Quantitative ethno-gynecological survey of traditional medicinal plants from Punjab province, Pakistan

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Research

Abstract

Background: The purpose of the present study was to document quantitative indigenous knowledge of medicinal plants used for treating various gynecological disorders by the herbalist (Hakeem) and traditional communities of selected rural areas of Punjab, Pakistan.

Materials and Methods: The study was conducted from February 2022 to January 2023. During the research work, the use of medicinal plants and their medicinal uses for curing gynecological disorders were recorded by interviewing 600 informants of different age groups (20-85 years) via semi-structured interviews.

Results: In all, 60 therapeutic plants belonging to 15 families were recorded that were used by the traditional communities of study areas for the cure of various kinds of gynecological disorders. Among families, Asteraceae was the largest that contributed 17 species. The dominant life form was herbs (39 species) and the mostly used plant part was whole plant (14 species). The highest Relative Frequency Citation (RFC) was recorded for *Anethum graveolens* (0.96). Similarly, the highest Use Value (0.98) was recorded for *Amaranthus caudatu,s Amaranthus angustifolius* and the lowest (0.33) for *Justicia adhatoda*. Likewise, the highest Fidelity Level (FL) was recorded for *Anaphalis nepalensis* (100%) which was used to treat leucorrhea, and the lowest FL was recorded for *Oxystelma esculentum* (41.94%) in treating gonorrhea. Family importance index (FIV) indicated that Asteraceae was the dominant (96.66) in the region for contributing medicinal plants, while Zingeberaceae was the lowest one (16.66).

Conclusions: The selected sites being remote areas are devoid of basic health facilities, so the natives learnt about medicinal plants to treat human diseases including gynecological problems. The current research work illustrated that the inhabitants have good knowledge about native plants for treating gynecological disorders. This research can be used as a benchmark for future pharmacological studies to discover novel herbal medicines.

Keywords: Folk knowledge, Quantitative, Medicinal plants, Gynecological disorders, Punjab, Pakistan

Background

Medicinal plants are essential part of human healthcare system and according to an estimate, approximately three-fourths of the plant-derived drugs are discovered from native plants locally and globally (Wakdikar 2004). Some of these studies contributed fortuitously to recording the traditional use of plants for discovering some drugs. According to the literature, 25% of modern drugs are plant-based either compounds, derivatives, or precursors obtained from plants. According to Schippmann *et al.* 2006, more than 50,000 flowering plants are globally utilized for medicinal purposes. Folk medicines are used as the chief potential for the major healthcare systems within the ethnic regions due to the shortage of contemporary healthcare facilities, the remote distance of the region, along a powerful intellectual faith due to the effectiveness of traditional medications (Rehman *et al.* 2022).

Consequently, the purpose of this research was to gather ethno-gynecological information regarding native plants from the inhabitants of six remote districts of Punjab province that might help to discover novel compounds for drug innovation. The current study would have a massive role at both national as well as international world in the applications of folk plants for the treatment of gynecological troubles. The current research will give baseline knowledge for future studies concerning phytochemistry, pharmacology, as well as conservation of gynecological plants. Ethno-gynecology is a research area within ethnobotany to document traditional methods of treatment of female disorders by the tribal living in different regions of the world. Medicinal plants are chief sources of medications to treat gynecological disorders like abortion, menstrual complaints, lactation, menopause, leucorrhea, infertility, childbirth, etc. Among the global ailments, 18% of diseases are related to female healthcare troubles (Jan *et al.* 2020). Modern drugs are common in practice nowadays for treating gynecological problems, but these are found associated with some potential side effects specifically when used for a longer time period (Lawal *et al.* 2020). There is an increasing interest in the developed world to use plant-based drugs to overcome human ailments. In terms of ethno-gynecological studies, there is sporadic information available, and few studies reported (Qureshi *et al.* 2009; Sahu 2011; Mahmood *et al.* 2013; Ahmad et *al.* 2014; Sadeghi & Mahmood 2014; Adnan *et al.* 2015; Aziz *et al.* 2018; Jan *et al.* 2020; Uzun *et al.* 2020; Al-Robai *et al.* 2022; Jan *et al.* 2022; Munir *et al.* 2022; Rehman *et al.* 2022). The current study was consequently planned to record folk knowledge of medicinal plants along with their gynecological applications within the six chief arid regions (i.e. Dera Ghazi Khan, Rahim Yar Khan, Bahawalnagar, Muzaffargarh, Vehari and Layyah) of Punjab Province, Pakistan. These are remote areas are deficient of basic healthcare facilities. People of the areas are poor and are going through elevated stages of scarcity with very poor lifestyles. Such conditions forced the inhabitants to utilize folk drugs as well as keep the native information intact.

In this research, we tried to find out answers of the subsequent questions regarding the therapeutic flora employed to treat gynecological diseases: (i) Which species are utilized natively for the treatment of gynecological diseases? (ii) Which kind of gynecological ailment is cured by a specific plant? (iii) Are specific plant families much or fewer utilized than supposed? (iv) Which section of the plant is utilized for the curative purpose? (v) What is the method of direction or intake of the medicine? Moreover, we carried out this research to discover precious therapeutic plants, to conserve the native assets of medicinal plants for awareness, as well as to make the native inhabitants conscious of the significance of feasible utilization of therapeutic flora. The current study was therefore proposed with the goal of documenting the ethnobotanical knowledge to record ethno-gynecological information of plant reserves specifically used for gynecological disorders by the local communities as well as to choose aspirant plants for more in vitro examinations.

Materials and Methods

Study area

The province contains about half the populace of Pakistan and is the world's fifth-chief crowded sub-national division, as well as the main heavily populated exterior to China or India. In the 2017 census (www.pbs.gov.pk), the populace of Punjab, Pakistan is 109,989,655 with 107,541,602 adhesives. The main religions within Punjab, Pakistan (2017 Census) are Islam (97.8%), Christianity (1.9%), Hinduism (0.2%), and others (0.1%). The main local language spoken within the Punjab is Punjabi, constituting the major language used as a way of communication within the country. Punjabi is distinguished as the provincial language of Punjab however it is not given any executive appreciation within the constitution of Pakistan on the national level. Numerous languages directly associated to Punjabi are spoken within the border of the area. Inside the southern part of Punjab, the popular language is Saraiki, whereas within the north there are presenters of Hindko and Pothwari. Pashto is also spoken within a few parts of Punjab, particularly within Attock, Mianwali as well as Rawalpindi districts. The map of study area is shown in Figure 1.

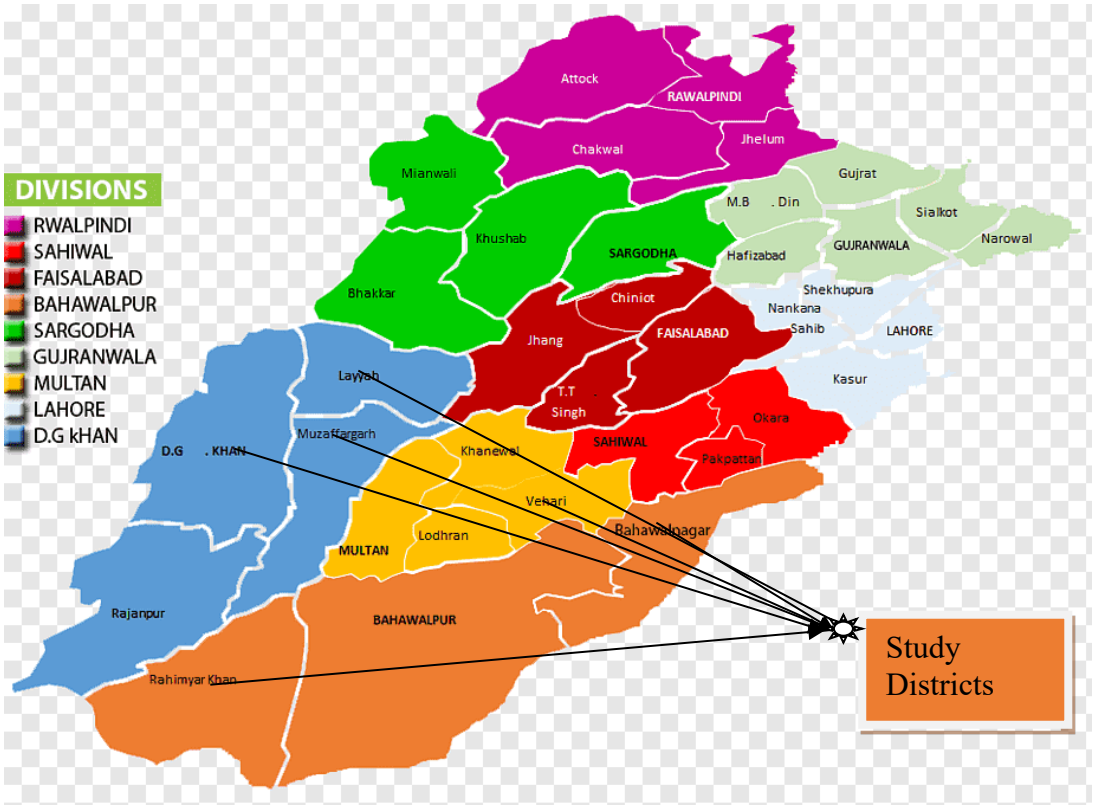

Figure 1. Map of study area showing location of plants collection

Ethnobotanical data collection

In order to collect information regarding medicinal plants, the overall research locality was visited frequent times as well as seasonally (spring, summer, winter and autumn) from February 2022 to January 2023. In the study area, the main target places were Dera Ghazi Khan, Rahim Yar Khan, Muzaffargarh, Vehari, Bahawalnagar and Layyah. These areas were represented by Punjabi and Siraiki ethnic groups residing in remote areas with poor communications and deprived of contemporary healthcare facilities. People of the areas had less earnings position as well as were suffering from elevated stages of scarcity. The purpose of the field visits was to collect field information along with activities such as (1) plant's collection, (2) indigenous information regarding medicinal plant uses along with recipes, through semi-structured questionnaires interviews, keen observations and group discussions and (3) photography. The questionnaire was organized in such a technique to gather greatest information regarding diverse floras, comprising (a) name of informers, sex, age, profession as well as education (b) knowledge regarding plants e.g. native name of the plant, components utilized, process of formation of recipe, method of direction as well as ethnobotanical uses.

The survey and interview techniques assisted to record native folk knowledge by involving knowledgeable persons, conventional healers (Hakims) and native people. Respondents were selected through arbitrary selection of natives who were significantly associated to plants and were involved in folk healthcare. Interviews were carried frequently in fields, by interviewing 600 people of different ages (20-85 years). Both males and females (250 males including 50 male herbalists/Hakeems and 350 women including 70 female herbalists/Dayiahs) were chosen Table 1). Participants were informed regarding the study purposes as well as were permitted to cease the interview at any moment. Every informer was interviewed habitually each season. The national language of Pakistan (Urdu) as well as the local language of the research region (Punjabi) was used as a source of contact. Afterward, an English language questionnaire was filled for every informer. The questionnaire that was employed for information compilation contains subsequent queries; (i) informer name, address, gender, *qualification,* age as well as occupation, (ii) plant's native name, place of plant collection, therapeutic significance, remedial significant component, mode of administration, and native curative method. The informers were requested to tell about the entire plants flora they recognized.

Table 1. Ethnographic data of the natives interviewed for ethnobotanical survey.

Category	Total	Percentage
Gender		
Male	250	41.66
Female	350	58.33
Age group		
Between 20-40	100	16.66
Between 40-50	120	20
Between 50-65	160	26.66
Between 75-85	110	18.33
Male Herbalists (Hakeems)	40	6.66
Female Herbalists (Da'ais)	70	11.66
Total No. of Informants	**600**	

Plant identification and preservation

The collected plant specimens were identified by Professor Dr. Rahmatullah Qureshi, (Department of Botany, Arid Agriculture University Rawalpindi), with the help of Floristic literature (www.efloras.org/). The Plants of the World Online (https://powo.science.kew.org) was consulted for the nomenclature. The fully determined voucher specimens were deposited to the Department of Chemical and Life Sciences, Qurtuba University Peshawar (Pakistan) for record.

Quantitative analysis of ethno-gynecological medicinal data

The collected ethno-gynecological data was analyzed using different quantitative indices including relative frequency citation (RFC), use value (UV) of medicinal plant**,** fidelity level (FL) and family importance value (FIV). The obtained data were presented in percentages and proportions (Bano *et al.*2014; Shah *et al*. 2020; Rehman *et al.* 2022). The details of indices are provided below:

Relative frequency citation (RFC)

Relative frequency citation (RFC) shows the importance of each species in the study area given by the FC (FC is the number of local informants reported the uses of plant species) divided by the total number of informants (N). The RFC was calculated by the following formula (Ibrar *et al.*2015; Hussain *et al.* 2018; Rehman *et al.* 2022; Zareef *et al*. 2023):

$$\text{RFC}=\frac{\text{FC}}{N}\,(0 < RFC < 1)$$

Use value (UV) of plant species

Use value (UV) determines the relative importance of plant species uses. (Ahmed *et al.* 2019). It was calculated using the following formula:

$$\text{UV}=\sum\frac{\text{Ui}}{N}$$

where "UV" indicates the use value of individual species, "Ui" is the number of uses recoded for a given species by each informant and "*N*" represents the number of total informants (Aziz *et al.*2018).

Fidelity Level (FL)

The fidelity level (FL) was elucidated for the most commonly used classification via manipulating the proportion of informers claiming the utilization of a definite plant for the identical key function (Ahmad *et al.* 2017).

$$\text{FL}=\frac{\text{Np}}{N}\,\text{x}\,100$$

where Np is the number of informers that declare a use of a plant species for a specific disorder as well as N is the number of informers that utilize the plants (Rehman *et al.* 2023).

Family Importance value (FIV)

This index was computed by the accounted formula given beneath:

$$FIV=\frac{FC}{N} x\ 100$$

where FC is the number of people mention the particular family as well as N represents the entire number of informers. Higher FIV values signify enormous knowledge as well as small values show fragile understanding of specific plant families (Nadaf *et al.* 2019).

Results

Informers demographic features

During the field visits, the entire of 250 males including 40 male healers (Hakims) and 350 females including 70 female herbalists (Da'ais) of different age groups (20-85 years) were interviewed regarding ethno-gynecological medicinal information (Table 1). There was a common observation in the study area that elder or old aged people were rich in traditional medicinal information because of their experience of using such plants-based medicines over a longer periods of times as compared to young people who were unaware of folk knowledge about medicinal plants. Most of the ethno-gynecological information was obtained from the local inhabitants of more than 55 years old. Informers with an age higher than 65 were generally uneducated. It was observed that the informers of an age over 55 were much well-informed. It was commonly observed that male herbalists mostly have much better knowledge regarding herbal medicines because of their experience and inherited from their family. Whereas female herbalists, they learned this folk knowledge from their experience and mostly inherited. Overall field survey has been shown in Figure 2.

Comparable outcomes were documented by other authors from neighboring regions and from other countries (Adnan *et al.* 2015; Jan *et al.* 2017; Jan *et al.* 2020; Jan *et al.* 2022; Rehman *et al.* 2022). The recorded information demonstrated that females were much familiar in contrast to males, also reported by the other research (Ahmad *et al.* 2014; Aziz *et al*. 2018; Tariq *et al.* 2018; Munir *et al.* 2022). Because females have a key task in preparing daily foods for a family, herbal home-based medications, as well as in helping for the fitness of the entire family members (Sarwat *et al.* 2012; Shinwari *et al.*2017; Hussain *et al.*2018).

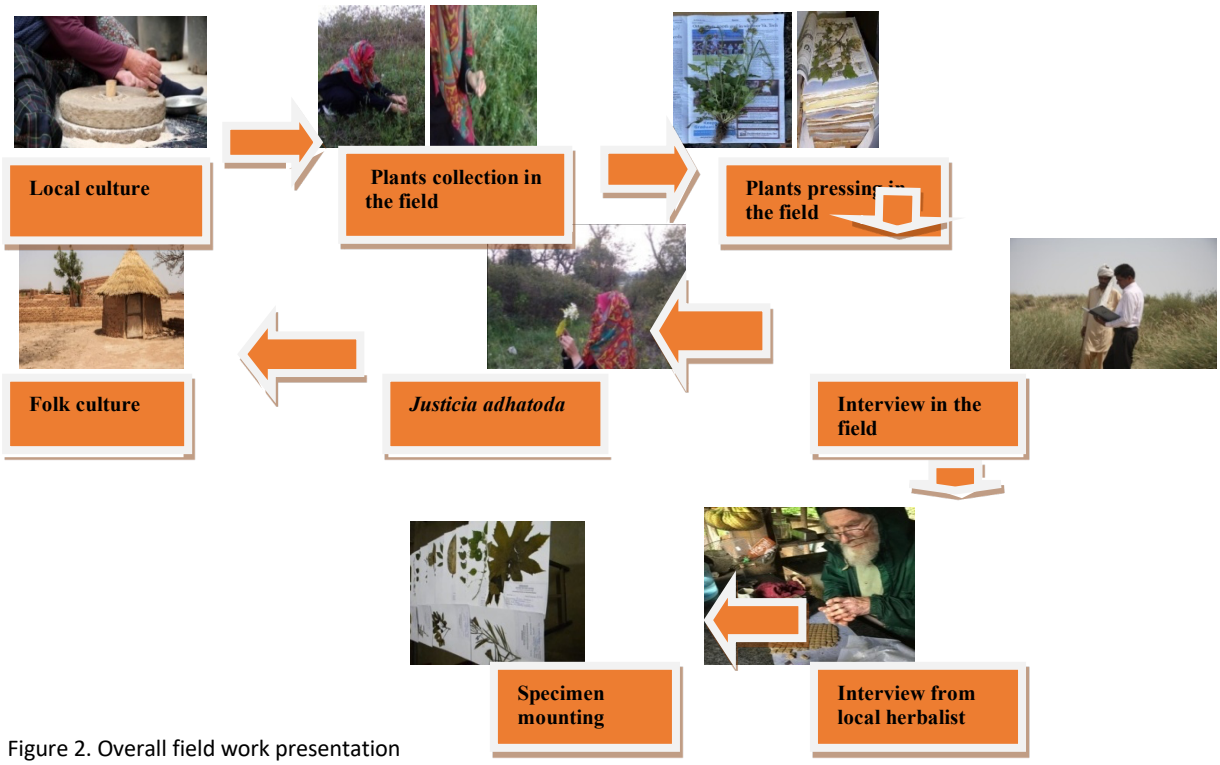

Figure 2. Overall field work presentation

Description of medicinal plant families

Overall sixty plant species belonging to 15 families were found in current study area which are mentioned in Table 2. Among them, Asteraceae was the largest family having 17 species, 28.33% followed by Apiaceae (10 species 16.66%), Amaranthaceae (7 species 11.66%), Apocynaceae (4species 6.66%), Brassicaceae (4 species 6.66%), Fabaceae (3 species5%), Zingeberaceae (3 species 5%) Zygophyllaceae (2 species 3.33%) and remaining families Euphorbiaceae, Caricaceae and Fagaceae with one species (1.66%) each (Fig. 3). The cause of supremacy of family Asteraceae is that members of that family are well recognized because of aroma.

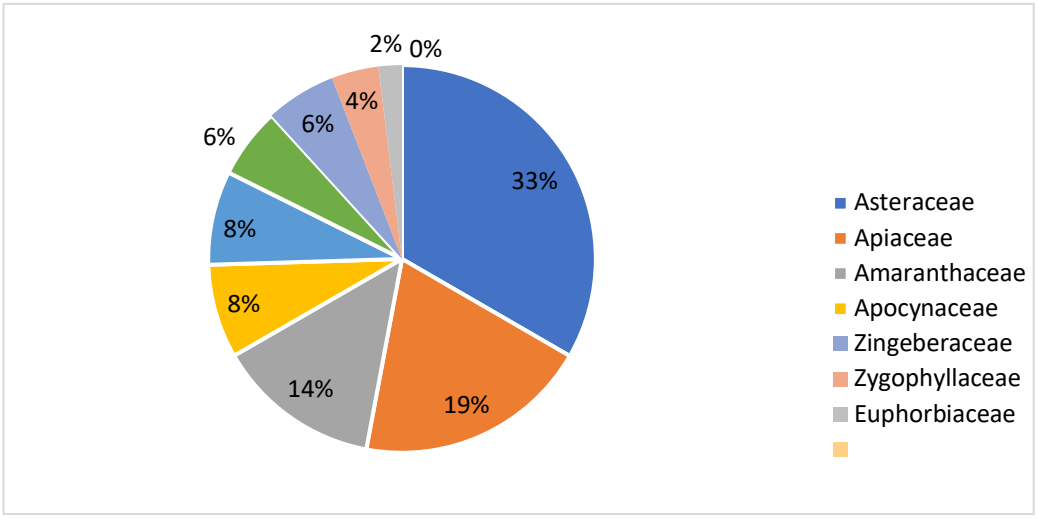

Figure 3. Percentage of families in the study area

Medicinal plant enumerations

Sixty plants were documented in this current study; herbs (39 species, 82.81%) were dominant, followed by shrubs (11 species, 18.33%), and trees (2 species, 3.33%) (Fig. 4). Complete information about each plant species includes botanical name, family, local name, habit, part used and their recipes are listed with RFC and UV and FL% in Table 2.

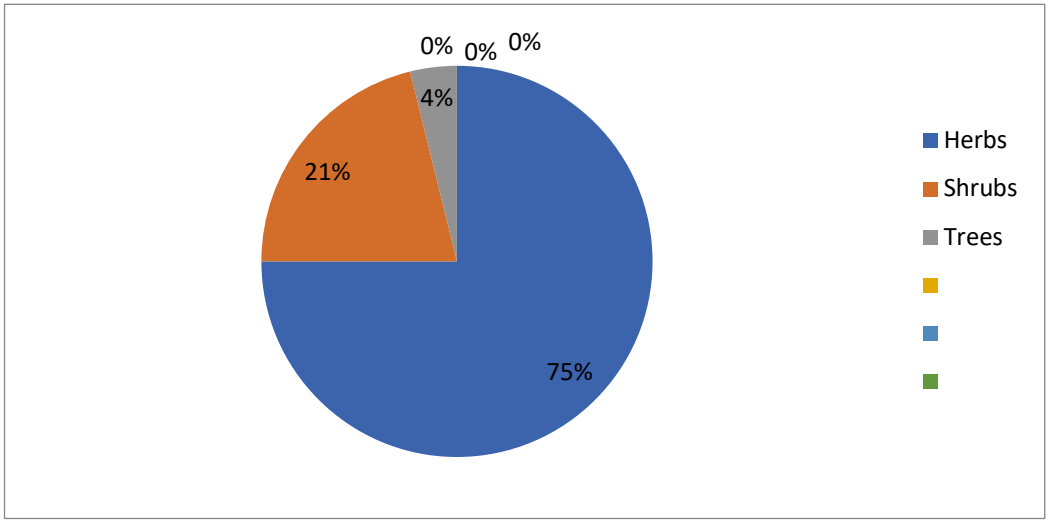

Figure 4. Percentage of life forms of plants

Table 2. Medicinal plant species used for gynecological diseases within the research region

Voucher No.	Plant species	Families	Local name	Habit	Part used	Medicinal use	Mode of administration or Medicinal Preparation(s)	RFC	UV	FL%
HZ-QUP-20221	*Achillea millefolium* L.	Asteraceae	Kungi	Herb	Whole plant	Treat menstrual disorder	Decoction	0.65	0.65	87.57%
HZ-QUP-20222	*Achyranthes aspera* L.	Amaranthaceae	Phut kanda	Shrub	Leaves, whole plant	Treat gonorrhea	Decoction	0.5		75%
HZ-QUP-20223	*Achyranthes bidentata* Blume	Amaranthaceae	Chaff flower	Herb	Roots	Placenta retention	Decoction	0.6	0.65	80%
HZ-QUP-20224	*Alhagi maurorum* Medik	Fabaceae	NA	Shrub	Arial part	Diuretic, leucorrhea	Infusion, distillate	0.7	0.48	63.56%
HZ-QUP-20225	*Alternanthera pungens* Kunth.	Amaranthaceae	Keshtto lata	Herb	Whole plant	Treat gonorrhea, leucorrhea	Decoction	0.63	0.66	92%
HZ-QUP-20226	*Amaranthus caudatus* L..	Amaranthaceae	Phulari	Herb	Leaves	Treat gonorrhea	Decoction	0.33	0.98	73.07%
HZ-QUP-20227	*Amaranthus spinosus* L	Amaranthaceae	Ganair	Herb	Leaves	Treat leucorrhea	Oral	0.53	0.58	73.91%
HZ-QUP-20228	*Amaranthus viridis* L.	Amaranthaceae	Cholai, Ganar	Herb	Whole plant, root	Excessive menstruation, leucorrhea	Decoction, ointment, poultice	0.56	0.61	93%
HZ-QUP-20229	*Anaphalis nepalensis* (Spreng.) Hand.-Mazz.	Asteraceae	Chora	Herb	Flowers	Gynecological infections, leucorrhea	Decoction	0.67	0.63	100%
HZ-QUP-202210	*Anethum graveolens* L.	Apiaceae	Soey	Herb	Fruit	Given to lactating mothers to increase milk flow	Oral	0.96	0.6	62.71%
HZ-QUP-202211	*Artemisia absinthium* L.	Asteraceae	Dhada	Herb	Whole plant shoots	Conceive pregnancy, leucorrhea	Oral	0.56	0.56	53.33%
HZ-QUP-202212	*Artemisia sieberi* Besser	Asteraceae	Dhada	Herb	Aerial parts	Abdominal pain	Decoction, pill	0.52	0.65	46.27%

Voucher No.	Plant species	Families	Local name	Habit	Part used	Medicinal use	Mode of administration or Medicinal Preparation(s)	RFC	UV	FL%
HZ-QUP-202213	*Artemisia vulgaris* L.	Asteraceae	NA	Herb	Flower, leaf	Amplification of uterine spasm	Infusion, pill, decoction	0.48	0.5	65.32%
HZ-QUP-202214	*Aster molliusculus* (Lindl. ex DC.) C.B.Clarke	Asteraceae	Aster	Herb	Flower	Treat amenorrhea, leucorrhea	Decoction	0.52	0.65	96.15%
HZ-QUP-202215	*Astragalus tribuloides* Delile	Fabaceae	NA	Herb	Arial part	Urinary infection	Infusion	0.73	0.52	75.57%
HZ-QUP-202216	*Brassica rapa* L.	Brassicaceae	Sharsham saag	Herb	Whole plant	Treat dysmenorrhoea	Decoction	0.85	0.61	86%
HZ-QUP-202217	*Calendula officinalis* L.	Asteraceae	Gul-e-Ashrafi	Herb	Flower	Irregular menstrual cycle	Infusion	0.6	0.33	77.33%
HZ-QUP-202218	*Calotropis procera* (Aiton) W.T.Aiton	Apocynaceae	Ak	Shrub	Latex, leaves, flower buds	Cure sexually transmitted diseases	Decoction	0.5	0.5	75%
HZ-QUP-202219	*Capsella bursa-pastoris* (L.) Medik.	Brassicaceae	shepherd's purse	Herb	Leaves	Regulate or stop excessive menstrual bleeding	Decoction	0.55	0.58	75%
HZ-QUP-202220	*Carica papaya* L.	Caricaceae	Unripe papaya	Herb	Fruit	Irregular periods	Oral	0.57	0.6	58.10%
HZ-QUP-202221	*Carthamus oxycantha* M. Bieb.	Asteraceae	Kandiyari, Azghibotay	Herb	Flower, seeds	Stimulate menstrual flow	Oral	0.63	0.6	70%
HZ-QUP-202222	*Carthamus tinctorius* L.	Asteraceae	Safflower, Kasumba	Herb	Flower	Menstruation	Infusion	0.56	0.34	80%
HZ-QUP-202223	*Cassia acutifolia* Delile	Fabaceae	Jangli Kikar	Shrub	Leaf	Diuretic, constipation	Decoction	0.65	0.54	73.76%
HZ-QUP-202224	*Centella asiatica* (L.) Urb.	Apiaceae	NA	Herb	Whole plant	Cure hepatitis, syphilis, and leucorrhea	Oral	0.66	0.67	58.30%

Voucher No.	Plant species	Families	Local name	Habit	Part used	Medicinal use	Mode of administration or Medicinal Preparation(s)	RFC	UV	FL%
HZ-QUP-202225	*Cichorium intybus* L.	Asteraceae	Bhangara	Herb	Leaves, root	Stimulate menstruation, leucorrhea	Decoction	0.65	0.62	63.11%
HZ-QUP-202226	*Citrullus colocynthis* (L.) Schrad.	Cucurbitaceae	Kora Kadoo	Herb	Fruit	Gestational diabetes, leucorrhea	Decoction	0.63	0.5	100%
HZ-QUP-202227	*Conyza canadensis* (L.) Cronquist	Asteraceae	NA	Herb	Whole plant	Treat uterine hemorrhage	Oral	0.81	0.65	98%
HZ-QUP-202228	*Coriandrum sativum* L.	Apiaceae	Dhania	Herb	Fruit	Diuretic, leucorrhea	Decoction	0.71	0.63	96%
HZ-QUP-202229	*Cousinia stocksii* C.Winkl.	Asteraceae	NA	Herb	Gum	Diuretic, antiseptic	Powder and pill	0.67	0.63	41.45%
HZ-QUP-202230	*Cuminum cyminum* L.	Apiaceae	Zira	Herb	Fruit	Given to pregnant women to cure their stomach problem	Oral	0.66	0.52	93%
HZ-QUP-202231	*Curcuma longa* L.	Zingiberaceae	Turmeric	Herb	Root	Irregular periods	Decoction	0.46	0.56	54.10%
HZ-QUP-202232	*Ducrosia anethifolia* (DC.) Boiss.	Apiaceae	NA	Herb	Aerial parts, seed	Carminative, stimulate menstruation, lactiferous	Oral, decoction	0.52	0.63	67.18%
HZ-QUP-202233	*Eclipta prostrata* (L.) L.	Asteraceae	Pattrati	Herb	Whole plant	Treat post-partum abnormal uterine bleeding	Oral	0.65	0.53	74%
HZ-QUP-202234	*Elettaria cardamomum* (L.) Maton	Zingeberaceae	Chotti illaichi	Shrub	Seeds	Treat leucorrhea and female impotency, leucorrhea	Decoction	0.66	0.59	67.19%

Voucher No.	Plant species	Families	Local name	Habit	Part used	Medicinal use	Mode of administration or Medicinal Preparation(s)	RFC	UV	FL%
HZ-QUP-202235	*Erigeron bonariensis* L.	Asteraceae	Chabal grass, Shpelaye	Herb	Whole plants,	Treat hemorrhage painful menstruation, leucorrhea	Infusion	0.59	0.59	87.12%
HZ-QUP-202236	*Fagonia indica* Burm.f.	Zygophyllaceae	Dhamasa, Damaho	Shrub	Whole plant	Gynae problems, Menses	Powder form	0.65	0.63	76.02%
HZ-QUP-202237	*Ferula assa-foetida* L.	Apiaceae	Hing	Herb	Leaf	Vaginal suppository, Abortion	Gum resin	0.83	0.65	64.15%
HZ-QUP-202238	*Ferula narthex* Boiss.	Apiaceae	Hing	Herb	Root, Stem, Resin	Treat habitual abortion, leucorrhea	Decoction	0.83	0.59	61.22%
HZ-QUP-202239	*Foeniculum vulgare* Mill.	Apiaceae	Saunf	Herb	Seeds, fruits	Treat leucorrhea, menses, abortion, infertility, and other reproductive diseases	Decoction and powder form	0.67	0.49	70.37%
HZ-QUP-202240	*Glycyrrhiza glabra* L.	Fabaceae	Malti	Herb	Root	Constipation, digestive problem	Pill	0.65	0.53	100%
HZ-QUP-202241	*Haloxylon salicornicum* (Moq.) Bunge ex Boiss.	Amaranthaceae	Lana	Shrub	NA	Abortion, excessive bleeding and leucorrhea	Oral	0.55	0.61	94%
HZ-QUP-202242	*Justicia adhatoda* L.	Acanthaceae	Baikar	Herb	Whole plant; roots, leaves, stem	Treat gonorrhea, menstrual pain	Decoction	0.29	0.33	66.66%
HZ-QUP-202243	*Launaea procumbens* (Roxb.) Ramayya & Rajagopal	Asteraceae	Kandiyari/Bhatter	Herb	Whole plant	Treat painful urination in gonorrhea and also in pregnancy	Oral	0.66	0.63	87.67%

Voucher No.	Plant species	Families	Local name	Habit	Part used	Medicinal use	Mode of administration or Medicinal Preparation(s)	RFC	UV	FL%
HZ-QUP-202244	*Lepidium draba L.*	Brassicaceae	NA	Shrub	Seed	Aphrodisiac, carminative, diuretic	Infusion	0.66	0.48	93.83%
HZ-QUP-202245	*Lepidium sativum L.*	Brassicaceae	Garden cress	Herb	Seed	Abortion, menstruation	Decoction with milk	0.62	0.4	56.11%
HZ-QUP-202246	*Leptadenia pyrotechnica* (Forssk.) Decne.	Apocynaceae	Khip	Shrub	Leaves, Shoot	Treat dysmenorrhoea	Decoction and powder form	0.56	0.49	68.37%
HZ-QUP-202247	*Matricaria chamomilla* L.	Asteraceae	Chitta Phool	Herb	Flower	Menstruation	Infusion	0.53	0.37	90%
HZ-QUP-202248	*Medicago sativa* L.	Fabaceae	Alfalfa	Herb	Seed	Lactiferous, menstruation additive	Decoction	0.66	0.56	70.43%
HZ-QUP-202249	*Nerium oleander* L.	Apocynaceae	Kaner, Kanhera	Shrub	Root, Flowers	Abortifacient	Oral	0.33	0.49	96%
HZ-QUP-202250	*Oxystelma esculentum* (L.f.) Sm.	Apocynaceae	Dudhi, Dudhani	Herb	Fruit, Whole plant	Treat Gonorrhea	Oral	0.5	0.53	41.94%
HZ-QUP-202251	*Pimpinella anisum* L.	Apiaceae	Aniseed, Daalchini	Herb	Fruit	Lactiferous, carminative, menstruation	Decoction, distillate	0.41	0.65	87.46%
HZ-QUP-202252	*Pulicaria andulata L.*	Asteraceae	Peeli Bhooti	Herb	Flower, leaf	Nausea, menstruation additive	Decoction	0.52	0.48	95.74%
HZ-QUP-202253	*Quercus infectoria* G.Olivier	Fagaceae	Mazu Sabz	Tree	Fruit	Back pain, leucorrhea	Decoction	0.58	0.6	72.63%
HZ-QUP-202254	*Ricinus communis* L.	Euphorbiaceae	Castor oil plant, Arind, Harnool	Shrub	Oil	Stimulate menses Constipation, leucorrhea	Orally	0.64	0.53	95%

Voucher No.	Plant species	Families	Local name	Habit	Part used	Medicinal use	Mode of administration or Medicinal Preparation(s)	RFC	UV	FL%
HZ-QUP-202255	*Schinus molle* L.	Anacardiaceae	Toor maruch	Tree	Bark, leaves, fruit	Treat menstrual disorder	Decoction	0.52	0.88	90%
HZ-QUP-202256	*Terminalia chebula* Retz.	Combretaceae	NA	Tree	Fruit	Lactiferous, carminative	Infusion	0.67	0.4	96.45%
HZ-QUP-202257	*Trachyspermum ammi* (L.) Sprague	Apiaceae	Ajwain	Herb	Fruit	Menstruation	Decoction, pill	0.68	0.59	63.77%
HZ-QUP-202258	*Tribulus terrestris* L.	Zygophyllaceae	Peeli Bhooti	Herb	Fruit, root, leaf	Urinary infection, constipation, carminative, leucorrhea	Decoction	0.63	0.65	72.05%
HZ-QUP-202259	*Trigonella foenum-graecum* L.	Fabaceae	Methi	Herb	Fruit or seed, leaf	Anemia during lactation, lactiferous, gestational hypertension	Decoction	0.66	0.65	65.63%
HZ-QUP-202260	*Zingiber officinale* Roscoe	Zingiberaceae	Ginger	Herb	Rhizome	Regulate menses	Decoction	0.47	0.44	58.10%

Plant parts used

Natives used different plant parts (either in combination or separately) within the research region for the treatment of different gynecological disorders. Amongst them, whole plant (14 spp., 23.3%) were the most commonly used part in herbal preparations, followed by leaves (13 spp., 21.6%), fruit (13 spp., 21.6%), flowers (10 spp., 16.6%), roots (8 spp., 12.5%), seed (8 spp., 13.3%), aerial parts (4 spp., 6.6%), stem (2 spp., 3.33%), and bark, gum as well as rhizome was used each from a single species (Fig. 5).

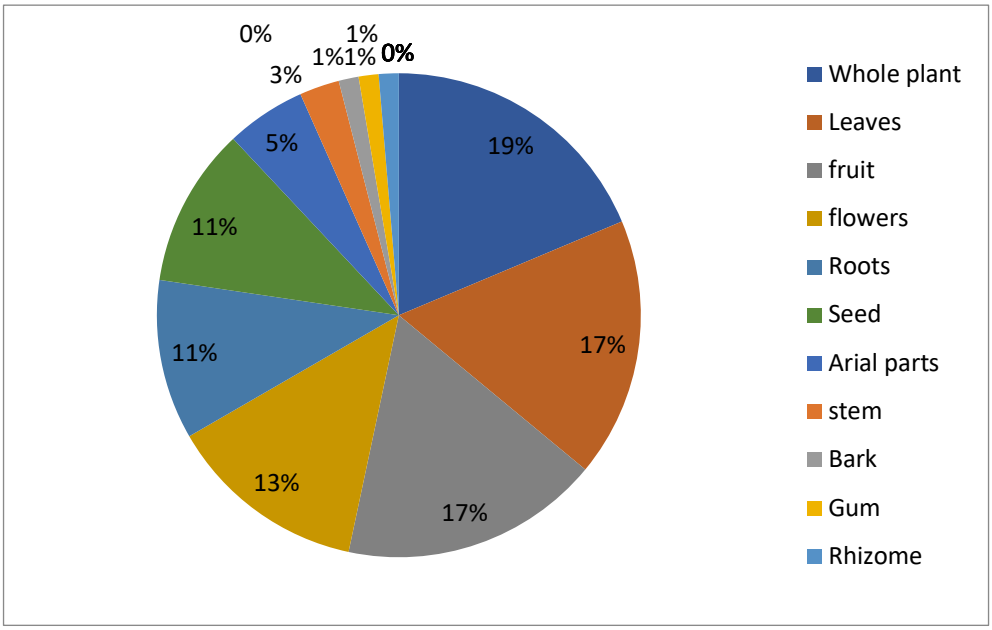

Figure 5. Percentage of Plant parts utilized within research area

Mode of preparation, administration and application

The recipes preparations of the 60 plant species are classified according to their type of preparations, which showed that decoction (34 spp., 56.66%) was an extensively utilized preparation by the natives, followed by oral (13spp., 21.66%), infusion (6spp., 10%), pills (5spp., 8.33%), powder (3spp., 5%) and poultice (single species, 1.66%) as shown in (Fig. 6). It was also documented that the native inhabitants utilized recipes of ethno-gynecological medicinal plant, equally as external as well as for internal use.

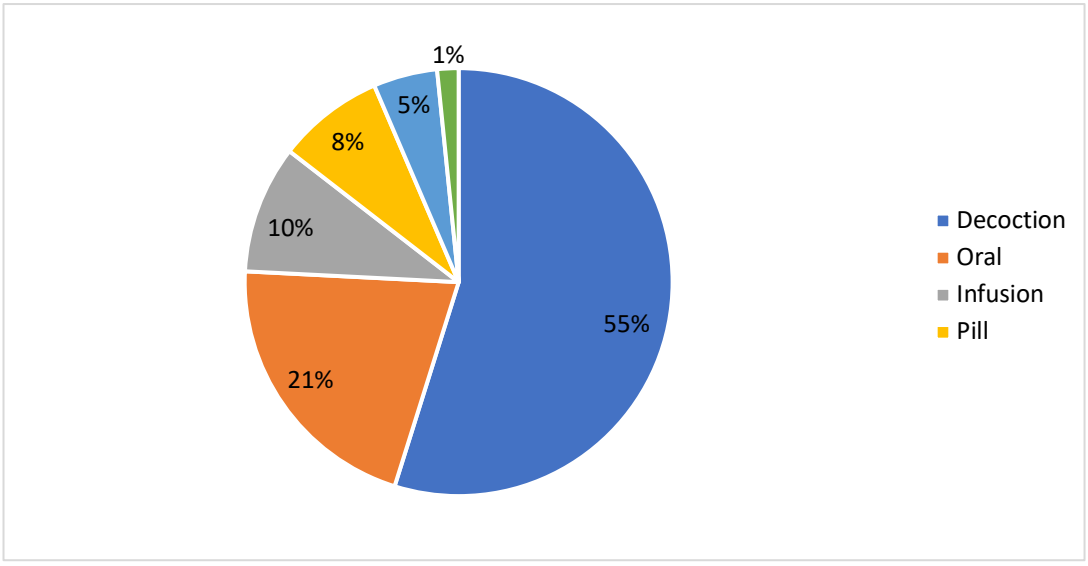

Figure 6. Percentage of mode of administration or Medicinal Preparation(s)

Quantitative analysis

To analyze ethno-gynecological medicinal data, following quantitative indices were quantified from the study areas:

Relative frequency citation (RFC)

The relative frequency of citation (RFC) for every therapeutic plant species is described in Table 2. Such quantitative methods are mostly utilized to search out the relative significance of single curative plant species. On the basis of values of RFC, the number of informers who reported the species for ethno-gynecological gynecological diseases at different locations, and the highest value of RFC was recorded for *Anethum graveolens*, *Brassica campestris*, *Ferula assa-foetida* and *Conyza canadensis* with 0.96, 0.85, 0.83 and 0.81, respectively (Fig. 7).The maximum values of RCF indicates that these therapeutic plant species are most recognized by the highest number of inhabitants of the study area. The plants with maximum RFC must be further analyzed phytochemically and pharmacologically to find out the active chemical constituents that will lead to novel drug discovery

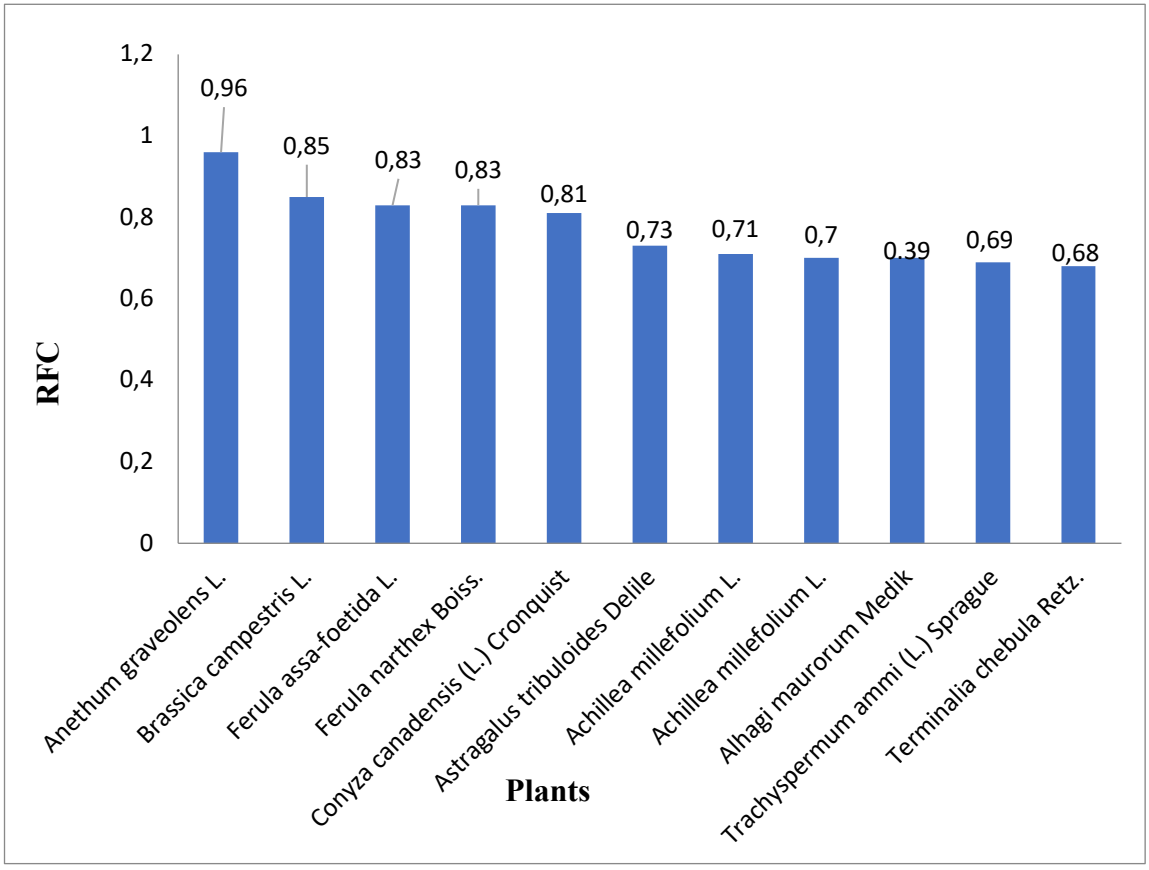

Figure 7. Plant species with highest RFC for ethno gynecological uses

Use value (UV)

The UV of plant species find outs the relative significance of plants within the research region. This index value ranges between zero to one. Curative plants with maximum UV has much use reports as well therapeutic plants with low UV has some less use reports. In the present research, the highest UV value for *Amaranthus caudatus*, *Schinus molle, Alternanthera pungens* and *Fagonia indica* were 0.66, 0.66, 0.65, and 0.63, respectively (Fig. 8). The remedial plants with maximum UV value is because of their frequent occurrence within the studied region. The local inhabitants are much recognizable for their remedial uses (Rahman *et al.* 2016).

Fidelity Level (FL)

In general, the high FL of a species indicates the utilization of a plant species for a specific disease in an area by the inhabitants (Umair *et al.* 2017). In the current study, the highest FL value was recorded for *Anaphalis nepalensis*to treat leucorrhea (100%), followed by *Citrulluscolocynthis* to treat amenorrhea (100%), *Conyza canadensis* which is used to treat uterine

hemorrhage (98%), and *Terminalia chebula* as lactiferous(92%), respectively (Fig. 9). In the same way, *Ranunculus sceleratus* was accounted for anti-urolithiatic agent to cure kidney stones (96.15%) which is also reported by Rahman *et al.* (2017).

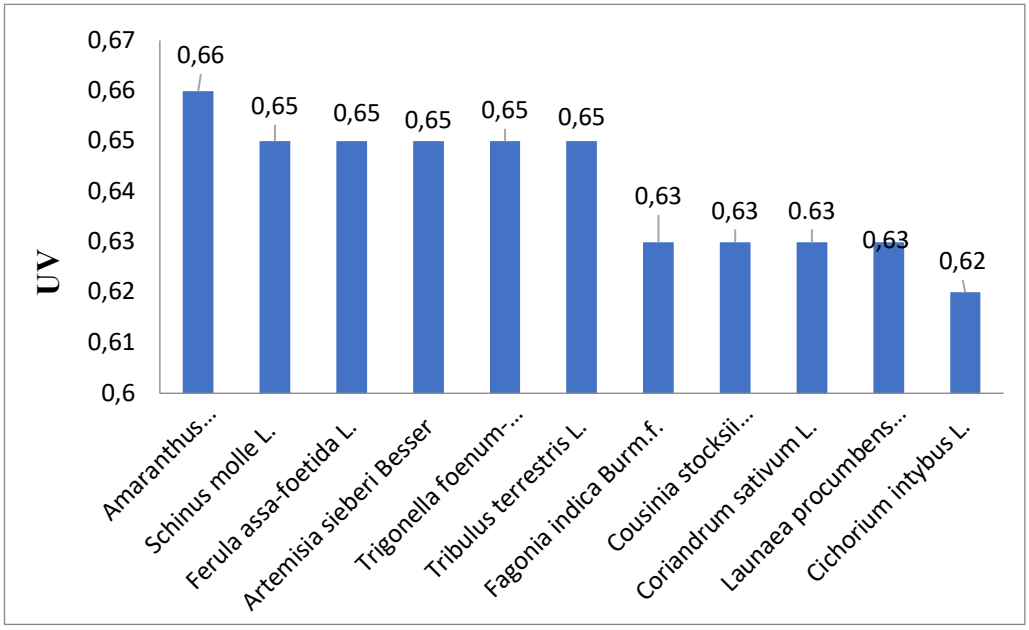

Figure 8. Plant species with highest UV for ethno gynecological uses

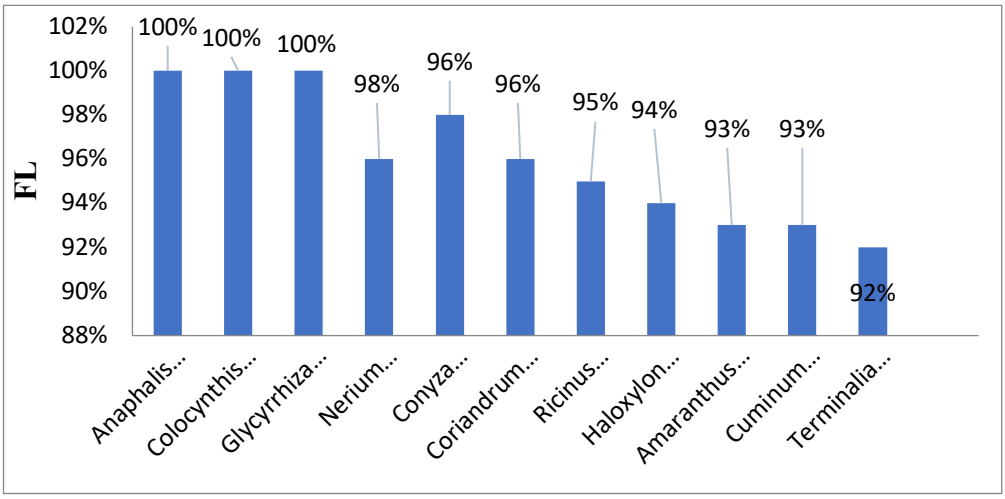

Figure 9. Plant species with highest FL for ethno gynecological uses

Family Importance value (FIV)

The FIV values indicate the contribution of individual families for plant species in the area of study (Table. 2). Based on the highest FIV values in study area, the most dominant family was Asteraceae (96.66%), followed by Amaranthaceae (83.33%), Apiaceae (81.66%), Acanthaceae (66.66%) and Apocyanaceae (63.33%) respectively (Fig. 10). Within the research region, the minimum FIV values were recorded for Fagaceae (26.66%), Zygophyllaceae (27.5%) and Zingeberaceae (16.66%). Nadaf *et al.* (2019) reported the highest value of FIV for Lamiaceae (35.29%), followed by Apiaceae and Malvaceae (8.82%).

Major threats to plant diversity

Plant resources are under severe threats. These major threats include fires, overgrazing, overexploitation and stone mining activities observed within the visited locations of the research region (Figure 11). Amongst them, the plant diversity of Dera Ghazi Khan, Rahim Yar Khan, Bahawalnagar, Muzaffargarh was exposed to all these major threats. Moreover, Vehari and Layyah were less/non exposed to the threat activities except only overgrazing. Therefore, it is need of time to preserve or conserve these precious plant resources by Public awareness and the government should actively participate in conserving the natural plant resources which are the natural assets of the country.

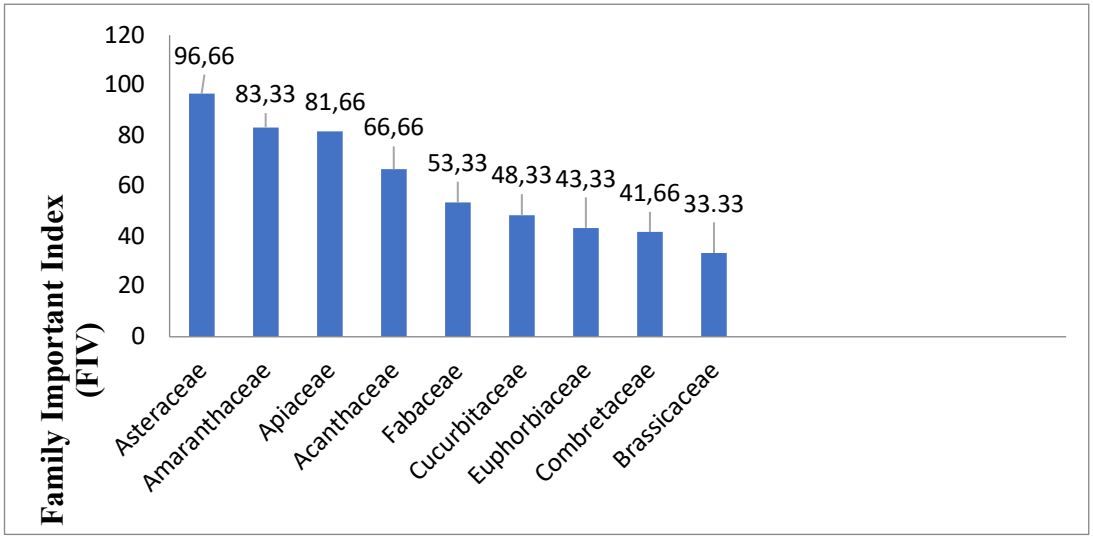

Figure 10. Plant species with highest FIV for ethno gynecological uses

Herbal medications comparative analysis and novelty of study

It is the first study within the area and the area as an entire to the greatest of our knowledge. The current investigation gives information regarding the precious uses of remedial flora for gynecological disorders. The ethno-gynecological results of current study were compared with previously published research articles on national along with international articles on similar topic. It was noticed while comparing some research articles, that some plant species have similar or different therapeutic significances (Rahman *et al.* 2022). This ethno-gynecological information is within significance with a little other ethno medicinal studies with the neighboring region as well as internationally, but slightly this study documented an entire of 60 remedial plant flora, that were specifically utilized for gynecological ailments. The information recognized that the plant parts used, mode of preparation of herbal treatments via the native inhabitants, as well as its method of direction or intake of drug very much differ in the region as well as globally, consequently giving novel ethno medicinal knowledge. These plant species might be use in future studies for further pharmacological as well as phytochemical screening for the detection of novel medicines.

Discussion

During the present research, we documented 60 therapeutic plants belonging to 15 families which are being used by the natives to treat different kinds of gynecological complaints. Ethno-gynecological research have been reported by earlier studies from the neighboring areas of country. Khadim *et al.* (2023) reported total of 108 medicinal plants relating to 54 families from Gujrat Punjab. Rehman *et al.* (2022) documented a total 67 medicinal plant species belonging to 38 families. Jan *et al.* (2020) reported a total of 60 plant species belonging to 40 families.

The present study showed that maximum number of plant species belonged to the family Apiaceae, Amaranthaceae, Apocynaceae, Brassicaceae and Fabaceae. Likewise results had been reported by Jan *et al.* (2022), Sulaiman *et al.* (2020) and Umair *et al.* (2017). Herbs had been the most leading growth forms utilized within herbal medicinal preparations. Similar results had been reported by Ahmad *et al.* (2014), Zahoor *et al.* (2017) and Balamurugan *et al.* (2018). The most utilized plant part was the whole plant. Similar results have been reported by Iqbal *et al.* (2020), Assen *et al.* (2021), and Zareef *et al.* (2023). The most dominant mode of herbal preparation was decoction. Likewise, findings have been reported by Haq *et al.* (2022), Hu *et al.* (2020) and Ahmad *et al.* (2014). The highest value of RFC was recorded for *Anethum graveolens*, followed by *Brassica campestris*, *Ferula assa-foetida,*and *Conyza canadensis.* Similar results have been reported by Amjad *et al.* (2020) and Jin *et al.* (2022). The maximum UV value was recorded for *Amaranthus caudatus*, followed by *Schinus molle*, *Alternanthera pungens* and *Fagonia indica*. Similar findings have been documented by Sulaiman *et al.* (2020), Bibi *et al.* (2022), and Jan *et al.* (2022). The highest FL value was recorded for *Anaphalis nepalensis* to treat leucorrhea followed by *Citrullus colocynthis* to treat amenorrhea, *Conyza canadensis* which is used to treat uterine hemorrhage, and *Terminalia chebula* as lactiferous, respectively. Likewise, results have been recorded by Saqib *et al.* (2018) and Arif *et al.* (2021). The highest FIV values within the study area were Asteraceae followed by Amaranthaceae, Apiaceae, Acanthaceae, and Apocyanaceae, respectively. Similar results have been reported by Maqsood *et al.*(2022) and Rehman *et al.*(2022). The greatest FIV value clarifies that the plant species of a specific plant family have been regularly employed in treating various ailments as reported through the

informants. Drug discovery in therapeutic plants is connected with interdisciplinary research including phytochemical screening as well as pharmacological techniques. However, every remedial plant within the present research had neither been depicted to the absolute pharmacological screenings.

Figure 11. Some glimpse of the major threats in the study areas/fields.

Conclusions

This research focused on rustic females' fitness as well as curing. Within the studied areas, contemporary fitness services are inadequate. Pastoral residents (midwives, folk practitioners) have indigenous information about plant-based treatments for curing gynecological ailments. The ethno-gynecological survey revealed that the folk information regarding remedial flora is mostly the positive feature of old age people. During the study, 60medicinal plants have been documented which are being utilized by the natives to treat various gynecological ailments within the research regions. According to ethnobotanical indices, some of the species such as *Amaranthus caudatus*, *Anethum graveolens, Artemisia sieberi, Glycyrrhiza glabra* and

Terminalia chebula were commonly used plants for the said purpose. This study can be used as a benchmark for futuristic clinical and pharmacological studies for developing plant-based therapeutic agents on gynecology.

Declarations

***Ethics approval and consent to participate*:** Earlier in the study, we obtained oral informed consent from each participant.
Consent for publication: Not applicable.
***Availability of data and materials**:* The figures and tables supporting the results of this study are included in the article, and the original data sets are available from the first author upon request.
Competing interests: The authors declare that there are no conflicts of interest in this article.
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Author's contribution: Huma Zareef wrote the original draft of the manuscript, Fazli Malik Sarim, and Rahmatullah Qureshi supervised this work, helped in statistical analysis also did the formal analysis. All the authors approved the final manuscript after revision.

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