregular urination	5	63	0.94	*Tribulus terrestris* L.,*Bryophyllum pinnatum* (Lam.) Oken., *Acacia nilotica* (L.) Delile, *Ficus religiosa* L.,*Convolvulus arvensis* L.
Antidote	Scorpion sting, insect bite, snake bite, dog bite	5	32	0.87	*Achyranthes aspera* L., *Allium cepa* L., *Allium sativum* L.,*Achyranthes aspera* L.
Ear and eye diseases	Ear diseases, eyesight, eye infection, redness of eyes	6	73	0.93	*Helianthus annuus* L., *Solanum nigrum* L., *Foeniculum vulgare* Mill., *Albizia lebbeck* (L.) Benth., *Rosa indica* L., *Aloe barbadensis* Mill
Oral and dental diseases	Mouth freshening, Mouth infections, toothache	13	198	0.94	*Mentha longifolia* (L.) L., *Acacia nilotica* (L.) Delile, *Psidium guajava* L. , *Bambusa bambos* (L.) Voss.,*Ziziphus nummularia* (Burm.f.) Wight & Arn.
Diabetes	Diabetes	3	25	0.92	*Azadirachta indica* A. Juss., *Syzygium cumini*., *Acacia nilotica* (L.) Delile
Dermatological disorders	Skin problems, pimples, dark circles itching, abscess, healing wounds	16	242	0.94	*Azadirachta indica* A. Juss.,*Aloe barbadensis* Mill.,*Tinospora cordifolia* (Willd.) Miers, *Rosa indica* L., s*Ziziphus nummularia* (Burm.f.) Wight & Arn., *Allium cepa* L., *Ficus benghalensis* L.
External injuries	Rheumatism/ body pain	10	136	0.93	*Calotropis procera* (Aiton) Dryand., *Aloe barbadensis* Mill., *Euclyptus globulens* L., *Brassica campestris* L., *Cassia fistula* L., *Calotropis procera* (Aiton) Dryand., *Ficus benghalensis* L., *Tribulus terrestris* L.
Parasitic and Hepatic disorders	Liver diseases, intestinal parasites	17	138	0.88	*Cichorium intybus* L., *Alhagi maurorum* Medik., *Solanum nigrum* L., *Punica granatum* L.,*Chenopodium album* L., *Trachyspermum ammi* (L.) Sprague .,
Blood and cardiac diseases	blood purifier, Anemia, Heart tonic	9	109	0.93	*Allium sativum* L., *Coriandrum sativum* L., *Azadirachta indica* A. Juss., *Tinospora cordifolia* (Willd.) Miers., *Punica granatum* L.,*Moringa oleifera* Lam
Sexual diseases	menstrual diseases, leacchorea	12	169	0.93	*Ficus benghalensis* L., *Dalbergia sissoo* DC. , *Acacia nilotica* (L.) Delile ,*Solanum nigrum* L ., *Peganum harmala L.,* *Trachyspermum ammi* (L.) Sprague., *Rosa indica* L.

Others (Weight lose typhoid, malaria, fever)	Typhoid, soothing effect, tumors, Weight loss, acidity, malaria, body inflammation, fever	18	332	0.95	*Anethum graveolens* L.,*Cucurbita maxima* Duchesne,*Cymbopogon citratus* (DC.) Stapf, *Trachyspermum ammi* (L.) Sprague., *Tinospora cordifolia* (Willd.) Miers .,*Musa paradisiaca L., Moringa oleifera* Lam., *Malvastrum coromandelianum* L.
Hair diseases	Dandruff, hair loss, strengthening of hairs, baldness	9	62	0.87	*Aloe barbadensis* Mill., *Allium cepa* L., *Dalbergia sissoo* DC., *Withania somnifera* L. Dund

Table 4. Jaccard Index, Comparison of present studies with previous published reports

Previous studies	Total documented spp.	No of plants with similar uses	No of plants with dissimilar uses	Common species	No of plants only in aligned areas	No of plants only in study areas	% of similarity	% of dissimilarity	jaccard index	References
From adjoining areas										
Bhera	98	13	15	28	70	32	13.27	15.31	21.54	[Qureshi et al ,2012]
Sarai Alamgir	49	15	9	24	25	36	30.61	18.37	28.24	[Khan et al 2016]
District Mandi Bahaudin	51	11	6	17	34	43	21.57	11.76	18.09	[Nisar et al, 2011]
Pind Dadan Khan	69	13	2	15	54	45	18.84	2.90	13.16	[Iqbal et al.2011]
Head Qadirabad and adjoining areas	54	2	16	18	36	42	3.70	29.63	18.75	[Hanif et al.2013]
TRIBAL COMMUNITIES OF SARGODHA REGION,	40	5	8	13	27	47	12.50	20.00	14.94	[Iqbal *et al.* 2019]
Mangowal, District Gujrat, Punjab	40	11	9	20	20	40	27.50	22.50	25.00	[Parvaiz, 2014]
From rest of Pakistan										
Herbal markets of Rawalpindi	92	10	9	19	73	41	10.87	9.78	14.29	[Ahmad et al 2018]
Alpine and Sub-alpine regions of Pakistan	125	0	1	1	124	59	0.00	0.80	0.54	[Kayani et al 2015]
Himalayan region of Azad Jammu and Kashmir	73	10	4	14	59	46	13.70	5.48	11.76	[Rashid et al 2015]
Tehsil CHAKWAL	29	7	4	11	18	49	24.14	13.79	14.10	[Qureshi et al 2009]
Phulgran village, Islamabad	49	16	6	22	27	38	32.65	12.24	25.29	[Naseer et al 2020]
District Bhimber Azad Jammu and Kashmir	38	11	0	11	27	49	28.95	0.00	12.64	[Ishtiaq et al 2021]
Swat, North Pakistan	106	11	7	18	88	42	10.38	6.60	12.16	[Akhtar et al,2013]
Ladha subdivision, South Waziristan agency, Pakistan	82	10	3	13	69	47	12.20	3.66	10.08	[Aziz et al, 2016]
Other countries										
Garo Hills of Durgapur, Bangladesh	71	4	7	11	60	49	5.63	9.86	9.17	[Khan et al,2015]
Zeliangrong ethnic group of Manipur, northeast India	145	4	8	12	133	48	2.76	5.52	6.22	[Panmei et al,2019]

Conclusion

The present ethnomedicinal study has disclosed that indigenous inhabitants of Tehsil Malakwal, district Mandi Bahauddin possess knowledge about the medicinal usage of plants. Local inhabitants of this area prefer native plant species for treatment of diseases due to less cost and easy availability. Majority of plants with greater use value are common in this area are also familiar to local inhabitants. But this traditional use of medicinal plants is restricted in hands of old age people while young generation is less interested in getting this information. Moreover, there is need for awareness among inhabitants of study area regarding sustainable use of medicinal plants for long time conservation.

Declarations

List of abbreviations: Relative Frequency of Citation (RFC), Use Value (UV), Fidelity Level (FL), Informant Consensus Factor (ICF) and Jaccard Index (JI).

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Consent for publications: Not applicable.

Ethics Approval: The authors confirm that study was reviewed and approved by an institutional review board of Pir Mehr Ali Shah-Arid Agriculture University Rawalpindi, Pakistan (ethics committee) before the study began. The committee further approved the study have and no direct harmful impact on participants and biodiversity of area under investigation.

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